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BUKU ABSTRAK
PROJEK SARJANA MUDA (PSM)

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Jawatankuasa Projek Sarjana Muda (PSM)
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Buku Abstrak Projek Sarjana Muda (PSM)

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SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA TEKNOLOGI DENGAN PENDIDIKAN (KEJURUTERAAN AWAM) DENGAN KEPUJIAN [SHPAH]

FAKTOR YANG MEMPENGARUHI STRES DI KALANGAN GURU TEKNOLOGI PEMBINAAN DI KOLEJ VOKASIONAL

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Kajian ini dijalankan bagi mengenal pasti faktor yang mempengaruhi stres dalam kalangan guru Program Teknologi Pembinaan di Kolej Vokasional. Kajian ini menggunakan pendekatan kualitatif melalui kaedah temu bual bagi mendapatkan maklumat berkaitan pengalaman guru dalam menghadapi tekanan kerja. Dapatan kajian menunjukkan bahawa antara faktor utama yang mempengaruhi stres guru ialah beban kerja, tugasan dokumentasi dan pentadbiran, kekangan masa, sikap pelajar, kemudahan bengkel serta tuntutan audit dan penilaian. Selain itu, stres turut memberi kesan kepada guru dari aspek keletihan fizikal, gangguan emosi, penurunan fokus dan kualiti pengajaran. Walau bagaimanapun, guru menggunakan beberapa strategi bagi mengurus stres seperti menyusun keutamaan kerja, mendapatkan sokongan rakan sejawat dan keluarga, mengamalkan amalan kerohanian serta menggunakan pengalaman mengajar sebagai panduan. Kesimpulannya, stres dalam kalangan guru Program Teknologi Pembinaan dipengaruhi oleh pelbagai faktor dalaman dan luaran. Oleh itu, langkah penambahbaikan perlu dilaksanakan bagi membantu mengurangkan tekanan kerja serta meningkatkan kesejahteraan guru di kolej vokasional.

This study was conducted to identify the factors influencing stress among Construction Technology Programme teachers in Vocational Colleges. A qualitative research approach was employed, using semi-structured interviews to collect data from teachers regarding their experiences in managing work-related stress. The findings revealed that the main factors contributing to stress include workload, administrative and documentation tasks, time constraints, students' attitudes, workshop facilities and equipment, as well as audit and assessment requirements. The study also found that stress affects teachers in terms of physical fatigue, emotional well-being, reduced concentration, and the quality of teaching. Nevertheless, participants adopted various coping strategies, such as prioritising work tasks, seeking support from colleagues and family members, practising spiritual activities, and drawing on their teaching experience to manage work-related stress. In conclusion, stress among Construction Technology Programme teachers is influenced by a combination of organisational and individual factors. Therefore, appropriate measures should be implemented to reduce work-related stress and enhance teachers' well-being, enabling them to perform their duties more effectively in vocational education institutions.

PEMBANGUNAN TEKNOLOGI REALITI MAYA (VR) SEBAGAI ALAT BANTU MENGAJAR DALAM KURSUS AMALI TEKNOLOGI PEMBINAAN

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Perkembangan Revolusi Industri 4.0 telah membawa perubahan yang signifikan terhadap pengguaan teknologi digital dalam pelbagai sektor termasuk Pendidikan. Dalam bidang Pendidikan dan latihan Teknikal dan Vokasional (TVET), penggunaan teknologi seperti Realiti maya (VR) dilihat berpotensi meningkatkan keberkesanan proses pengajaran dan pembelajaran, khususnya bagi kursus yang melibatkan kemahiran amali. Walaubagaimanapun, kaedah peengajaran tradisional yang masih bergantung kepada penerangan teori, lukisan dua dimensi dan demonstrasi manual didapati mempunyai kekangan dalam membantu pelajar memvisualisasikan proses pembinaan sebenar. Justeru, kajian ini dijalankan bagi meneroka potensi penggunaan teknologi VR sebagai alat bantu mengajar dalam kursus amali Teknologi Pembinaan. Kajian ini mempunyai tiga objektif utama iaitu mengenal pasti persepsi pengajar terhadap penggunaan VR sebagai alat bantu mengajar dalam kursus amali Teknologi Pembinaan, membangunkan sistem VR sebagai alat bantu mengajar bagi kursus tersebut serta menilai kesesuaian sistem VR yang dibangunkan berdasarkan penilaian pakar daripada Akademi Binaan Malaysia (ABM). Kajian ini menggunakan pendekatan kaedah campuran (mixed methods) yang menggabungkan kaedah kualitatif dan kuantitatif. Data kualitatif diperoleh melalui temu bual separa berstruktur yang melibatkan tenaga pengajar di Kolej Vokasional Sungai Buloh manakala data kuantitatif diperoleh melalui borang penilaian pakar bagi menilai kesesuaian sistem VR yang dibangunkan. Sistem VR dibangunkan menggunakan perisian Unity berdasarkan kandungan modul kursus amali Teknologi Pembinaan. Kajian ini dijangka dapat menghasilkan sebuah sistem VR yang bersesuaian sebagai alat bantu mengajar dalam kursus amali Teknologi Pembinaan serta mendapat maklum balas positif daripada pengajar dan pakar industri. Selain itu, hasil kajian ini diharapkan dapat membantu meningkatkan keberkesanan proses pengajaran dan pembelajaran melalui pengalaman pembelajaran yang lebih interaktif, visual dan imersif. Kajian ini juga diharap dapat menjadi rujukan kepada institusi TVET, penggubal kurikulum serta penyelidik lain dalam memperluaskan penggunaan teknologi VR dalam pendidikan teknikal pada masa hadapan.

The development of the 4.0 Industrial Revolution has brought significant changes to the use of digital technology in various sectors including Education. In the field of Technical and Vocational Education and Training (TVET), the use of technology such as Virtual Reality (VR) is seen as having the potential to improve the effectiveness of the teaching and learning process, especially for courses involving practical skills. However, traditional teaching methods that still rely on theoretical explanations, two-dimensional drawings and manual demonstrations are found to have limitations in helping students visualize the actual construction process. Therefore, this study was conducted to explore the potential of using VR technology as a teaching aid in the Construction Technology practical course. This study has three main objectives, namely, to identify instructors' perceptions of the use of VR as a teaching aid in the Construction Technology practical course, to develop a VR system as a teaching aid for the course, and to assess the suitability of the VR system developed based on expert evaluation from the Malaysian Construction Academy (ABM). This study uses a mixed methods approach that combines qualitative and quantitative methods. Qualitative data was obtained through semi-structured interviews involving instructors at the Sungai Buloh Vocational College while quantitative data was obtained through an expert evaluation form to assess the suitability of the developed VR system. The VR system was developed using

Unity software based on the content of the Construction Technology practical course module. This study is expected to produce a VR system that is suitable as a teaching aid in the Construction Technology practical course and receive positive feedback from instructors and industry experts. In addition, the results of this study are expected to help improve the effectiveness of the teaching and learning process through a more interactive, visual and immersive learning experience. This study is also expected to be a reference for TVET institutions, curriculum developers and other researchers in expanding the use of VR technology in technical education in the future.

PERBANDINGAN KEPERLUAN KEMAHIRAN BIM ANTARA KONTRAKTOR BANGUNAN DAN KONTRAKTOR INFRASTRUKTUR SERTA PENILAIANNYA TERHADAP GRADUAN KOLEJ VOKASIONAL

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Building Information Modelling (BIM) merupakan antara teknologi utama dalam transformasi digital industri pembinaan yang meningkatkan kecekapan, produktiviti dan kualiti pelaksanaan projek. Seiring dengan perkembangan tersebut, industri memerlukan tenaga kerja yang memiliki kemahiran BIM mengikut keperluan sektor pembinaan. Namun, perbezaan keperluan kemahiran BIM antara kontraktor bangunan dan kontraktor infrastruktur serta tahap kesediaan graduan Kolej Vokasional masih kurang diberi perhatian. Oleh itu, kajian ini dijalankan untuk mengenal pasti keperluan kemahiran BIM bagi kontraktor bangunan dan kontraktor infrastruktur, membandingkan perbezaan keperluan tersebut serta menilai persepsi majikan terhadap tahap kesediaan graduan Kolej Vokasional dalam menguasai kemahiran BIM. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Soal selidik telah diedarkan kepada 59 orang responden daripada lima buah syarikat pembinaan di daerah Johor Bahru. Data dianalisis menggunakan SPSS versi 27.0. Analisis deskriptif melibatkan kekerapan, peratusan, min dan sisihan piawai digunakan bagi menjawab objektif pertama, kedua dan keempat, manakala Independent Samples t-test digunakan bagi menjawab objektif ketiga. Dapatan kajian menunjukkan bahawa keperluan kemahiran BIM bagi kontraktor bangunan (min = 3.76) dan kontraktor infrastruktur (min = 4.16) berada pada tahap tinggi. Keputusan ujian Independent Samples t-test menunjukkan terdapat perbezaan yang signifikan antara kedua-dua sektor ($p < 0.001$). Selain itu, persepsi majikan terhadap tahap kesediaan graduan Kolej Vokasional dalam menguasai kemahiran BIM juga berada pada tahap tinggi (min = 4.00). Kajian ini diharapkan dapat menjadi rujukan kepada institusi TVET dalam memperkukuh kurikulum BIM agar selari dengan keperluan industri pembinaan.

Building Information Modelling (BIM) is one of the key technologies driving the digital transformation of the construction industry by improving project efficiency, productivity, and quality. As BIM adoption continues to grow, the industry requires a workforce equipped with BIM competencies that meet the needs of different construction sectors. However, limited studies have compared BIM skill requirements between building and infrastructure contractors while assessing employers' perceptions of the readiness of Vocational College graduates. Therefore, this study aimed to identify BIM skill requirements among building and infrastructure contractors, compare the differences between both sectors, and assess employers' perceptions of the readiness of Vocational College graduates in mastering BIM skills. This study employed a quantitative survey design. A questionnaire was distributed to 59 respondents from five construction companies in Johor Bahru. Data were analysed using

SPSS version 27.0. Descriptive statistics were used to address the first, second and fourth objectives, whereas the Independent Samples t-test was employed to address the third objective. The findings revealed that BIM skill requirements among building contractors (mean = 3.76) and infrastructure contractors (mean = 4.16) were both at a high level. The Independent Samples t-test indicated a significant difference between the two sectors ($p < 0.001$). Employers also perceived the readiness of Vocational College graduates in mastering BIM skills to be at a high level (mean = 4.00). The findings are expected to serve as a reference for TVET institutions in strengthening BIM-related curricula to better meet the needs of the construction industry.

PERSEPSI PELAJAR IJAZAH SARJANA MUDA TEKNOLOGI DENGAN PENDIDIKAN KEJURUTERAAN AWAM DENGAN KEPUJIAN DALAM KEBERKESANAN PEMBELAJARAN KURSUS BIM

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Building Information Modelling (BIM) merupakan satu teknologi digital yang semakin penting dalam industri pembinaan dan telah diperkenalkan dalam institusi pengajian tinggi bagi melahirkan graduan yang memenuhi keperluan industri. Walau bagaimanapun, pemilihan pendekatan pembelajaran yang sesuai merupakan faktor penting dalam memastikan pelajar dapat memahami dan menguasai kursus BIM dengan berkesan. Oleh itu, kajian ini dijalankan untuk meneroka pendekatan pembelajaran yang berkesan bagi pembelajaran BIM serta mengenal pasti pandangan pelajar terhadap pendekatan pembelajaran yang dilaksanakan dalam kursus BIM. Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk kajian kes. Data kajian dikumpulkan melalui temu bual separa berstruktur yang melibatkan empat orang pelajar Ijazah Sarjana Muda Teknologi Dengan Pendidikan (Kejuruteraan Awam) Dengan Kepujian di Universiti Teknologi Malaysia (UTM) yang telah mengikuti kursus BIM. Data yang diperoleh dianalisis menggunakan kaedah analisis tematik melalui proses pengekodan terbuka (open coding), pengekodan paksi (axial coding) dan pengekodan terpilih (selective coding). Hasil kajian mendapati bahawa pendekatan pembelajaran yang paling berkesan bagi pembelajaran BIM ialah pendekatan hibrid yang menggabungkan pembelajaran berpusatkan guru dan pembelajaran berpusatkan pelajar. Demonstrasi dan bimbingan secara langsung oleh pensyarah membantu pelajar memahami penggunaan perisian BIM, manakala aktiviti pembelajaran berasaskan projek, kerja berkumpulan dan penyelesaian masalah meningkatkan penglibatan serta pemahaman pelajar terhadap aplikasi BIM dalam situasi sebenar. Selain itu, kajian turut mendapati bahawa pelajar mempunyai pandangan yang positif terhadap pendekatan pembelajaran yang menggabungkan elemen bimbingan pensyarah dan penglibatan aktif pelajar. Faktor pengalaman sedia ada serta motivasi kendiri turut dikenal pasti sebagai elemen yang mempengaruhi keberkesanan pembelajaran BIM. Secara keseluruhannya, kajian ini menunjukkan bahawa pendekatan pembelajaran yang seimbang antara pembelajaran berpusatkan guru dan pembelajaran berpusatkan pelajar mampu meningkatkan keberkesanan pembelajaran BIM. Dapatan kajian ini diharapkan dapat membantu pengajar dan institusi pendidikan dalam merancang strategi pengajaran yang lebih efektif bagi meningkatkan kualiti pembelajaran BIM dalam bidang pendidikan dan kejuruteraan.

Building Information Modelling (BIM) is a digital technology that has become increasingly important in the construction industry and has been introduced in higher education institutions to produce graduates who meet industry demands. However, selecting an

appropriate learning approach is a crucial factor in ensuring that students can effectively understand and master BIM courses. Therefore, this study was conducted to explore effective learning approaches for BIM education and to identify students' perceptions of the learning approaches implemented in BIM courses. This study employed a qualitative approach using a case study design. Data were collected through semi-structured interviews involving four Bachelor Of Technology With Education (Civil Engineering) With Honours students at Universiti Teknologi Malaysia (UTM) who had completed a BIM course. The collected data were analysed using thematic analysis through the processes of open coding, axial coding, and selective coding. The findings revealed that the most effective learning approach for BIM education is a hybrid approach that combines teacher-centered learning and student-centered learning. Direct demonstrations and guidance provided by lecturers help students understand the use of BIM software, while project-based learning activities, group work, and problem-solving tasks enhance student engagement and understanding of BIM applications in real-world situations. In addition, the study found that students hold positive perceptions towards learning approaches that integrate lecturer guidance with active student participation. Prior experience and self-motivation were also identified as factors influencing the effectiveness of BIM learning. Overall, the study indicates that a balanced approach between teacher-centered and student-centered learning can enhance the effectiveness of BIM education. The findings are expected to assist lecturers and educational institutions in designing more effective teaching strategies to improve the quality of BIM learning in engineering and educational fields.

TAHAP KESEDIAAN KEMAHIRAN INSANIAH PELAJAR LEPASAN KOLEJ VOKASIONAL DALAM MENYESUAIKAN DIRI DENGAN KAEDAH PEMBELAJARAN DI UNIVERSITI AWAM

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Kajian ini bertujuan untuk mengenal pasti tahap kesediaan kemahiran insaniah pelajar lepasan Kolej Vokasional dalam menyesuaikan diri dengan kaedah pembelajaran di Universiti Teknologi Malaysia (UTM) sebagai Universiti Awam (UA) yang dipilih. Peralihan daripada sistem pendidikan vokasional yang berfokuskan latihan praktikal kepada persekitaran pembelajaran universiti yang menekankan aspek teori, pemikiran kritis dan pembelajaran kendiri merupakan satu cabaran besar kepada pelajar lepasan Kolej Vokasional. Sehubungan itu, kajian ini memfokuskan kepada empat elemen kemahiran insaniah utama iaitu kemahiran komunikasi, kemahiran berfikir kritis dan penyelesaian masalah, kemahiran pengurusan maklumat dan pembelajaran sepanjang hayat, serta kemahiran kerja berpasukan. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kajian tinjauan, melibatkan pelajar lepasan Kolej Vokasional yang sedang mengikuti pengajian peringkat Ijazah Sarjana Muda Pendidikan di Universiti Teknologi Malaysia. Instrumen kajian berupa soal selidik digunakan bagi mengumpul data berkaitan tahap kesediaan, strategi penyesuaian serta bentuk persepsi sokongan yang diterima oleh responden. Data yang diperoleh dianalisis menggunakan statistik deskriptif dan inferensi bagi menentukan tahap kesediaan kemahiran insaniah pelajar serta hubungkait antara Kemahiran Insaniah, strategi dan persepsi sokongan yang meningkatkan kesediaan dalam menyesuaikan diri dengan kaedah pembelakaran di Universiti Awam. Dapatan menunjukkan tahap kemahiran insaniah pelajar lepasan Kolej Vokasional berada pada tahap sederhana. Secara keseluruhannya, kajian ini diharapkan dapat menyumbang kepada peningkatan kualiti peralihan akademik pelajar lepasan Kolej Vokasional ke Universiti Awam dan menyokong pembangunan graduan TVET yang holistik.

This study aims to examine the level of soft skills readiness among Vocational College graduates in adapting to learning methods at Universiti Teknologi Malaysia as a selected public university. The transition from a vocational education system that emphasizes hands-on, competency-based learning (CBT) to a university environment that prioritizes theoretical understanding, critical thinking, and self-directed learning presents significant challenges for these students. Consequently, this study focused on four key elements of soft skills: communication skills, critical thinking and problem-solving skills, information management and lifelong learning skills, and teamwork skills. Utilizing a quantitative approach with a survey research design, this study involved Vocational College graduates who were pursuing a Bachelor of Education degree at Universiti Teknologi Malaysia. A questionnaire was used as the research instrument to collect data regarding the respondents' readiness levels, adaptation strategies, and perceptions of the support received. The data obtained were analyzed using descriptive and inferential statistics to determine the students' soft skills readiness levels, as well as the correlation between soft skills, strategies, and perceptions of support that enhanced readiness in adapting to learning methods at Public Universities. The findings indicated that the soft skills level of Vocational College graduates was at a moderate level. Overall, this study was expected to contribute to improving the quality of the academic transition for Vocational College graduates to Public Universities and to support the development of holistic TVET.

PEMBANGUNAN MODUL AKADEMIK KERJA BATA DAN KEMASAN

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Pendidikan dan Latihan Teknikal dan Vokasional (TVET) memainkan peranan penting dalam melahirkan tenaga kerja mahir yang memenuhi keperluan industri pembinaan. Walau bagaimanapun, bahan pembelajaran bagi topik kerja bata dan kemasan masih kurang dibangunkan secara sistematik berdasarkan keperluan kurikulum dan standard kompetensi industri. Oleh itu, kajian ini dijalankan bagi membangunkan Modul Kerja Bata dan Kemasan serta menentukan tahap kesahan kandungannya berdasarkan persetujuan pakar. Kajian ini mempunyai dua objektif, iaitu membangunkan kandungan Modul Kerja Bata dan Kemasan berdasarkan analisis kandungan dokumen serta menentukan tahap kesahan kandungan modul melalui penilaian pakar. Kajian menggunakan pendekatan kaedah campuran (mixed methods) dengan reka bentuk embedded design. Pembangunan modul berpandukan Model Pembinaan Modul Sidek melalui analisis kandungan empat dokumen utama, iaitu National Occupational Skills Standard (NOSS), Kurikulum Standard Kolej Vokasional (KSKV), Buku Panduan Akademik Akademi Binaan Malaysia (ABM) dan Course Information (CI). Kajian ini menggabungkan analisis kandungan dokumen dengan penilaian kesahan kandungan oleh pakar menggunakan Cohen's Kappa dan Gwet's AC1 bagi memastikan kandungan modul dibangunkan secara sistematik dan disahkan melalui pendekatan statistik yang mantap. Penilaian kandungan modul melibatkan dua orang pakar, manakala data dianalisis menggunakan kekerapan, peratusan, Cohen's Kappa dan Gwet's AC1. Hasil analisis kandungan mengenal pasti lima topik utama, iaitu Kerja Bata, Pengikat dan Keselamatan Kerja, Pemasangan Pintu, Tingkap dan Lintel, Alternatif Bata: Sistem Binaan Berindustri (IBS), serta Kerja Kemasan. Penilaian pakar menunjukkan semua topik memperoleh tahap persetujuan yang tinggi hingga hampir sempurna. Walaupun nilai Cohen's Kappa bagi dua topik dipengaruhi oleh fenomena Kappa Paradox, analisis Gwet's AC1 merekodkan nilai antara 0.802 hingga 1.000, sekali gus mengesahkan bahawa tahap persetujuan sebenar antara pakar adalah tinggi dan konsisten. Kesimpulannya, kajian ini berjaya menghasilkan Modul

Kerja Bata dan Kemasan yang dibangunkan secara sistematik, mempunyai tahap kesahan kandungan yang tinggi serta memenuhi keperluan kurikulum dan kompetensi industri. Modul ini berpotensi dijadikan bahan sokongan dalam proses pengajaran dan pembelajaran bidang Pendidikan Kejuruteraan Awam serta menyumbang kepada pembangunan bahan pembelajaran yang berkualiti dalam bidang TVET.

Technical and Vocational Education and Training (TVET) plays a vital role in producing a skilled workforce capable of meeting the demands of the construction industry. However, learning materials for brickwork and finishing are still inadequately developed in a systematic manner that aligns with curriculum requirements and industry competency standards. Consequently, teaching and learning activities often rely on fragmented learning resources, limiting students' comprehensive understanding of the subject matter. Therefore, this study aimed to develop a Brickwork and Finishing Module and to validate its content through expert evaluation. A mixed methods approach employing an embedded design was adopted to achieve two objectives: (i) to develop the content of the Brickwork and Finishing Module through document content analysis, and (ii) to validate the module content through expert evaluation. The module was systematically developed based on the Sidek Module Development Model. Document content analysis was conducted using four primary reference documents: the National Occupational Skills Standard (NOSS), the Vocational College Standard Curriculum (KSKV), the Akademi Binaan Malaysia (ABM) Academic Handbook, and the Course Information (CI). This study integrated document content analysis with expert content validation using Cohen's Kappa and Gwet's AC1 to ensure that the module content was systematically developed and statistically validated. The developed module was subsequently evaluated by two subject-matter experts, and the data were analysed using frequency, percentage, Cohen's Kappa, and Gwet's AC1. The findings identified five major topics for inclusion in the module: Brickwork, Masonry Materials and Occupational Safety, Installation of Doors, Windows and Lintels, Brickwork Alternatives Using the Industrialised Building System (IBS), and Finishing Work. The expert evaluation demonstrated that all topics achieved a high to almost perfect level of agreement. Although Cohen's Kappa values for two topics were influenced by the Kappa Paradox, Gwet's AC1 values ranging from 0.802 to 1.000 confirmed that the actual level of expert agreement was high and consistent, thereby demonstrating strong content validity for the developed module. In conclusion, this study successfully developed a systematic Brickwork and Finishing Module with high content validity that fulfils curriculum requirements and industry competency standards. The module can serve as a supporting teaching and learning resource for Civil Engineering Education while contributing to the development of high-quality instructional materials in Technical and Vocational Education and Training (TVET).

KEBERKESANAN INTEGRASI KECERDASAN BUATAN (AI) SEBAGAI ALAT BANTUAN PROFESIONAL DALAM PENYEDIAAN BAHAN PENGAJARAN DAN PEMBELAJARAN (PDP) DI KOLEJ VOKASIONAL.

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Kajian ini bertujuan mengenal pasti tahap penggunaan Kecerdasan Buatan (AI) dalam penyediaan Pengajaran dan Pembelajaran (PdP), menentukan tahap keberkesanannya serta mengenal pasti hubungan antara penggunaan AI dengan keberkesanan PdP dalam kalangan guru Kolej Vokasional. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan yang melibatkan guru-guru TVET Kolej Vokasional, dan data dianalisis menggunakan perisian SPSS. Dapatan kajian menunjukkan bahawa AI digunakan secara meluas dalam penyediaan bahan pengajaran, perancangan aktiviti pembelajaran dan pencarian maklumat, serta memberikan kesan positif terhadap keberkesanan PdP melalui peningkatan kecekapan guru, penyediaan bahan pembelajaran yang lebih menarik dan pembelajaran yang lebih interaktif. Kajian ini turut mendapati terdapat hubungan yang signifikan antara penggunaan AI dengan keberkesanan PdP, yang menunjukkan bahawa penggunaan AI berpotensi meningkatkan kualiti pengajaran dan menyokong transformasi pendidikan digital dalam pendidikan teknikal dan vokasional. Oleh itu, usaha berterusan perlu dilaksanakan bagi memperkukuhkan kemahiran guru, menyediakan kemudahan teknologi yang mencukupi serta menggalakkan penggunaan AI secara beretika dan berkesan dalam sistem pendidikan.

This study aimed to identify the level of Artificial Intelligence (AI) usage in the preparation of Teaching and Learning (T&L), determine its effectiveness, and examine the relationship between AI usage and T&L effectiveness among Vocational College teachers. A quantitative survey research design was employed, involving TVET teachers from Vocational Colleges, and the collected data were analyzed using the Statistical Package for Social Sciences (SPSS). The findings revealed that AI is widely utilized in preparing teaching materials, planning learning activities, and obtaining additional information related to teaching subjects. Furthermore, AI usage was found to have a positive impact on T&L effectiveness by enhancing teachers' efficiency, producing more engaging learning materials, and creating a more interactive learning environment. The study also identified a significant relationship between AI usage and T&L effectiveness, indicating that greater integration of AI has the potential to improve the quality of teaching and support digital transformation in technical and vocational education. Therefore, continuous efforts should be made to strengthen teachers' AI competencies, provide adequate technological facilities, and promote the ethical and effective use of AI in the education system.

PEMBELAJARAN INTERAKTIF DALAM KALANGAN PELAJAR TVET DI UNIVERSITI TEKNOLOGI MALAYSIA, JOHOR BAHRU

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Transformasi Pendidikan dan Latihan Teknikal dan Vokasional (TVET) memerlukan pendekatan pedagogi yang dinamik seiring dengan keperluan industri semasa untuk melahirkan graduan yang kompeten. Walau bagaimanapun, isu kebergantungan kepada kaedah pengajaran konvensional sering kali menyebabkan tahap penglibatan dan pemahaman kognitif pelajar kurang optimum, terutamanya dalam menguasai elemen teknikal. Oleh itu, kajian ini bertujuan untuk menilai pelaksanaan pembelajaran interaktif dalam kalangan pelajar TVET di Universiti Teknologi Malaysia (UTM), Johor Bahru. Kajian ini menggunakan reka bentuk tinjauan kuantitatif, di mana data dikumpul melalui instrumen soal selidik yang diedarkan kepada responden pra-siswazah. Hasil analisis data menunjukkan tahap pelaksanaan elemen interaktif oleh para pensyarah berada pada tahap yang tinggi, manakala persepsi pelajar terhadap keberkesanannya turut mencatatkan tahap persetujuan yang cemerlang. Selain itu, analisis korelasi membuktikan wujud hubungan positif yang sangat kuat dan signifikan antara penyediaan persekitaran interaktif dengan tingkat kefahaman pelajar. Kesimpulannya, kaedah interaksi dua hala secara bersemuka berserta sokongan pedagogi terbukti lebih berkesan dalam merangsang kefahaman berbanding kebergantungan mutlak kepada aplikasi digital semata-mata. Sebagai implikasi kajian, pihak pengurusan universiti dicadangkan untuk menambah baik fasiliti ruang tutorial berpusatkan pelajar bagi menyokong kelestarian dasar New Academia Learning Innovation (NALI) pada masa hadapan.

The transformation of Technical and Vocational Education and Training (TVET) requires a dynamic pedagogical approach in line with current industry needs to produce competent graduates. However, the issue of reliance on conventional teaching methods often leads to suboptimal student engagement and cognitive understanding, especially in mastering technical elements. Therefore, this study aims to evaluate interactive learning implementation among TVET students at Universiti Teknologi Malaysia (UTM), Johor Bahru. This study employs a quantitative survey design, where data was collected through a questionnaire instrument distributed to undergraduate respondents. The data analysis results indicate that the level of interactive element implementation by lecturers is high, while student perceptions of its effectiveness also recorded an excellent level of agreement. In addition, correlation analysis proves the existence of a very strong and significant positive relationship between the provision of an interactive environment and students' comprehension levels. In conclusion, face to-face, two-way interaction methods coupled with pedagogical support are proven to be more effective in stimulating understanding compared to absolute reliance on digital applications alone. As an implication of the study, it is recommended that the university management improves student-centered tutorial room facilities to support the sustainability of the New Academia Learning Innovation (NALI) policy in the future.

PEMBANGUNAN MODUL INTERAKTIF KURSUS BAHAN ASAS PEMBINAAN BAGI PROGRAM TEKNOLOGI PEMBINAAN DI KOLEJ VOKASIONAL.

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Kajian ini memfokuskan kepada pembangunan Modul Interaktif Kursus Bahan Asas Pembinaan bagi pelajar Program Teknologi Pembinaan di Kolej Vokasional (KV). Pelajar sering menghadapi kesukaran memvisualisasikan sifat dan konsep teknikal bahan binaan yang abstrak berikutan ketiadaan bahan bantu mengajar interaktif serta kebergantungan institusi kepada kaedah pengajaran tradisional yang statik. Oleh itu, kajian ini bermatlamat untuk membangunkan sebuah modul interaktif berasaskan Model Reka Bentuk Instruksional ADDIE , di samping mengenal pasti persepsi guru dan tahap kebolehgunaan modul dalam kalangan pelajar. Reka bentuk tinjauan kuantitatif telah diaplikasikan dengan menggunakan teknik persampelan bertujuan ke atas 113 orang pelajar Tahun 1 dan 10 orang guru pakar di Kolej Vokasional Ipoh dan Kolej Vokasional Lebuh Cator. Data yang dikumpul melalui borang soal selidik dianalisis menggunakan perisian SPSS versi 31.1 bagi menjana statistik deskriptif seperti kekerapan, peratusan, min, dan sisihan piawai. Hasil analisis menunjukkan bahawa persepsi guru pakar terhadap modul berada pada tahap yang sangat tinggi (Min = 3.54) , manakala penerimaan pelajar terhadap reka bentuk fizikal, kandungan, elemen multimedia, dan motivasi turut mencatatkan purata min yang tinggi (Min = 3.50). Pengintegrasian elemen digital melalui imbasan Kod QR serta penggunaan format fizikal bersaiz B5 terbukti amat praktikal dan berkesan. Pelaksanaan modul ini telah memberikan dwi-implikasi yang signifikan; ia bukan sahaja menjimatkan masa penerangan guru di dalam bilik kuliah, malah bertindak sebagai rujukan amali secara kendiri bagi pelajar di bengkel. Hal ini secara langsung berjaya membina keyakinan pelajar sebagai persediaan sebelum menjalani Latihan Industri (OJT). Kesimpulannya, pembangunan modul interaktif ini telah berjaya merombak landskap pembelajaran TVET konvensional kepada ekosistem pembelajaran hibrid yang selari dengan keperluan Pembelajaran Abad Ke-21 dan tuntutan Revolusi Perindustrian 4.0 (IR 4.0).

This study focuses on the development of an Interactive Module for the Basic Construction Materials Course, specifically targeted at Building Technology Program students in Vocational Colleges (KV). Students frequently encounter difficulties in visualizing abstract technical concepts and material properties due to the lack of interactive teaching aids and an overreliance on static, traditional instructional methods. Consequently, this research aims to develop an interactive module grounded in the ADDIE Instructional Design Model , while simultaneously determining expert teachers' perceptions and assessing the module's usability acceptance among students. A quantitative survey research design was employed, utilizing a purposive sampling technique on 113 Year 1 students and 10 expert teachers from KV Ipoh and KV Lebuh Cator. Data collected via questionnaires were analyzed using SPSS version 31.1 to produce descriptive statistics including frequency, percentage, mean, and standard deviation. The findings indicate that the expert teachers' perception of the module was at a very high level (Mean = 3.54). Similarly, students' acceptance of the physical design, content, multimedia elements, and overall motivation recorded a high average mean (Mean = 3.50). The integration of digital elements via QR Codes and the use of a physical B5 size format proved to be highly practical and effective. The implementation of this module yielded a significant dual-impact: it optimized teachers' instructional time in the classroom and served as a self-directed practical reference for students in the workshop. This approach successfully bolstered students' confidence, adequately preparing them for their On-The-Job Training (OJT). In conclusion, the development of this interactive module has effectively transformed

the conventional TVET learning landscape into a hybrid educational ecosystem, closely aligning with 21st-Century Learning requirements and the demands of the Fourth Industrial Revolution (IR 4.0).

TAHAP KOMPETENSI DIGITAL DAN KESEDIAAN GURU PELATIH BIDANG KEJURUTERAAN AWAM UNIVERSITI TEKNOLOGI MALAYSIA UNTUK MENGINTEGRASIKAN TEKNOLOGI KECERDASAN BUATAN (AI) DI DALAM PENGAJARAN

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Penyelidikan ini dijalankan bagi mengenal pasti tahap kompetensi digital dan kesediaan guru pelatih bidang Kejuruteraan Awam di Universiti Teknologi Malaysia (UTM) untuk mengintegrasikan teknologi kecerdasan buatan (AI) di dalam pengajaran. Usaha ini selari dengan aspirasi Pelan Hala Tuju Kecerdasan Buatan Kebangsaan 2021–2025 dan Dasar Pendidikan Digital (DPD) untuk melahirkan pendidik TVET yang kompeten dalam mendepani cabaran Revolusi Industri 4.0. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan deskriptif melalui kaedah keratan rentas. Kajian sensus telah dilaksanakan ke atas keseluruhan populasi seramai 58 orang guru pelatih Kejuruteraan Awam di Fakulti Sains Pendidikan dan Teknologi, UTM. Instrumen soal selidik yang mengandungi 69 item telah disahkan oleh pakar dan mencatatkan nilai kebolehpercayaan Cronbach's Alpha yang cemerlang iaitu 0.968. Data dianalisis secara deskriptif menggunakan perisian SPSS Version 28 untuk mendapatkan nilai frekuensi, peratusan, min, dan sisihan piawai. Dapatan kajian menunjukkan bahawa tahap kompetensi keseluruhan guru pelatih adalah Tinggi (Min = 4.24), manakala tahap kesediaan mereka berada pada tahap Sangat Tinggi (Min = 4.54). Analisis item mendedahkan bahawa responden sangat mahir dalam menggunakan alat digital generik seperti chatbot AI (ChatGPT/Gemini) dan platform penilaian (Kahoot/Quizizz), namun wujud jurang kompetensi yang ketara dalam perisian teknikal khusus kejuruteraan seperti SAP2000 (Min = 3.03) dan Building Information Modeling (BIM) (Min = 3.60) serta teknologi imersif (AR/VR). Selain itu, pengalaman semasa praktikum dikenal pasti sebagai faktor penyokong terkuat (Min = 4.53) dalam membina kompetensi mereka. Secara kesimpulannya, wujud dispariti di mana motivasi guru pelatih jauh melampaui kemahiran teknikal praktikal mereka. Kajian ini mencadangkan agar pihak universiti menyemak semula kurikulum dengan menyepadukan elemen AI domain-spesifik dan memperkasakan infrastruktur digital bagi melahirkan ejen perubahan pendidikan yang berdaya saing di peringkat global.

This research was conducted to identify the level of digital competency and readiness among Civil Engineering teacher trainees at Universiti Teknologi Malaysia (UTM) to integrate artificial intelligence (AI) technology into their teaching. This effort aligns with the aspirations of the National Artificial Intelligence Roadmap 2021–2025 and the Digital Education Policy (DPD) to produce TVET educators who are competent in facing the challenges of Industrial Revolution 4.0. This study adopted a quantitative approach with a descriptive survey design using a cross-sectional method. A census study was carried out on the entire population of 58 Civil Engineering teacher trainees at the Faculty of Social Sciences and Humanities, UTM. The 69-item questionnaire instrument was validated by experts and recorded an excellent Cronbach's Alpha reliability value of 0.968. Data were analyzed descriptively using SPSS Version 28 to obtain frequency, percentage, mean, and standard deviation values. The findings indicated that the overall competency level of teacher

trainees is High (Mean = 4.24), while their readiness level is Very High (Mean = 4.54). Item analysis revealed that respondents are highly proficient in using generic digital tools such as AI chatbots (ChatGPT/Gemini) and assessment platforms (Kahoot/Quizizz); however, a significant competency gap exists in domain-specific engineering software such as SAP2000 (Mean = 3.03) and Building Information Modeling (BIM) (Mean = 3.60), as well as immersive technologies (AR/VR). Furthermore, teaching practicum experience was identified as the strongest supporting factor (Mean = 4.53) in building their competency. In conclusion, there is a disparity where teacher trainees' motivation far exceeds their practical technical skills. This study suggests that the university should review the curriculum by integrating domain-specific AI elements and strengthening digital infrastructure to produce education change agents who are globally competitive.

IMPAK PEMBELAJARAN SERVIS TERHADAPN TRANSFORMASI TINGKAH LAKU PELAJAR TVET

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Kajian ini bertujuan untuk mengenal pasti impak pembelajaran servis terhadap transformasi tingkah laku pelajar TVET. Kajian ini memberi tumpuan kepada tahap penglibatan pelajar dalam aktiviti pembelajaran servis, persepsi pelajar terhadap keberkesanan pelaksanaan pembelajaran servis, perkembangan kemahiran insaniah serta perubahan sikap dan kesedaran sosial selepas mengikuti pembelajaran servis. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan dengan menggunakan borang soal selidik sebagai instrumen kajian. Seramai 120 orang responden yang terdiri daripada pelajar tahun tiga dan tahun akhir Jabatan Pendidikan dan Latihan Teknikal dan Vokasional Termaju, Fakulti Sains Pendidikan dan Teknologi (FEST), Universiti Teknologi Malaysia, menggunakan perisian IBM SPSS Statistics melalui analisis deskriptif seperti kekerapan, peratusan, min, dan sisihan piawai. Hasil dapatan kajian menunjukkan bahawa pembelajaran servis memberi impak positif terhadap transformasi tingkah laku pelajar TVET. Secara keseluruhannya, pelajar menunjukkan tahap penglibatan yang tinggi, mempunyai persepsi yang positif terhadap pembelajaran servis, mengalami perkembangan kemahiran insaniah serta menunjukkan perubahan sikap dan kesedaran sosial yang baik. Walau bagaimanapun, dapatan kajian turut menunjukkan bahawa aspek minat terhadap pembelajaran, kepimpinan semasa melaksanakan aktiviti dan kesedaran terhadap masalah sosial di persekitaran masih boleh diperkukuh. Kajian ini memberi sumbangan kepada bidang pendidikan TVET dengan menunjukkan bahawa pembelajaran servis bukan sahaja berperanan sebagai aktiviti komuniti, tetapi juga sebagai pendekatan pembelajaran yang dapat membentuk kemahiran, sikap dan kesedaran sosial pelajar. Dapatan kajian ini diharapkan dapat menjadi panduan kepada pensyarah, pihak fakulti dan institusi pendidikan dalam merancang pelaksanaan pembelajaran servis yang lebih berkesan dan bermakna.

This study aims to identify the impact of service learning on the behavioural transformation of TVET students. The study focuses on students' level of involvement in service learning activities, students' perceptions of the effectiveness of service learning implementation, the development of soft skills, and changes in attitudes and social awareness after participating in service learning. This study employed a quantitative survey design using a questionnaire as the research instrument. A total of 120 respondents, consisting of third-year and final-year students from the Department of Advanced Technical and Vocational Education and Training, Faculty of Educational Sciences and Technology (FEST), Universiti Teknologi Malaysia, were involved in this study. The data were analysed using IBM SPSS Statistics through descriptive analysis, including frequency, percentage, mean, and standard deviation. The findings show that service learning has a positive impact on the behavioural transformation of TVET students. Overall, students demonstrated a high level of involvement, positive perceptions towards service learning, development of soft skills, and positive changes in attitudes and social awareness. However, the findings also indicate that several aspects still require further attention, particularly students' interest in learning, leadership during activity implementation, and awareness of social issues in the surrounding environment. This study contributes to the field of TVET education by showing that service learning functions not only as a community-based activity, but also as a learning approach that can develop students' skills, attitudes and social awareness. The findings are expected to serve as a guide for lecturers, faculties and educational institutions in planning more effective and meaningful service learning implementation.

HUBUNGAN TAHAP PENDIDIKAN DAN PENGALAMAN KERJA TERHADAP KEMAHIRAN TEKNIKAL PEKERJA DALAM INDUSTRI PEMBINAAN

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Industri pembinaan merupakan penyumbang utama kepada ekonomi Malaysia yang menuntut tenaga kerja berkemahiran tinggi bagi menjamin produktiviti, kualiti kerja dan keberkesanan pelaksanaan projek pembinaan. Kemahiran teknikal seperti membaca pelan dan mengendalikan tugas teknikal merupakan elemen penting dalam memastikan kejayaan sesuatu projek pembinaan. Walau bagaimanapun, industri pembinaan berdepan dengan isu ketidakseimbangan kompetensi apabila pekerja yang mempunyai tahap pendidikan tinggi sering kekurangan pengalaman praktikal manakala pekerja yang berpengalaman pula menghadapi kesukaran untuk menyesuaikan diri dengan perkembangan teknologi moden. Kajian yang membandingkan pengaruh tahap pendidikan dan pengalaman kerja terhadap kemahiran teknikal secara serentak juga masih terhad dalam konteks industri pembinaan di Malaysia. Oleh itu, kajian ini dijalankan untuk mengenalpasti hubungan antara tahap pendidikan dengan kemahiran teknikal pekerja, mengenalpasti hubungan antara pengalaman kerja dengan kemahiran teknikal pekerja serta menentukan faktor yang paling mempengaruhi antara kedua-dua aspek tersebut dalam kalangan pekerja. Dalam kajian ini, pengkaji menggunakan reka bentuk kuantitatif berbentuk tinjauan dengan mengedarkan instrumen soal selidik berskala Likert secara dalam talian kepada personel penyeliaan teknikal tapak di sekitar Johor dan Selangor melalui kaedah persampelan rawak mudah. Data yang diperoleh dianalisis menggunakan perisian IBM SPSS melalui analisis deskriptif dan inferensi. Hasil kajian menunjukkan tidak terdapat hubungan statistik yang signifikan antara tahap pendidikan mahupun tempoh pengalaman kerja dengan tahap kemahiran teknikal pekerja. Penemuan menunjukkan bahawa kemahiran teknikal pekerja mungkin dipengaruhi oleh faktor-faktor lain yang tidak dikaji dalam penyelidikan ini. Kajian ini dapat memberikan sumbangan dengan menyediakan bukti bahawa kelayakan akademik dan tempoh pengalaman kerja bukanlah penentu utama kepada tahap kemahiran teknikal pekerja dalam industri pembinaan. Kesimpulannya, pembangunan kemahiran teknikal memerlukan usaha dan pembelajaran berterusan.

The construction industry is a major contributor to the Malaysian economy which demands a highly skilled workforce to guarantee productivity, work quality and the effectiveness of construction project implementation. Technical skills such as reading blueprints and handling technical tasks are important elements in ensuring the success of a construction project. However, the construction industry faces the issue of competency imbalance when workers with a high education level often lack practical experience, while experienced workers face difficulties adapting to modern technology developments. In addition, studies comparing the influence of education level and work experience on technical skills simultaneously are still limited within the context of the construction industry in Malaysia. Therefore, this study was conducted to identify the relationship between education level and workers' technical skills, identify the relationship between work experience and workers' technical skills, as well as determine the factor that most influences between those two aspects among workers. In this study, the researcher used a quantitative survey design by distributing Likert-scale questionnaire instruments online to site technical supervision personnel around Johor and Selangor through a simple random sampling method. The data obtained was analyzed using IBM SPSS software through descriptive and inferential analysis. The results of the study show that there is no statistically significant relationship between either education level or duration of work experience with the level of workers' technical skills. The findings

show that workers' technical skills might be influenced by other factors not studied in this research. This study can provide a contribution by providing evidence that academic qualifications and duration of work experience are not the main determinants of the level of workers' technical skills in the construction industry. The researcher hopes that the results of this study can help educational and technical training institutions, employers, as well as future researchers in planning technical skill competency development strategies more effectively. In conclusion, the development of technical skills requires continuous effort and learning.

IMPAK KILANG PENGAJARAN TERHADAP PERUBAHAN TINGKAH LAKU PELAJAR DI UNIVERSITI AWAM MALAYSIA

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Kajian ini dijalankan untuk mengkaji impak pelaksanaan pendekatan Kilang Pengajaran terhadap perubahan tingkah laku pelajar di institusi pengajian tinggi awam Malaysia. Secara khusus, kajian ini menilai tiga aspek utama iaitu tahap penglibatan pelajar, persepsi pelajar terhadap keberkesanan Kilang Pengajaran dan impak pendekatan tersebut terhadap tingkah laku sosial dalam aspek kerja berkumpulan. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Data dikumpul melalui borang soal selidik berstruktur berskala Likert 6-mata yang diedarkan secara digital kepada 200 responden. Responden terdiri daripada pelajar tahun akhir program Sarjana Muda Teknologi (BTECH) dari empat buah universiti awam di Malaysia, iaitu Universiti Tun Hussein Onn Malaysia (UTHM), Universiti Teknikal Malaysia Melaka (UTeM), Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA), dan Universiti Malaysia Perlis (UniMAP) dengan pecahan seimbang seramai 50 orang pelajar bagi setiap institusi. Data dianalisis secara deskriptif menggunakan perisian SPSS untuk mendapatkan nilai min, sisihan piawai, kekerapan, dan peratusan. Hasil analisis menunjukkan bahawa tahap penglibatan pelajar dalam Kilang Pembelajaran berada pada tahap yang tinggi dengan nilai min keseluruhan 5.48. Selain itu, persepsi pelajar terhadap keberkesanan kaedah ini juga mencatatkan skor yang tinggi min iaitu 5.53, terutamanya dalam membantu mereka menguasai kemahiran praktikal secara hands-on serta membuat persediaan menghadapi alam pekerjaan. Impak pelaksanaan Kilang Pembelajar Kilang Pengajaran terhadap tingkah laku sosial pelajar dalam aspek kerja berkumpulan turut berada pada tahap yang sangat positif dengan min keseluruhan 5.54, di mana elemen pengamalan sikap profesional semasa melaksanakan tugasan merekodkan penilaian tertinggi. Secara keseluruhannya, kajian ini membuktikan bahawa pendekatan Kilang Pembelajaran berjaya bertindak sebagai laluan strategik yang menghubungkan teori akademik dengan amalan industri sebenar. Pendekatan ini bukan sahaja meningkatkan kompetensi teknikal pelajar, malah memberikan impak besar terhadap pembentukan kemahiran insaniah seperti komunikasi, tanggungjawab, dan kerjasama kolaboratif yang amat diperlukan bagi meningkatkan kebolehpasaran graduan dalam bidang Pendidikan Teknikal dan Vokasional (TVET).

This study was conducted to examine the impact of implementing the Teaching Factory approach on students' behavioral changes in Malaysian public higher education institutions. Specifically, this study evaluates three main aspects: the level of student involvement, student perceptions of the program's effectiveness, and the impact of the approach on social behavior within teamwork. This study utilizes a quantitative approach with a survey design. Data were

collected through a structured 6-point Likert scale questionnaire distributed digitally to 200 respondents. The respondents consisted of final-year Bachelor of Technology (BTECH) students from four public universities in Malaysia, namely Universiti Tun Hussein Onn Malaysia (UTHM), Universiti Teknikal Malaysia Melaka (UTeM), Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA), and Universiti Malaysia Perlis (UniMAP), with an equal distribution of 50 students per institution. Data were analyzed descriptively using SPSS software to determine the mean, standard deviation, frequency, and percentage value.The analysis results indicated that the level of student involvement in the Teaching Factory was high, with an overall mean score of 5.48. In addition, student perceptions of the effectiveness of this method also recorded a high mean score of 5.53, particularly in helping them master practical skills through hands-on activities and preparing them for the workforce. The impact of the Teaching Factory implementation on students' social behavior in teamwork was also highly positive, with an overall mean of 5.54, where the practice of professional attitudes during assignments recorded the highest evaluation. Overall, this study proves that the Teaching Factory approach successfully acts as a strategic bridge connecting academic theory with actual industrial practice. This approach not only enhances students' technical competence but also significantly impacts the development of soft skills such as communication, responsibility, and collaborative cooperation, which are essential for increasing graduate employability in the field of Technical and Vocational Education and Training (TVET).

TAHAP PENGETAHUAN, SIKAP DAN AMALAN KESELAMATAN BENGKEL DALAM KALANGAN PELAJAR DIPLOMA VOKASIONAL MALAYSIA (DVM) TEKNOLOGI PEMBINAAN DI KOLEJ VOKASIONAL SABAH

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Kajian ini dijalankan bagi meneliti aspek keselamatan bengkel dalam Pendidikan dan Latihan Teknikal dan Vokasional (TVET), khususnya dalam kalangan pelajar Diploma Vokasional Malaysia (DVM) Teknologi Pembinaan yang terdedah kepada aktiviti amali berisiko tinggi di bengkel. Walau bagaimanapun, isu kemalangan dan ketidakpatuhan terhadap prosedur keselamatan masih berlaku, yang menunjukkan kemungkinan wujudnya kelemahan dari segi pengetahuan, sikap dan amalan keselamatan bengkel dalam kalangan pelajar. Oleh itu, objektif kajian ini dijalankan bagi mengenal pasti secara keseluruhan tahap pengetahuan, sikap dan amalan keselamatan bengkel serta hubungan antara ketiga-tiga pemboleh ubah tersebut di dalam kalangan pelajar DVM Teknologi Pembinaan di beberapa buah kolej vokasional yang terletak di bahagian timur negeri Sabah. Populasi kajian terdiri daripada pelajar DVM Tahun 4, dan kaedah persampelan rawak mudah digunakan bagi memastikan keseluruhan populasi terlibat sebagai sampel kajian. Instrumen kajian dibangunkan dalam bentuk soal selidik berstruktur berdasarkan Model Knowledge-Attitude-Practices (KAP) dan menggunakan Skala Likert empat mata untuk mengukur tahap pengetahuan, sikap dan amalan keselamatan bengkel. Instrumen tersebut melalui proses kajian rintis bagi menguji kesahan kandungan serta kebolehpercayaan sebelum digunakan dalam kajian sebenar. Pengumpulan data dijalankan secara beretika dengan menekankan kerahsiaan responden. Data yang diperoleh dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) 29.0 melalui analisis statistik deskriptif dan inferensi bagi menjawab persoalan kajian. Hasil dapatan kajian ini dijangka dapat mengenal pasti corak tahap pengetahuan, sikap dan amalan keselamatan bengkel, sekali gus menyediakan asas empirikal bagi penambahbaikan pelaksanaan keselamatan bengkel.

This study was conducted to examine workshop safety aspects within Technical and Vocational Education and Training (TVET), particularly among Diploma Vokational Malaysia (DVM) students in Construction Technology who are exposed to high-risk practical activities in workshops. Nevertheless, issues related to accidents and non-compliance with safety procedures continue to occur, indicating potential deficiencies in workshop safety knowledge, attitudes, and practices among students. Therefore, the objective of this study is to comprehensively identify the levels of knowledge, attitudes, and workshop safety practices, as well as the relationships among these three variables, among DVM Construction Technology students at several vocational colleges located in the eastern region of Sabah. The study population comprised Year 4 DVM students, and a simple random sampling method was employed to ensure that the entire population was involved as the study sample. The research instrument was developed in the form of a structured questionnaire based on the Knowledge–Attitude–Practice (KAP) model and utilised a four-point Likert scale to measure the levels of workshop safety knowledge, attitudes, and practices. The instrument underwent a pilot study to test content validity and reliability prior to its application in the actual study. Data collection was conducted ethically with an emphasis on respondent confidentiality. The data obtained were analysed using the Statistical Package for the Social Sciences (SPSS) version 29.0 through descriptive and inferential statistical analyses to address the research questions. The findings of this study are expected to identify patterns in the levels of workshop safety knowledge, attitudes, and practices, thereby providing an empirical basis for improving the implementation of workshop safety practices.

PEMBANGUNAN MODUL PEMBELEJARAN PERPAIPAN DOMESTIK SELARAS

INDSUTRI

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Pendekatan Pembelajaran Berasaskan Hasil (Outcome-Based Education, OBE) dalam pendidikan teknikal dan kejuruteraan awam di Universiti Teknologi Malaysia (UTM) memainkan peranan kritikal bagi melahirkan graduan yang kompeten dari segi teori dan amali. Walau bagaimanapun, bahan pengajaran sedia ada bagi aspek perpaipan domestik didapati masih bersifat umum dan pelaksanaan pentaksiran sedia ada kurang menekankan penilaian formatif berasaskan prestasi secara berterusan. Kajian ini bertujuan untuk (i) mengenal pasti isi kandungan pembelajaran yang diperlukan bagi pembinaan modul Perpaipan Domestik berdasarkan analisis dokumen mengikut standard industri, dan (ii) menilai kesesuaian serta kesahan kandungan modul yang dibangunkan berdasarkan penilaian panel pakar. Reka bentuk kajian ini menggunakan pendekatan kajian pembangunan yang mengadaptasi Model Pembangunan Modul Sidek (2005) secara sistematik. Pada fasa pertama, analisis dokumen secara kualitatif dilaksanakan terhadap kurikulum kejuruteraan awam UTM, standard kompetensi Akademi Binaan Malaysia (ABM), serta garis panduan Suruhanjaya Perkhidmatan Air Negara (SPAN). Seterusnya, draf modul yang dibina dinilai secara kuantitatif oleh panel pakar bidang yang terdiri daripada dua orang pakar penilai. Data maklum balas pakar dianalisis menggunakan peratusan persetujuan keseluruhan, indeks Cohen’s Kappa, dan statistik Pekali Gwet’s AC1 bagi mengekang herotan interpretasi matematik akibat ralat kebetulan (prevalence index). Dapatan kajian bagi objektif pertama berjaya menstrukturkan lima komponen utama, iaitu aspek keselamatan kerja, lukisan teknikal perpaipan, pengendalian peralatan, pengecaman bahan, dan kaedah amali penyambungan paip. Bagi objektif kedua, analisis statistik merekodkan tahap kesepakatan dan persetujuan panel pakar yang sempurna dengan pencapaian peratus persetujuan 100% (P_o = 1.000) dan nilai Pekali Gwet’s AC1 bernilai 1.000 bagi kesemua subtopik yang dinilai. Hal ini mengesahkan draf modul tersebut mempunyai kesahan kandungan yang sangat tinggi dan bebas daripada ralat konsep. Implikasi kajian membuktikan bahawa modul yang dibangunkan berupaya menjadi bahan bantu mengajar (BBM) yang berkualiti tinggi .

The Outcome-Based Education (OBE) approach in technical and civil engineering education at Universiti Teknologi Malaysia (UTM) plays a critical role in producing graduates who are competent both theoretically and practically. However, existing instructional materials for the domestic plumbing aspect were found to be still general in nature, and the current assessment implementation places less emphasis on continuous performance-based formative evaluation. This study aims to (i) identify the learning content required for the development of a Domestic Plumbing module based on document analysis according to industry standards, and (ii) evaluate the appropriateness and content validity of the developed module based on a panel expert evaluation. The research design employs a developmental research approach that systematically adapts the Sidek Module Development Model (2005). In the first phase, a qualitative document analysis was conducted on the UTM civil engineering curriculum, the competency standards of the Akademi Binaan Malaysia (ABM), and the guidelines of the Suruhanjaya Perkhidmatan Air Negara (SPAN). Subsequently, the developed draft module was quantitatively evaluated by a field expert panel consisting of two expert evaluators. The expert feedback data were analyzed using the overall percentage of agreement, Cohen's Kappa index, and Gwet's AC1 coefficient statistics to mitigate mathematical interpretation distortions caused by chance agreement (prevalence index). The research findings for the first objective successfully structured five main components, namely occupational safety, technical plumbing drawing, equipment handling, material identification, and practical pipe

connection methods. For the second objective, the statistical analysis recorded a perfect level of consensus and agreement among the expert panel, achieving a 100% percentage of agreement (P_o = 1.000) and a Gwet's AC1 coefficient value of 1.000 across all evaluated subtopics. This confirms that the draft module possesses very high content validity and is free from conceptual flaws. The implications of the study prove that the developed module is capable of becoming a high-quality instructional aid.

PEMBANGUNAN SMART LEVEL TRITOOL SEBAGAI ALAT PELBAGAI FUNGSI DALAM AMALI KERJA BATA DI KOLEJ VOKASIONAL

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Kajian ini dijalankan bagi membangunkan Smart Level Tritool sebagai alat pelbagai fungsi dalam amali kerja bata di Kolej Vokasional. Permasalahan kajian ini adalah berdasarkan penggunaan beberapa alat pengukuran yang berasingan seperti penimbang air, sesiku L dan tolok ukuran semasa amali kerja bata dijalankan. Penggunaan alat yang berasingan boleh menyebabkan pelajar perlu menukar alat secara berulang, mengambil masa yang lebih lama serta berpotensi menimbulkan kekeliruan terhadap fungsi setiap alat. Oleh itu, kajian ini bertujuan untuk mengenal pasti ciri-ciri yang diperlukan dalam pembangunan Smart Level Tritool, mereka bentuk dan membangunkan Smart Level Tritool yang praktikal serta menilai kesesuaian penggunaannya dalam amali kerja bata. Kajian ini menggunakan Model Design Thinking sebagai panduan pembangunan produk yang melibatkan fasa empati, takrif, penjanaan idea, prototaip dan pengujian. Seramai 27 orang pelajar Tahun 4 Ijazah Sarjana Muda Teknologi serta Pendidikan (Kejuruteraan Awam) dengan Kepujian, Universiti Teknologi Malaysia yang telah menjalani latihan mengajar telah dipilih sebagai responden kajian. Data dikumpulkan menggunakan borang soal selidik berskala Guttman, iaitu pilihan jawapan “Ya” dan “Tidak”, serta dianalisis menggunakan statistik deskriptif berbentuk kekerapan dan peratusan dengan bantuan perisian SPSS. Dapatan kajian menunjukkan bahawa majoriti responden bersetuju bahawa Smart Level Tritool mempunyai ciri-ciri yang diperlukan dalam amali kerja bata. Dapatan juga menunjukkan bahawa majoriti responden memberikan maklum balas positif terhadap kesesuaian penggunaan Smart Level Tritool. Secara keseluruhannya, Smart Level Tritool berpotensi digunakan sebagai alat bantu dalam kerja kerana menggabungkan fungsi semakan aras, ketegakan dan sudut dalam satu alat yang lebih praktikal. Kajian ini diharapkan dapat menyumbang kepada pembangunan inovasi alat dalam melaksanakan kerja amali yang sesuai dengan keperluan pendidikan teknikal dan vokasional.

This study was conducted to develop the Smart Level Tritool as a multifunctional tool for brickwork practical activities in Vocational Colleges. The research problem was based on the use of separate measuring tools such as a penimbang air, L-square and measuring gauge during brickwork practical sessions. The use of separate tools may require students to frequently switch between tools, consume more time and potentially cause confusion regarding the function of each tool. Therefore, this study aimed to identify the required features in the development of the Smart Level Tritool, design and develop a practical Smart Level Tritool, and evaluate its suitability for use in brickwork practical activities. This study employed the Design Thinking Model as a product development guide, which involved the phases of empathize, define, ideate, prototype and test. A total of 27 fourth-year students from the Bachelor of Technology with Education (Civil Engineering) with Honours programme at

Universiti Teknologi Malaysia who had undergone teaching practice were selected as respondents. Data were collected using a Guttman scale questionnaire with "Yes" and "No" responses and were analysed using descriptive statistics in the form of frequency and percentage with the assistance of SPSS software. The findings showed that the majority of respondents agreed that the Smart Level Tritool has the required features for brickwork practical activities. The findings also indicated that most respondents provided positive feedback on the suitability of the Smart Level Tritool. Overall, the Smart Level Tritool has the potential to be used as a practical training aid as it combines level, verticality and angle checking functions in one practical tool. This study is expected to contribute to the development of innovative practical tools that meet the needs of technical and vocational education.

PEMBANGUNAN MODUL AKADEMIK PEMBELAJARAN BIM BERINTEGRASI

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Kajian ini bertujuan untuk membangunkan kandungan modul akademik Development of an Integrated BIM Learning Module bagi menyokong pembelajaran Building Information Modelling (BIM) dalam pendidikan Kejuruteraan Awam dan Technical and Vocational Education and Training (TVET), serta menilai tahap persetujuan pakar terhadap kandungan modul yang dibangunkan. Perkembangan pesat industri pembinaan digital telah meningkatkan keperluan terhadap penguasaan kemahiran BIM secara menyeluruh. Walau bagaimanapun, amalan pembelajaran sedia ada masih menunjukkan jurang kemahiran digital apabila perisian seperti Autodesk Revit dan AutoCAD diajar secara berasingan tanpa penekanan terhadap aliran kerja kolaboratif antara disiplin. Kajian ini memfokuskan kepada pembangunan modul bersepadu yang menggabungkan empat disiplin utama dalam BIM iaitu Architecture, Structure, Plumbing (M&E) dan Quantity Surveying dalam satu aliran kerja pembelajaran yang sistematik. Reka bentuk kajian adalah berasaskan Model Pembinaan Modul Sharifah Alwiah Alsagoff. Analisis kandungan dokumen telah dijalankan ke atas sumber rujukan seperti National Occupational Skills Standard (NOSS), Kurikulum Standard Kolej Vokasional (KSKV), Akademi Binaan Malaysia (ABM), dokumen BIM serta bahan pembelajaran Autodesk Revit bagi mengenal pasti topik, subtopik dan elemen pembelajaran yang sesuai dimasukkan ke dalam modul. Seterusnya, kesahan kandungan modul dinilai oleh dua orang pakar yang mewakili industri dan pendidikan menggunakan instrumen penilaian kesahan kandungan. Tahap persetujuan pakar dianalisis menggunakan Percentage Agreement, pekali Cohen's Kappa, serta pengesahan tambahan melalui Gwet's AC1. Hasil kajian menunjukkan kesemua elemen yang dinilai memperoleh peratus persetujuan sebanyak 100%. Walaupun analisis Cohen's Kappa menunjukkan keterbatasan interpretasi akibat persetujuan mutlak antara pakar (Kappa Paradox), analisis Gwet's AC1 merekodkan nilai AC1 = 1.00 yang menunjukkan tahap persetujuan sempurna (Perfect Agreement). Secara keseluruhannya, modul Development of an Integrated BIM Learning Module yang dibangunkan mempunyai tahap kesahan kandungan dan kebolehpercayaan yang sangat tinggi berdasarkan penilaian pakar. Modul ini berpotensi menjadi bahan pembelajaran berstruktur yang dapat membantu pelajar memahami konsep BIM secara bersepadu serta menyokong keperluan kemahiran digital dalam industri pembinaan moden. Kata kunci: Building Information Modelling (BIM), pembangunan modul, modul pembelajaran berintegrasi, kesahan kandungan, Gwet's AC1.

This study aims to develop the content of an academic module titled Development of an

Integrated BIM Learning Module to support the learning of Building Information Modelling (BIM) in Civil Engineering education and Technical and Vocational Education and Training (TVET), as well as to determine the level of expert agreement on the developed module content. The rapid development of the digital construction industry has increased the demand for comprehensive BIM competency. However, current teaching practices still reveal a digital skills gap, where software such as Autodesk Revit and AutoCAD are taught separately without emphasizing an integrated and collaborative interdisciplinary workflow. This study focuses on the development of an integrated module that combines four main BIM disciplines, namely Architecture, Structure, Plumbing (M&E), and Quantity Surveying, into a systematic learning workflow. The study design is based on the Module Development Model by Sharifah Alwiah Alsagoff. Content analysis was conducted on relevant reference documents such as the National Occupational Skills Standard (NOSS), Curriculum Standard for Vocational Colleges (KSKV), Akademi Binaan Malaysia (ABM), BIM-related documents, and Autodesk Revit learning materials to identify suitable topics, subtopics, and learning elements to be included in the module. Next, the content validity of the module was evaluated by two experts representing industry and education using a content validity assessment instrument. The level of expert agreement was analyzed using Percentag Agreement, Cohen's Kappa coefficient, and further validation using Gwet's AC1. The findings show that all evaluated elements achieved a 100% agreement rate. Although Cohen's Kappa analysis indicated interpretational limitations due to perfect agreement between experts (Kappa Paradox), Gwet's AC1 recorded a value of 1.00, indicating perfect agreement. Overall, the developed Development of an Integrated BIM Learning Module demonstrates a very high level of content validity and reliability based on expert evaluation. The module has strong potential as a structured learning resource to enhance students' understanding of BIM in an integrated manner while supporting the digital competency needs of the modern construction industry.
Keywords: Building Information Modelling (BIM), module development, integrated learning module, content validity, Gwet's AC1.

PENERAPAN ELEMEN BAHAN BINAAN LESTARI BAGI PEMBINAAN HIJAU DALAM PENGAJARAN PROGRAM TEKNOLOGI PEMBINAAN DI KOLEJ VOKASIONAL

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Kajian ini dijalankan bertujuan mengenal pasti penerapan elemen bahan binaan lestari bagi pembinaan hijau dalam pengajaran Program Teknologi Pembinaan di Kolej Vokasional. Pendekatan kualitatif digunakan dengan menggabungkan dua kaedah pengumpulan data utama iaitu analisis dokumen dan temu bual separa berstruktur bersama lima orang pensyarah yang dipilih melalui persampelan bertujuan. Analisis dokumen dijalankan terhadap Dokumen Pentaksiran Standard Kompetensi (DPSK) serta modul pengajaran program Sijil Vokasional Malaysia (SVM) dan Diploma Vokasional Malaysia (DVM), manakala data temu bual dianalisis menggunakan analisis tematik berdasarkan model Braun dan Clarke (2006). Dapatan kajian menunjukkan bahawa elemen bahan binaan lestari telah diterapkan secara formal dalam kurikulum, namun bersifat progresif dan tidak seragam antara peringkat Sijil dan Diploma, di mana peringkat DVM lebih menyeluruh berbanding SVM terutamanya dalam aspek bahan rendah karbon dan kecekapan tenaga. Berdasarkan perspektif pensyarah, penerapan dilaksanakan melalui perbincangan teori dalam kelas, penggunaan bahan alternatif seperti bata interlock dalam amali bengkel serta amalan pengurusan sisa binaan secara 3R. Indikator bahan binaan lestari yang paling sesuai untuk diterapkan dalam kurikulum ialah ketahanan bahan, kebolehgunaan semula dan kesan negatif yang minimum terhadap alam sekitar. Kajian turut mendedahkan bahawa kesemua pensyarah tidak pernah mendapat latihan khusus berkaitan bahan binaan lestari, menyebabkan mereka memerlukan program latihan yang lebih spesifik, modular dan berasaskan kolaborasi industri. Kajian ini diharapkan menjadi panduan kepada penggubal kurikulum dan pihak institusi dalam memperkasakan penerapan elemen hijau secara menyeluruh bagi melahirkan graduan yang bersedia menghadapi tuntutan industri pembinaan lestari masa hadapan.

This study aims to identify the integration of sustainable building material elements for green construction in the teaching of Program Teknologi Pembinaan at Kolej Vokasional. A qualitative approach was adopted by combining two primary data collection methods, namely document analysis and semi-structured interviews with five lecturers selected through purposive sampling. Document analysis was conducted on the Curriculum Standard Assessment Documents (DPSK) as well as the teaching modules for the Malaysian Vocational Certificate (SVM) and Malaysian Vocational Diploma (DVM) programmes, while interview data were analysed using thematic analysis based on Braun and Clarke's (2006) model. Findings reveal that sustainable building material elements have been formally integrated into the curriculum, albeit in a progressive and non-uniform manner across the Certificate and Diploma levels, with DVM demonstrating more comprehensive coverage compared to SVM, particularly in low-carbon materials and energy efficiency aspects. From the lecturers' perspectives, integration is implemented through theoretical classroom discussions, the use of alternative materials such as interlocking bricks in practical sessions, and construction waste management practices based on the 3R principle. The most suitable sustainable building material indicators for curriculum integration were identified as material durability, reusability and minimum negative environmental impact. The study also reveals that all lecturers had never received specific training related to sustainable building materials, indicating a critical need for more targeted, modular, and industry collaborative training programmes. It is hoped that this study will serve as a guide for curriculum developers and institutional stakeholders in strengthening the holistic integration of green elements to

produce graduates who are prepared to meet the demands of the sustainable construction industry in the future.

PEMATUHAN PENGGUNAAN SISTEM PERANGKAP MINYAK DALAM OPERASI BENGKEL MASAKAN KOLEJ VOKASIONAL

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Pendidikan dan Latihan Teknikal dan Vokasional (TVET) di Kolej Vokasional berperanan penting dalam melahirkan tenaga kerja profesional dalam bidang penyediaan makanan melalui pendekatan pembelajaran berasaskan amali. Namun begitu, aktiviti amali di bengkel masakan menghasilkan sisa lemak, minyak dan gris (FOG) yang berpotensi menyebabkan penyumbatan sistem pembetungan serta pencemaran alam sekitar sekiranya tidak diurus dengan baik. Oleh itu, penggunaan sistem perangkap minyak amat penting sebagai kaedah rawatan awal yang berfungsi memerangkap dan mengasingkan sisa FOG sebelum air sisa dilepaskan ke sistem saliran. Kajian ini dijalankan bagi mengenal pasti tahap pengaruh faktor dalaman (pengetahuan, kesedaran dan sikap), faktor luaran (infrastruktur, pengurusan dan penguatkuasaan), pematuhan garis panduan (pemasangan, operasi, penyelenggaraan dan pelupusan sisa) serta hubungan antara faktor dalaman dan faktor luaran terhadap pematuhan garis panduan penggunaan sistem perangkap minyak di bengkel masakan. Data kajian dikumpulkan melalui soal selidik berstruktur yang melibatkan 43 orang pensyarah kursus kulinari dan bakeri pastri daripada tiga buah Kolej Vokasional di Johor. Data dianalisis menggunakan kekerapan, peratusan, min, sisihan piawai dan korelasi Spearman rho. Dapatan kajian menunjukkan bahawa faktor dalaman berada pada tahap tinggi (M=4.55, SP=0.37), diikuti pematuhan garis panduan yang turut mencatatkan tahap tinggi (M=4.18, SP=0.63), manakala faktor luaran berada pada tahap sederhana tinggi (M=3.80, SP=0.56). Analisis korelasi pula menunjukkan bahawa faktor luaran mempunyai hubungan signifikan yang lebih kuat terhadap pematuhan ($r=0.653$, $p<0.001$) berbanding faktor dalaman ($r=0.440$, $p=0.003$). Secara keseluruhannya, kajian ini merumuskan bahawa penyediaan infrastruktur, sokongan pengurusan dan amalan penguatkuasaan yang konsisten merupakan elemen penting dalam meningkatkan tahap pematuhan penggunaan sistem perangkap minyak serta memperkukuhkan pengurusan sisa dapur yang sistematik dan lestari.

Technical and Vocational Education and Training (TVET) in Vocational Colleges plays an important role in developing skilled culinary professionals through practical learning. However, culinary laboratory activities generate fat, oil and grease (FOG) waste that may contribute to sewage blockages and environmental issues if improperly managed. This highlights the importance of grease trap systems as pre-treatment facilities to intercept and separate FOG before wastewater discharge into drainage systems. This case study aims to identify the level of internal factors (knowledge, awareness and attitudes), external factors (infrastructure, management and enforcement), compliance (installation, operation, maintenance and waste disposal) and the relationship between internal and external factors towards compliance on grease trap usage guidelines in culinary laboratories. Data were collected from 43 culinary and bakery pastry lecturers from three Vocational Colleges in Johor using a structured questionnaire. Data were analysed using frequency, percentage, mean, standard deviation and Spearman's rho correlation. The findings revealed high levels of internal factors (M=4.55, SD=0.37), followed by overall compliance (M=4.18, SD=0.63), while external factors showed a medium high level (M=3.80, SD=0.56). Correlation analysis showed that external factors had a stronger significant relationship with compliance

(r=0.653, p<0.001) as compare to internal factors (r=0.440, p=0.003). The study concludes that effective infrastructure, management support and enforcement practices are key drivers in improving grease trap system compliance and enhancing kitchen waste management.

PEMBANGUNAN MODUL AKADEMIK PEMASANGAN DAN PENGENDALIAN KOMPONEN BESI DAN STRUKTUR BUMBUNG

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Kekurangan pendedahan khusus dan ketiadaan bahan rujukan berstruktur bagi elemen struktur besi sering menyukarkan persediaan pelajar Pendidikan Kejuruteraan Awam di Universiti Teknologi Malaysia (UTM) sebelum mereka menjalani latihan mengajar. Oleh itu, kajian ini dijalankan dengan matlamat untuk membangunkan Modul Akademik Pemasangan dan Pengendalian Komponen Besi dan Struktur Bumbung, serta menilai tahap kesahan kandungan dan persetujuan pakar terhadap modul yang dihasilkan. Kajian ini mengaplikasikan reka bentuk kaedah campuran melalui penilaian formatif dan kajian kebolehjanaan (feasibility study). Pembangunan draf modul dilaksanakan secara bersistematik berlandaskan integrasi Model Pembinaan Modul Sidek dan Model Sharifah Alwiah Alsagoff, dengan dipandu oleh analisis dokumen rujukan industri seperti National Occupational Skills Standard (NOSS) dan Lembaga Pembangunan Industri Pembinaan (CIDB). Seramai dua (2) orang pakar yang mewakili bidang akademik dan industri telah dipilih menggunakan teknik pensampelan bertujuan, yang mana saiz panel ini adalah sah bersandarkan standard Lynn (1986) bagi penilaian kandungan modul. Data yang dikumpul dianalisis menggunakan pengiraan peratusan kesahan dan statistik Gwet's AC1 untuk mengukur kesepakatan antara penilai (inter-rater reliability) bagi tujuan penentusahan modul dan bukan bertujuan membuat generalisasi populasi. Hasil dapatan kajian berjaya menstrukturkan enam topik bagi struktur besi dan lima topik bagi struktur bumbung keluli. Penilaian pakar pula mencatatkan peratus persetujuan pemerhatian maksimum iaitu 100%. Di samping itu, analisis kebolehpercayaan statistik Gwet's AC1 merekodkan nilai 1.00 (Cemerlang), yang membuktikan tahap kesepakatan pakar yang mutlak dan sempurna. Kesimpulannya, modul akademik ini mempunyai kesahan dan kebolehpercayaan yang sangat utuh, lantas menjadikannya bahan sokongan pengajaran dan pembelajaran (PdP) yang efektif bagi memperkasa kemahiran amali pelajar selari dengan keperluan industri pembinaan moden. Kata Kunci: Pembangunan Modul, Pendidikan Kejuruteraan Awam, Penilaian Formatif, Kesahan Kandungan, Gwet's AC1, Struktur Besi dan Bumbung Keluli.

The lack of specific exposure and the absence of structured reference materials for steel structure elements often hinder the preparation of Civil Engineering Education students at Universiti Teknologi Malaysia (UTM) prior to their teaching practicum. Therefore, this study was conducted with the aim of developing the Academic Module for the Installation and Handling of Steel Components and Roof Structures, as well as evaluating the level of content validity and expert agreement on the developed module. This study applied a mixed-methods design focusing on formative evaluation and a feasibility study. The development of the module draft was carried out systematically based on the integration of the Sidek Module Development Model and the Sharifah Alwiah Alsagoff Model, guided by the document analysis of industry references such as the National Occupational Skills Standard (NOSS) and the Construction Industry Development Board (CIDB). A total of two (2) experts representing the academic and industrial fields were selected using a purposive sampling

technique, a sample size validated by Lynn's (1986) standards for module content evaluation. The collected data were analyzed using validity percentages and Gwet's AC1 statistics to measure inter-rater reliability for module validation purposes, without aiming for population generalization. The findings successfully structured six topics for steel structures and five topics for steel roof structures. The expert evaluation recorded a maximum observed agreement percentage of 100%. Additionally, the reliability analysis using Gwet's AC1 statistics recorded a value of 1.00 (Excellent), which proves an absolute and perfect level of expert consensus. In conclusion, this academic module possesses highly robust validity and reliability, thereby making it an effective teaching and learning (T&L) support material to empower students' practical skills in line with the needs of the modern construction industry.
Keywords: Module Development, Civil Engineering Education, Formative Evaluation, Content Validity, Gwet's AC1, Steel and Roof Structures.

PERSEPSI GURU TERHADAP KESEDIAAN MASA HADAPAN KURIKULUM PROGRAM TEKNOLOGI PEMBINAAN DI KOLEJ VOKASIONAL

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Kajian ini dijalankan bagi mengenal pasti persepsi guru terhadap kesediaan masa hadapan kurikulum Program Teknologi Pembinaan di Kolej Vokasional Negeri Johor. Fokus kajian ini melibatkan tiga aspek utama, iaitu kurikulum program, kesediaan kemudahan bengkel dan keperluan sokongan bagi meningkatkan kualiti program pada masa hadapan. Kajian ini menggunakan pendekatan kualitatif deskriptif melalui kaedah temu bual bersama enam orang pensyarah Program Teknologi Pembinaan daripada enam buah kolej vokasional di negeri Johor. Data yang diperoleh dianalisis secara tematik bagi mengenal pasti tema utama berdasarkan objektif kajian. Dapatan kajian menunjukkan bahawa majoriti guru berpandangan kurikulum semasa adalah relevan, tersusun dan berupaya meningkatkan pengetahuan, pemahaman serta kemahiran pelajar. Walau bagaimanapun, elemen keusahawanan, inovasi dan pemikiran kritis masih memerlukan penambahbaikan agar lebih sejajar dengan keperluan industri masa hadapan. Dari segi kemudahan bengkel, peserta kajian berpendapat bahawa kemudahan asas adalah memadai tetapi masih terdapat keperluan untuk menambah baik ruang amali, peralatan digital dan infrastruktur pembelajaran. Selain itu, sokongan kewangan, latihan berterusan kepada guru dan kerjasama dengan pihak industri dikenal pasti sebagai elemen penting dalam memperkukuh pelaksanaan program. Secara keseluruhannya, kajian ini merumuskan bahawa penambahbaikan berterusan terhadap kurikulum, kemudahan bengkel dan bentuk sokongan amat penting bagi memastikan Program Teknologi Pembinaan kekal relevan serta mampu melahirkan graduan yang kompeten, berdaya saing dan memenuhi kehendak industri pembinaan masa hadapan.

This study was conducted to identify teachers' perceptions of the future readiness of the Construction Technology Program curriculum at Vocational Colleges in Johor. It focused on three main aspects, it is the program curriculum, workshop facility readiness and support needs to improve the program's future quality. The study used a descriptive qualitative approach through interviews with six lecturers from the Construction Technology Program at six vocational colleges in Johor. The data were analyzed thematically to identify the main themes based on the study objectives. The findings showed that most teachers viewed the current curriculum as relevant, well organized, and capable of improving students' knowledge, understanding, and skills. However, entrepreneurship, innovation, and critical thinking still need improvement so that they align more closely with future industry needs. In terms of workshop facilities, the participants felt that the basic facilities were adequate, but there was still a need to improve practical space, digital equipment, and learning infrastructure. In addition, financial support, ongoing teacher training, and collaboration with industry were identified as important elements in strengthening program implementation. Overall, the study concludes that continuous improvement in the curriculum, workshop facilities, and support systems is essential to ensure that the Construction Technology Program remains relevant and able to produce competent, competitive graduates who meet the needs of the future construction industry.

TAHAP KESEDIAAN PELAJAR BIDANG PENDIDIKAN TVET UTM BAGI MENGHADAPI ALAM PEKERJAAN SELEPAS MENJALANI LATIHAN MENGAJAR DAN LATIHAN INDUSTRI

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Program latihan amali dwi-lapangan yang merangkumi Latihan Mengajar (LM) dan Latihan Industri (LI) merupakan komponen penting dalam membentuk kesediaan profesional pelajar bidang Pendidikan dan Latihan Teknikal dan Vokasional (TVET) sebelum memasuki alam pekerjaan. Kajian ini bertujuan mengenal pasti tahap kesediaan pelajar bidang Pendidikan TVET Universiti Teknologi Malaysia (UTM) bagi menghadapi alam pekerjaan selepas menjalani LM dan LI. Tahap kesediaan pelajar dinilai berdasarkan tiga aspek utama, iaitu pengetahuan, kemahiran dan sikap. Kajian ini menggunakan reka bentuk tinjauan kuantitatif berbentuk deskriptif dengan sokongan analisis kandungan deskriptif bagi soalan terbuka. Responden kajian terdiri daripada 82 orang pelajar tahun akhir bidang Pendidikan TVET UTM yang telah menjalani kedua-dua latihan tersebut. Data dikumpulkan menggunakan soal selidik Google Forms yang mengandungi maklumat demografi, 34 item berskala Likert empat mata bagi konstruk pengetahuan, kemahiran dan sikap, serta dua soalan terbuka berkaitan cadangan penambahbaikan. Data kuantitatif dianalisis menggunakan statistik deskriptif yang melibatkan kekerapan, peratusan, min dan sisihan piawai, manakala maklum balas soalan terbuka dianalisis secara analisis kandungan deskriptif. Dapatan kajian menunjukkan bahawa tahap kesediaan pelajar secara keseluruhan berada pada tahap tinggi. Konstruk sikap mencatatkan skor min tertinggi (M = 3.29), diikuti oleh konstruk kemahiran (M = 3.13), manakala konstruk pengetahuan mencatatkan skor min paling rendah (M = 3.03). Dapatan ini menunjukkan bahawa LM dan LI memberi sumbangan positif terhadap pembentukan sikap profesional, kemahiran praktikal dan pengetahuan pelajar, namun aspek pengetahuan masih memerlukan penambahbaikan. Analisis soalan terbuka pula mengenal pasti tiga tema utama cadangan penambahbaikan, iaitu pengukuhan latihan praktikal dan amali, pemantapan pelaksanaan LM dan LI serta peluasan pendedahan kerjaya dan dunia pekerjaan. Secara keseluruhannya, kajian ini memberi implikasi kepada pihak universiti, penyelia latihan dan pihak berkepentingan dalam memperkukuh struktur latihan amali supaya pelajar Pendidikan TVET lebih bersedia, berkeyakinan dan berdaya saing untuk memasuki alam pekerjaan.

The dual-field practical training Program which includes teaching training (LM) and Industrial Training (LI) is an important component in shaping the professional readiness of students in the field of technical and Vocational Education and training (TVET) before entering the workforce. This study aims to identify the level of readiness of students in the field of TVET education Universiti Teknologi Malaysia (UTM) to face the nature of work after undergoing LM and LI. The level of readiness of students is assessed based on three main aspects, namely knowledge, skills and attitudes. This study uses a descriptive quantitative survey design with the support of descriptive content analysis for open-ended questions. The survey respondents consisted of 82 students in the final year of TVET UTM Education who had undergone both trainings. The Data was collected using a Google Forms questionnaire containing demographic information, 34 items on a four-point Likert scale for knowledge, skills and attitude constructs, and two open-ended questions on suggestions for improvement. Quantitative Data were analyzed using descriptive statistics involving frequency, percentage, mean and standard deviation, while open-ended question responses were analyzed using descriptive content analysis. The findings show that the overall readiness level of students is at a high level. The attitude construct recorded the highest mean score (M = 3.29), followed by the skill construct (M = 3.13), while the knowledge construct recorded the lowest mean

score (M = 3.03). These findings indicate that LM and LI make a positive contribution to the formation of professional attitudes, practical skills and knowledge of students, but aspects of knowledge still require improvement. The open-ended question analysis identified three main themes of improvement proposals, namely strengthening practical and hands-on training, strengthening the implementation of LM and LI and expanding career exposure and the world of work. Overall, this study has implications for the university, training supervisors and stakeholders in strengthening the structure of practical training so that TVET education students are more prepared, confident and competitive to enter the workforce.

PERSEPSI TAHAP PENGUASAAN KEMAHIRAN PRAKTIKAL DAN KESEDIAAN MENGAJAR DALAM KALANGAN BAKAL GURU KEJURUTERAAN AWAM DI UNIVERSITI TEKNOLOGI MALAYSIA

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Kemahiran praktikal dan kesediaan mengajar merupakan elemen penting dalam melahirkan bakal guru TVET yang kompeten. Justeru, kajian ini bertujuan menilai persepsi tahap penguasaan kemahiran praktikal dan kesediaan mengajar dalam kalangan bakal guru Kejuruteraan Awam di Universiti Teknologi Malaysia (UTM), di samping mengenal pasti strategi penambahbaikan latihan praktikal bagi meningkatkan kesediaan mengajar. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan deskriptif. Seramai 86 orang pelajar Program Pendidikan Kejuruteraan Awam dipilih sebagai sampel kajian melalui teknik persampelan rawak mudah berdasarkan jadual Krejcie dan Morgan. Data dikumpulkan menggunakan soal selidik dan dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui statistik deskriptif yang melibatkan kekerapan, peratusan, min dan sisihan piawai. Dapatan kajian menunjukkan bahawa persepsi tahap penguasaan kemahiran praktikal berada pada tahap tinggi, dengan aspek sikap merekodkan skor min tertinggi, diikuti aspek pengetahuan, manakala aspek kemahiran berada pada tahap sederhana. Sebaliknya, persepsi tahap kesediaan mengajar berada pada tahap sederhana. Bagi strategi penambahbaikan latihan praktikal, majoriti responden mencadangkan penyelarasan silibus dengan keperluan Kolej Vokasional dan industri, diikuti penambahan kelas amali dan latihan hands-on, pemanjangan tempoh latihan praktikal, penambahbaikan fasiliti bengkel, peningkatan pendedahan kepada simulasi pengajaran serta penambahan pembantu bengkel. Kesimpulannya, penguasaan kemahiran praktikal yang tinggi sahaja belum mencukupi untuk membentuk tahap kesediaan mengajar yang optimum. Oleh itu, penambahbaikan kurikulum dan latihan praktikal yang lebih sistematik serta selaras dengan keperluan industri wajar diberi perhatian bagi melahirkan bakal guru TVET yang kompeten dan bersedia menghadapi profesion perguruan.

Practical skills and teaching readiness are essential elements in producing competent Technical and Vocational Education and Training (TVET) teachers. Therefore, this study aimed to evaluate the perceptions of practical skills mastery and teaching readiness among Civil Engineering pre-service teachers at University Technology Malaysia (UTM), as well as to identify strategies for improving practical training to enhance their teaching readiness. This study employed a quantitative approach using a descriptive survey design. A total of 86 Civil Engineering Education students were selected as the research sample through simple random sampling based on the Krejcie and Morgan sampling table. Data were collected using a questionnaire and analysed using the Statistical Package for the Social Sciences (SPSS)

through descriptive statistics, including frequency, percentage, mean, and standard deviation. The findings revealed that the overall perception of practical skills mastery was at a high level, with the attitude aspect recording the highest mean score, followed by the knowledge aspect, while the skills aspect was at a moderate level. In contrast, the overall level of teaching readiness was found to be moderate. Regarding strategies for improving practical training, most respondents suggested aligning the curriculum with the needs of Vocational Colleges and industry, followed by increasing practical classes and hands-on training, extending the duration of practical training, improving workshop facilities, providing greater exposure to teaching simulations, and increasing the number of workshop assistants. In conclusion, high practical skills mastery alone is insufficient to ensure a high level of teaching readiness. Therefore, improvements to the curriculum and practical training that are more systematic and aligned with industry needs should be prioritised to produce competent and well-prepared future TVET teachers.

PENGGUNAAN TEKNOLOGI DRON DALAM MENINGKATKAN KEBOLEHPASARAN GRADUAN KOLEJ VOKASIONAL DI SEKTOR PEMBINAAN

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Perkembangan pesat teknologi dron dalam era Revolusi Industri 4.0 (IR 4.0) telah mengubah landskap operasi sektor pembinaan secara drastik menerusi pemantauan dan pengawasan keselamatan yang lebih efisien. Walau bagaimanapun, proses automasi ini telah mencetuskan krisis kebolehpasaran kritikal bagi graduan Kolej Vokasional (KV) akibat isu "dwi-cabaran" kompetensi iaitu kekurangan literasi teknologi digital baharu serta kelemahan ketara dalam penguasaan kemahiran insaniah. Justeru, kajian ini dijalankan dengan objektif untuk meneroka keperluan kemahiran teknikal dan generik graduan KV serta menilai kesan pengaplikasian dron terhadap perubahan skop kerja tenaga separa mahir di tapak bina. Menggunakan pendekatan kualitatif dengan reka bentuk kajian kes, data primer diperoleh melalui temu bual mendalam separa struktur bersama panel pakar industri daripada firma pembinaan bertaraf Gred 7 (G7) yang mengintegrasikan teknologi dron. Dapatan kajian mendedahkan bahawa proses penganalisisan data dron menuntut rantaian kompetensi hibrid yang bermula daripada asas matematik dan manipulasi hamparan Microsoft Excel sebelum diterjemahkan ke dalam perisian AutoCAD atau Revit. Selain itu, kajian turut membongkar isu kerapuhan kestabilan emosi tenaga kerja muda yang mudah tersinggung dan cepat putus asa apabila menerima teguran profesional di lapangan kerja. Rumusannya, penguasaan kemahiran digital yang seimbang dengan ketahanan mental yang tinggi adalah kunci utama penentu tahap kebolehpasaran graduan. Oleh itu, kajian ini mencadangkan agar pihak Kementerian Pendidikan Malaysia (KPM) dan institusi KV segera merombak kurikulum sedia ada dengan mewajarkan penyepaduan modul analisis data digital secara mandatori di samping melaksanakan simulasi tekanan di dalam bengkel amali bagi melatih ketahanan psikologi pelajar sebelum melangkah ke alam industri.

The rapid advancement of drone technology in the Industrial Revolution 4.0 (IR 4.0) era has drastically transformed the operational landscape of the construction sector through more efficient monitoring and safety surveillance. However, this automation process has triggered a critical employability crisis for Vocational College (KV) graduates due to a "dual-competency challenge," namely a lack of new digital technology literacy and significant deficiencies in soft skills mastery. Hence, this study was conducted with the objective of

exploring the required technical and generic skills of KV graduates as well as evaluating the impact of drone application on the changing work scope of semi-skilled labor at construction sites. Utilizing a qualitative approach with a case study design, primary data were gathered through semistructured in-depth interviews with an industry expert panel from Grade 7 (G7) construction firms that integrate drone technology. The findings revealed that the drone data analysis process demands a hybrid chain of competencies starting from fundamental mathematics and data manipulation in Microsoft Excel spreadsheets prior to translation into AutoCAD or Revit software. Furthermore, the study uncovered critical issues regarding the fragile emotional stability of the young workforce, who are easily offended and quick to lose motivation when receiving professional reprimands in the field. In summary, balancing digital proficiency with high mental fortitude serves as the primary determinant of graduate employability. Therefore, this study proposes that the Ministry of Education Malaysia (MOE) and KV institutions promptly overhaul the existing curriculum by mandating the integration of digital data analysis modules, alongside executing stress-test simulations in practical workshops to cultivate students' psychological resilience before entering the industry.

TAHAP KESEDIAAN PENGAJAR TVET DARI ASPEK PENGETAHUAN TERHADAP PENGAJARAN DAN PEMBELAJARAN BERASASKAN REVOLUSI INDUSTRI 5.0

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Revolusi Industri 5.0 (IR 5.0) merupakan satu perkembangan baharu yang menekankan keseimbangan antara kemajuan teknologi, nilai kemanusiaan, kelestarian dan keperluan industri. Dalam konteks Pendidikan dan Latihan Teknikal dan Vokasional (TVET), perubahan ini menuntut pengajar agar sentiasa bersedia mengintegrasikan teknologi serta mengaplikasikan pendekatan pedagogi yang sesuai bagi memenuhi keperluan pembelajaran masa kini. Kesediaan pengajar amat penting kerana mereka berperanan dalam membentuk tenaga kerja yang berkemahiran, berpengetahuan dan mampu menyesuaikan diri dengan perubahan teknologi industri. Justeru itu, kajian ini bertujuan untuk mengkaji tahap kesediaan pengajar TVET dari aspek pengetahuan terhadap pengajaran dan pembelajaran berasaskan Revolusi Industri 5.0 berdasarkan tiga aspek iaitu pengetahuan teknologi, pengetahuan pedagogi dan pengetahuan kandungan. Seramai 80 orang pengajar TVET daripada dua buah Kolej Vokasional dipilih sebagai responden melalui kaedah persampelan berstrata. Kajian ini menggunakan pendekatan kuantitatif dengan data dikumpulkan melalui instrumen soal selidik. Data kemudiannya dianalisis menggunakan statistik deskriptif menerusi perisian Statistical Package for the Social Sciences (SPSS). Dapatan kajian menunjukkan bahawa tahap kesediaan pengajar TVET dari aspek pengetahuan berada pada tahap tinggi bagi ketiga-tiga aspek yang dikaji iaitu pengetahuan teknologi, pengetahuan pedagogi dan pengetahuan kandungan. Implikasi kajian ini diharapkan dapat menyumbang kepada pembangunan dasar dan amalan TVET, khususnya dalam merangka program latihan tenaga pengajar serta pelaksanaan pengajaran dan pembelajaran (PdP) yang lebih sistematik dan holistik selaras dengan tuntutan IR 5.0.

The Industrial Revolution 5.0 (IR 5.0) is a recent development that emphasises a balance between technological advancement, human values, sustainability and industrial needs. In the context of Technical and Vocational Education and Training (TVET), this development requires educators to be prepared to integrate technology and apply appropriate pedagogical approaches to meet current learning needs. Educator readiness is crucial as educators play an important role in developing a skilled, knowledgeable workforce that is able to adapt to changes in industrial technology. Therefore, this study aimed to examine the level of TVET educators readiness in terms of knowledge towards teaching and learning based on Industrial Revolution 5.0 from three aspects namely technological knowledge, pedagogical knowledge and content knowledge. A total of 80 TVET educators from two Vocational Colleges were selected as respondents through stratified sampling. This study employed a quantitative approach, in which data were collected using a questionnaire instrument. The data were then analysed using descriptive statistics through the Statistical Package for the Social Sciences (SPSS) software. The findings showed that the level of readiness in terms of knowledge among TVET educators was high across all three aspects examined namely technological knowledge, pedagogical knowledge and content knowledge. The implications of this study are expected to contribute to the development of TVET policies and practices, particularly in designing educator training programmes and implementing more systematic and holistic teaching and learning practices in line with the demands of IR 5.0.

KAJIAN KESEDARAN PELAJAR TERHADAP KESELAMATAN BENGKEL

BERDASARKAN PENGETAHUAN, SIKAP DAN AMALAN DALAM PENDIDIKAN TEKNIKAL DAN VOKASIONAL DI UTM

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Kajian ini dijalankan untuk menentukan tahap pengetahuan, sikap dan amalan keselamatan bengkel dalam kalangan pelajar Pendidikan Teknikal dan Vokasional (TVET) di Universiti Teknologi Malaysia (UTM), serta mengenal pasti sama ada terdapat perbezaan berdasarkan jantina. Kajian menggunakan pendekatan kuantitatif melalui kaedah tinjauan dan kaedah ujian pencapaian dengan instrumen soal selidik dan ujian pengetahuan berstruktur berasaskan Model Pengetahuan, Sikap dan Amalan (KAP). Seramai 80 orang responden dipilih menggunakan teknik persampelan rawak mudah daripada populasi seramai 98 orang pelajar yang menggunakan bengkel di Bangunan N30, UTM. Data dianalisis menggunakan statistik deskriptif dan inferensi melalui perisian Statistical Package for the Social Sciences (SPSS). Dapatan kajian menunjukkan bahawa tahap pengetahuan, sikap dan amalan keselamatan bengkel berada pada tahap yang tinggi. Responden didapati mempunyai pengetahuan yang baik mengenai prosedur operasi standard (SOP), penggunaan peralatan perlindungan diri (PPE), tindakan kecemasan dan pengurusan risiko. Selain itu, mereka turut menunjukkan sikap yang positif terhadap kepentingan keselamatan serta mengamalkan prosedur keselamatan secara konsisten semasa menjalankan aktiviti amali. Keputusan ujian-t sampel bebas menunjukkan bahawa tidak terdapat perbezaan yang signifikan dalam tahap pengetahuan, sikap dan amalan keselamatan bengkel berdasarkan jantina. Secara keseluruhannya, dapatan kajian menyokong Model KAP yang menjelaskan bahawa pengetahuan, sikap dan amalan yang baik membentuk sikap yang positif dan seterusnya menyokong amalan keselamatan yang baik. Kajian ini diharapkan dapat menjadi rujukan kepada pihak universiti dalam memperkukuhkan budaya keselamatan dan mengurangkan risiko kemalangan dalam persekitaran TVET.

This study was conducted to determine the level of workshop safety knowledge, attitudes, and practices among Technical and Vocational Education and Training (TVET) students at Universiti Teknologi Malaysia (UTM), as well as to identify whether there were any differences based on gender. The study employed a quantitative approach using a survey method and an achievement test, with a structured questionnaire and a structured knowledge test developed based on the Knowledge, Attitude, and Practice (KAP) Model. A total of 80 respondents were selected through simple random sampling from a population of 98 students who used the workshops in Building N30, UTM. The data were analysed using descriptive and inferential statistics through the Statistical Package for the Social Sciences (SPSS) software. The findings revealed that the respondents demonstrated high levels of workshop safety knowledge, attitudes, and practices. The respondents possessed good knowledge of standard operating procedures (SOPs), the use of personal protective equipment (PPE), emergency response procedures, and risk management. In addition, they exhibited positive attitudes towards the importance of workplace safety and consistently adhered to safety procedures during practical activities. The results of the independent samples t-test indicated that there were no statistically significant differences in workshop safety knowledge, attitudes, and practices based on gender. Overall, the findings support the KAP Model, which suggests that adequate knowledge contributes to positive attitudes, which in turn promote good safety practices. It is hoped that the findings of this study will serve as a useful reference for the university in strengthening the safety culture and reducing the risk of accidents within the TVET learning environment.

PEMBINAAN BORANG PENILAIAN NILAI SOPAN DAN BUDI BAHASA

PELAJAR TVET MELALUI PENDEKATAN PEMBELAJARAN PRAKTIKAL

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Pendidikan dan Latihan Teknikal dan Vokasional (TVET) bukan sahaja menekankan penguasaan kemahiran teknikal, malah memerlukan pelajar memiliki nilai sopan, budi bahasa dan etika profesional. Namun demikian, penilaian aspek afektif semasa pembelajaran praktikal masih banyak bergantung pada pemerhatian umum guru tanpa instrumen khusus dan seragam. Oleh itu, kajian ini bertujuan meneroka elemen yang mempengaruhi pemupukan nilai sopan dan budi bahasa, meneroka kriteria pembelajaran praktikal yang menyumbang kepada pengukuhan nilai tersebut serta membina borang penilaian untuk kegunaan guru. Kajian ini menggunakan pendekatan kualitatif berbentuk penerokaan dan pembangunan instrumen. Seramai enam orang guru TVET dipilih secara persampelan bertujuan dan ditemu bual secara separa berstruktur melalui platform Google Meet. Data dianalisis menggunakan analisis tematik melalui proses pembacaan berulang, pengekodan, pembentukan dan semakan tema. Dapatan menunjukkan bahawa elemen penting merangkumi hormat-menghormati, disiplin, tanggungjawab, komunikasi berhemah, kerjasama, integriti, profesionalisme dan penerimaan teguran. Pemupukan nilai tersebut dipengaruhi oleh teladan serta bimbingan guru, budaya dan peraturan bengkel, kerja berkumpulan, pemantauan, latar belakang pelajar, pengaruh media sosial dan kekangan masa. Pembelajaran praktikal mengukuhkan nilai melalui pengalaman kerja autentik, pembahagian peranan, pematuhan prosedur operasi standard, pengurusan masa, penjagaan peralatan, kebersihan serta pemerhatian dan teguran berterusan. Berdasarkan dapatan tersebut, sebuah borang penilaian telah dibina yang mengandungi enam konstruk dan 37 item, iaitu hormat-menghormati, disiplin, tanggungjawab, komunikasi berhemah, kerjasama serta integriti dan profesionalisme. Borang ini menggunakan skala penilaian lima tahap dan menyediakan ruang ulasan guru. Kesimpulannya, borang yang dibina berpotensi membantu guru menilai tingkah laku pelajar secara lebih sistematik dan konsisten semasa pembelajaran praktikal. Walau bagaimanapun, instrumen ini masih memerlukan kesahan pakar dan kajian rintis sebelum digunakan secara meluas.

Technical and Vocational Education and Training (TVET) emphasises not only the mastery of technical skills but also students' courtesy, good manners, and professional ethics. However, assessment of the affective domain during practical learning still largely depends on teachers' general observations without a specific and standardised instrument. Therefore, this study aimed to explore the elements influencing the cultivation of courtesy and good manners, explore the criteria within practical learning that contribute to strengthening these values, and develop an assessment form for teachers. This study employed an exploratory qualitative and instrument-development approach. Six TVET teachers were selected through purposive sampling and interviewed using semi-structured interviews conducted via Google Meet. The data were analysed thematically through repeated reading, coding, theme development, and theme review. The findings indicated that the key elements comprised respect, discipline, responsibility, courteous communication, cooperation, integrity, professionalism, and receptiveness to feedback. The cultivation of these values was influenced by teachers' role modelling and guidance, workshop culture and rules, group work, monitoring, students' backgrounds, social media influence, and time constraints. Practical learning strengthened these values through authentic work experiences, role allocation, compliance with standard operating procedures, time management, care of equipment, cleanliness, and continuous observation and feedback. Based on these findings, an assessment form consisting of six constructs and 37 items was developed. The constructs were respect, discipline,

responsibility, courteous communication, cooperation, and integrity and professionalism. The form uses a five-level rating scale and includes space for teachers' comments. In conclusion, the developed form has the potential to assist teachers in assessing students' behaviour more systematically and consistently during practical learning. Nevertheless, the instrument still requires expert validation and pilot testing before it can be widely implemented.

PEMBANGUNAN LAMAN WEB TVETBINA BIDANG TEKNOLOGI PEMBINAAN BERDASARKAN KEPERLUAN INDUSTRI

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Perkembangan teknologi dalam industri pembinaan telah meningkatkan keperluan terhadap tenaga kerja yang memiliki kemahiran teknikal dan digital. Perubahan ini turut memberi implikasi terhadap pelaksanaan Pendidikan dan Latihan Teknikal dan Vokasional (TVET), khususnya dalam bidang Teknologi Pembinaan di Kolej Vokasional (KV). Justeru, kajian ini dijalankan bagi mengenal pasti kepentingan penerapan teknologi dalam bidang Teknologi Pembinaan serta menilai potensi pembangunan laman sesawang TVETBINA sebagai platform sokongan pengajaran dan pembelajaran (PdP). Kajian ini menggunakan pendekatan kaedah campuran yang melibatkan kaedah kualitatif dan kuantitatif, iaitu data kualitatif diperoleh melalui temu bual bersama guru-guru bidang Teknologi Pembinaan di KV dan pihak Akademi Binaan Malaysia (ABM), manakala data kuantitatif dikumpulkan melalui soal selidik kepada pihak ABM. Data yang diperoleh dianalisis menggunakan kaedah yang bersesuaian bagi mengenal pasti persepsi terhadap penerapan teknologi, ciri-ciri laman sesawang yang memenuhi keperluan PdP serta pandangan pihak industri terhadap pembangunan laman sesawang tersebut bagi memastikan kandungan pembelajaran yang disediakan relevan dengan perkembangan dan keperluan semasa industri pembinaan. Dapatan kajian ini dijangka dapat mengenal pasti potensi penggunaan laman sesawang TVETBINA dalam memperkukuh pelaksanaan PdP di KV, di samping menyokong penyampaian kandungan pembelajaran yang lebih efektif serta selaras dengan keperluan semasa industri pembinaan.

The development of technology in the construction industry has increased the demand for a workforce equipped with technical and digital skills. This transformation has also impacted the implementation of Technical and Vocational Education and Training (TVET), particularly in Construction Technology at Vocational Colleges (KV). Therefore, this study was conducted to identify the importance of integrating technology in Construction Technology and to evaluate the potential development of the TVETBINA website as a teaching and learning (T&L) support platform. This study employed a mixed-method approach involving both qualitative and quantitative methods, where qualitative data were obtained through interviews with Construction Technology teachers at KV and representatives from the Construction Industry Development Board (CIDB), while quantitative data were collected through questionnaires distributed to CIDB representatives. The collected data were analysed using appropriate methods to identify perceptions on technology integration, website features that meet T&L requirements, and industry perspectives on the development of the website to ensure that the learning content remains relevant to current construction industry developments and needs. The findings of this study are expected to identify the potential use of the TVETBINA website in strengthening T&L implementation at KV, as well as supporting more effective delivery of learning content aligned with current industry requirements.

SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA SAINS DENGAN PENDIDIKAN (KIMIA) DENGAN KEPUJIAN [SHPCH]

PEMBANGUNAN KOMIK CHEMSTORY BERASASKAN PEMBELAJARAN PENCERITAAN TERHADAP APLIKASI KADAR TINDAK BALAS PERLAHAN MELALUI ISU KAKISAN LOGAM DALAM KEHIDUPAN HARIAN

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Kajian ini bertujuan untuk membangunkan Komik ChemStory berasaskan pembelajaran penceritaan bagi membantu pelajar memahami konsep kadar tindak balas perlahan melalui isu kakisan logam serta menilai kesesuaiannya sebagai bahan pembelajaran Kimia. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk deskriptif dan proses pembangunan berpandukan Model Alessi dan Trollip yang merangkumi fasa perancangan, reka bentuk serta pembangunan dan penilaian. Struktur penceritaan komik pula disusun berdasarkan Piramid Freytag yang melibatkan fasa pengenalan, perkembangan konflik, klimaks, peleraian dan penyelesaian. Instrumen kajian terdiri daripada ujian diagnostik 10 item dan borang penilaian Komik ChemStory menggunakan skala Likert lima mata. Kajian rintis melibatkan 30 orang pelajar Tingkatan 4 dan memperoleh pekali kebolehpercayaan sebanyak 0.742. Ujian diagnostik kemudiannya ditadbir kepada 100 orang pelajar Tingkatan 4 bagi mengenal pasti kefahaman dan miskonsepsi mereka terhadap konsep kadar tindak balas perlahan dan kakisan logam. Data dianalisis secara deskriptif menggunakan kekerapan dan peratusan. Dapatan menunjukkan bahawa majoriti pelajar masih mempunyai miskonsepsi berkaitan syarat pengaratan, peranan elektrolit, kesan suhu, luas permukaan, teori perlanggaran dan kaedah pencegahan kakisan. Berdasarkan dapatan tersebut, Komik ChemStory bertajuk Projek Besi Berkarat telah dibangunkan dengan menggabungkan elemen visual, dialog, penyiasatan, penerangan konsep, infografik dan aktiviti pengukuhan. Komik tersebut dinilai oleh tiga orang pakar pensyarah dan enam orang guru Kimia. Hasil penilaian menunjukkan bahawa komik memperoleh tahap kesesuaian yang tinggi dari aspek kandungan, penceritaan dan pedagogi, reka bentuk dan visual, kebolehgunaan serta struktur penceritaan. Kesimpulannya, Komik ChemStory sesuai digunakan sebagai bahan bantu mengajar alternatif yang kontekstual dan berstruktur bagi menyokong pemahaman pelajar terhadap konsep kadar tindak balas perlahan melalui isu kakisan logam. Implikasi kajian menunjukkan bahawa Komik ChemStory berpotensi digunakan sebagai bahan pembelajaran alternatif yang dapat membantu guru menyampaikan konsep kadar tindak balas perlahan secara lebih visual, kontekstual dan berasaskan penceritaan. Kajian ini juga menyediakan asas bagi penyelidikan lanjutan untuk menguji keberkesanan komik terhadap kefahaman dan pencapaian pelajar.

This study aimed to develop a storytelling-based ChemStory Comic to support students' understanding of slow reaction rates through the issue of metal corrosion and to evaluate its suitability as a Chemistry learning material. The study employed a quantitative approach with a descriptive research design, while the development process was guided by the Alessi and Trollip Model, which consists of the planning, design, and development and evaluation phases. The comic narrative was structured according to Freytag's Pyramid, comprising exposition, rising action, climax, falling action, and resolution. The research instruments consisted of a 10-item diagnostic test and a five-point Likert-scale evaluation form for the ChemStory Comic. A pilot study involving 30 Form Four students produced a reliability coefficient of 0.742. The diagnostic test was subsequently administered to 100 Form Four students to identify their understanding and misconceptions regarding slow reaction rates and metal corrosion. The data were analysed descriptively using frequencies and percentages. The findings revealed that most students still demonstrated misconceptions concerning the conditions required for rusting, the role of electrolytes, the effects of

temperature and surface area, collision theory, and corrosion prevention methods. Based on these findings, a ChemStory Comic entitled Projek Besi Berkarat was developed by integrating visual elements, dialogue, scientific investigation, conceptual explanations, infographics, and reinforcement activities. The comic was evaluated by three Chemistry education experts and six experienced Chemistry teachers. The evaluation findings indicated that the comic achieved a high level of suitability in terms of content, storytelling and pedagogy, design and visuals, usability, and narrative structure. In conclusion, the ChemStory Comic is suitable as an alternative, contextual, and systematically structured teaching aid to support students' understanding of slow reaction rates through the issue of metal corrosion. The findings imply that the ChemStory Comic has the potential to be used as an alternative learning resource to assist teachers in presenting the concept of slow reaction rates in a more visual, contextual, and story-based manner. This study also provides a foundation for future research to examine the effectiveness of the comic in improving students' understanding and achievement.

TINJAUAN PERSEPSI MAHASISWA GURU KIMIA TERHADAP PENGGUNAAN PENDEKATAN GAMIFIKASI DAN KEFAHAMAN MURID DALAM TOPIK PERSAMAAN KIMIA

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Kajian ini dijalankan untuk meneroka persepsi mahasiswa guru Kimia di Universiti Teknologi Malaysia (UTM) terhadap penggunaan pendekatan gamifikasi dalam pengajaran topik Persamaan Kimia serta kesannya terhadap kefahaman murid. Reka bentuk kajian yang digunakan adalah kuantitatif analisis deskriptif yang menggunakan soal selidik berstruktur dengan skala Likert 4 mata yang dibina melalui adaptasi daripada kajian lepas. Seramai 61 orang mahasiswa guru Kimia di UTM telah terlibat di dalam kajian ini sebagai responden yang telah dipilih berdasarkan kepada kaedah persampelan bertujuan. Data dianalisis dengan menggunakan statistik deskriptif iaitu min dan sisihan piawai serta statistik inferensi iaitu analisis korelasi Pearson dengan menggunakan perisian SPSS. Hasil analisis deskriptif menunjukkan bahawa persepsi mahasiswa guru terhadap penggunaan pendekatan gamifikasi berada pada tahap yang tinggi dengan nilai min keseluruhan (M = 3.18). Seterusnya, persepsi mahasiswa guru terhadap kefahaman murid melalui pendekatan ini juga mencatatkan tahap positif yang tinggi iaitu dengan nilai min keseluruhan (M = 3.22). Dapatan kajian turut menunjukkan bahawa terdapat hubungan positif yang signifikan secara statistik dan kuat di antara persepsi terhadap penggunaan pendekatan gamifikasi dengan kefahaman murid di dalam topik Persamaan Kimia dengan nilai korelasi Pearson $r = 0.695$, $p = 0.001$ ($p < 0.05$). Implikasi kajian ini mencadangkan agar Kementerian Pendidikan Malaysia (KPM) dan institusi pendidikan mengintegrasikan elemen gamifikasi secara formal dalam kurikulum kimia bagi menggantikan kaedah tradisional. Oleh itu, pendekatan gamifikasi berpotensi besar sebagai bahan bantu mengajar yang inovatif dan efektif bagi memudahkan pemahaman konsep kimia yang abstrak.

This study aims to explore the perceptions of Chemistry pre-service teachers at Universiti Teknologi Malaysia (UTM) on the use of gamification in teaching the Chemical Equations topic and its impact on students' understanding. The research design employed a quantitative descriptive design using a 4-point Likert scale structured questionnaire adapted from previous study. A total of 61 Chemistry pre-service teachers at UTM were involved as respondents in this study, selected through a purposive sampling method. Data were analyzed using descriptive statistics, which is mean and standard deviation as well as inferential statistics involving Pearson correlation analysis via SPSS software. The descriptive analysis results showed that pre-service teachers' perceptions of using the gamification were at a high level, with an overall mean value of M = 3.18. Furthermore, their perceptions regarding student's understanding through this approach also recorded a highly positive level, with an overall mean value of M = 3.22. The research findings also showed a statistically significant and strong positive relationship between the perception of gamification usage and students' understanding in the Chemical Equations topic, with a Pearson correlation value of $r = 0.695$, $p = 0.001$ ($p < 0.05$). The implications of this study suggest that the Ministry of Education (MOE) and educational institutions should formally integrate gamification elements into the chemistry curriculum to replace the traditional methods. Therefore, gamification had substantial potential as an innovative and effective teaching tool to facilitate the understanding of abstract chemistry concepts.

KEBERKESANAN MODUL EKSPERIMEN BERDASARKAN PEMBELAJARAN BERASASKAN PENGALAMAN BAGI MENINGKATKAN KEFAHAMAN PELAJAR TERHADAP TOPIK KONSEP MOL, FORMULA DAN PERSAMAAN KIMIA

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Kajian ini bertujuan untuk mereka bentuk dan membangunkan modul eksperimen berdasarkan pembelajaran berasaskan pengalaman serta mengkaji keberkesanannya terhadap kefahaman pelajar dalam topik Konsep Mol, Formula dan Persamaan Kimia. Modul ini dibangunkan berdasarkan model ADDIE dan mengandungi dua aktiviti eksperimen, iaitu pembakaran magnesium oksida (MgO) dan penguraian kuprum(II) karbonat. Kajian ini menggunakan reka bentuk pra eksperimental satu kumpulan ujian pra dan ujian pasca. Seramai 31 orang pelajar Tingkatan 4 aliran sains dari sebuah sekolah menengah di daerah Johor Bahru terlibat sebagai responden kajian. Data kuantitatif dianalisis menggunakan analisis deskriptif dan ujian-t sampel berpasangan, manakala data kualitatif dianalisis menggunakan analisis tematik. Dapatan kajian menunjukkan bahawa tahap kefahaman pelajar meningkat selepas penggunaan modul, dengan min skor ujian pra sebanyak 24.94 dan min skor ujian pasca sebanyak 26.13. Keputusan ujian-t sampel berpasangan menunjukkan terdapat perbezaan yang signifikan antara skor ujian pra dan ujian pasca, dengan nilai signifikan p = 0.014. Dapatan kualitatif pula menunjukkan bahawa pelajar memberikan pandangan positif terhadap modul, khususnya dalam aspek peningkatan kefahaman, penglibatan aktif dan keupayaan menghubungkan konsep kimia dengan aktiviti eksperimen. Secara keseluruhannya, modul eksperimen berasaskan pembelajaran berasaskan pengalaman berpotensi membantu meningkatkan kefahaman pelajar terhadap topik Konsep Mol, Formula dan Persamaan Kimia.

This study aims to design and develop an experimental module based on experiential learning and to investigate its effectiveness in enhancing students' understanding of the topic of Mole Concept, Chemical Formulae and Chemical Equations. The module was developed based on the ADDIE model and consists of two experimental activities, namely the combustion of magnesium oxide (MgO) and the decomposition of copper(II) carbonate. This study employed a one-group pre-test and post-test pre-experimental design. A total of 31 Form Four science stream students from a secondary school in the Johor Bahru district participated as respondents. Quantitative data were analysed using descriptive analysis and paired sample t-test, while qualitative data were analysed using thematic analysis. The findings showed an increase in students' level of understanding after using the module, with the mean pre-test score increasing from 24.94 to 26.13 in the post-test. The paired sample t-test indicated a significant difference between the pre-test and post-test scores, with a significance value of p = 0.014. The qualitative findings also revealed that students expressed positive views towards the module, particularly in terms of improving understanding, encouraging active involvement and helping them relate chemical concepts to experimental activities. Overall, the experimental module based on experiential learning has the potential to enhance students' understanding of the topic of Mole Concept, Chemical Formulae and Chemical Equations.

PEMBANGUNAN DAN KESAN KOMIK CHEMSTORY DALAM TOPIK KADAR TINDAK BALAS MELALUI ISU KOSMETIK TIRUAN DAN UBATAN SEMULAJDI

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Kajian ini bertujuan untuk membangunkan dan menilai keberkesanan Komik ChemStory sebagai alat kognitif visual berasaskan penceritaan yang direka bagi menyokong pengajaran dan pembelajaran dalam subtopik Aplikasi Kadar Tindak Balas bagi mata pelajaran Kimia Tingkatan 4. Subtopik ini sering dianggap mencabar kerana pelajar menghadapi kesukaran menghubungkaitkan faktor-faktor yang mempengaruhi kadar tindak balas dengan aplikasinya dalam kehidupan seharian. Bagi menangani isu tersebut, Komik ChemStory dibangunkan dengan mengintegrasikan naratif kontekstual berkaitan isu kosmetik tiruan dan ubatan semula jadi bagi mewujudkan pengalaman pembelajaran yang lebih bermakna dan kontekstual. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk pembangunan berasaskan Model ADDIE yang merangkumi fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Fasa analisis melibatkan ujian diagnostik yang ditadbir kepada 100 orang pelajar Tingkatan 4 aliran sains yang dipilih melalui persampelan rawak mudah bagi mengenal pasti keperluan pembangunan komik. Keberkesanan Komik ChemStory dinilai melalui pelaksanaan intervensi dalam sesi pengajaran dan pembelajaran yang diikuti dengan ujian diagnostik pasca intervensi. Data kajian dianalisis menggunakan statistik deskriptif yang melibatkan kekerapan dan peratusan. Dapatan kajian menunjukkan bahawa penggunaan Komik ChemStory berkesan dalam membantu pelajar menghubungkaitkan faktor-faktor yang mempengaruhi kadar tindak balas dengan aplikasinya dalam kehidupan seharian, sekali gus menyokong pengajaran dan pembelajaran Kimia secara lebih kontekstual. Implikasi kajian menunjukkan bahawa Komik ChemStory berpotensi dijadikan sebagai bahan bantu mengajar yang inovatif bagi meningkatkan pemahaman konsep Kimia, menggalakkan pembelajaran secara kontekstual serta menyokong amalan pengajaran guru yang lebih kreatif dan berpusatkan pelajar. Kesimpulannya, kajian ini menunjukkan bahawa Komik ChemStory berpotensi sebagai alat kognitif visual yang dapat menyokong pengajaran dan pembelajaran Kimia serta membantu pelajar menghubungkaitkan konsep kadar tindak balas dengan aplikasinya dalam kehidupan seharian.

This study aims to develop and evaluate the effectiveness of the ChemStory Comic, a storytelling-based visual cognitive tool designed to support the teaching and learning of the Application of Reaction Rate subtopic in Form Four Chemistry. This subtopic is often perceived as challenging because students experience difficulty relating the factors affecting the rate of reaction to their applications in everyday life. To address this issue, the ChemStory Comic was developed by integrating contextual narratives related to counterfeit cosmetics and natural medicines to create a more meaningful and contextual learning experience. The study employed a quantitative research approach guided by the ADDIE instructional design model, which comprises the analysis, design, development, implementation, and evaluation phases. The analysis phase involved a diagnostic test administered to 100 Form Four science stream students selected through simple random sampling to identify the need for developing the comic. The effectiveness of the ChemStory Comic was evaluated through its implementation during classroom teaching and learning, followed by a post-intervention diagnostic test. The data were analysed using descriptive statistics involving frequency and percentage. The findings indicate that the ChemStory Comic was effective in helping students relate the factors affecting the rate of reaction to their applications in everyday life, thereby supporting more contextual Chemistry teaching and learning. The implications of this study

suggest that the ChemStory Comic has the potential to serve as an innovative teaching aid that enhances students' conceptual understanding of Chemistry, promotes contextual learning, and supports more creative and student-centred teaching practices. In conclusion, the study demonstrates that the ChemStory Comic has the potential to serve as a visual cognitive tool that supports Chemistry teaching and learning while helping students relate reaction rate concepts to their applications in everyday life.

EKSPLORASI PERANAN MEDIA SOSIAL SEBAGAI ALAT PEMBELAJARAN TIDAK FORMAL KIMIA DALAM KALANGAN MURID GENERASI ALFA

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Generasi alfa menghabiskan lebih 4 jam sehari daripada masa mereka dengan melayari media sosial. Oleh itu, media sosial berpotensi untuk digunakan sebagai platform pembelajaran terutamanya kandungan yang melibatkan visual. Ini kerana, pendekatan visualisasi kimia secara formal di dalam bilik darjah bagi menjelaskan konsep kimia yang abstrak pada aras mikroskopik didapati masih kurang berkesan dalam memenuhi keperluan pendidikan murid generasi alfa. Selain itu, lambakan elemen multimedia di media sosial mencetuskan cabaran mencetuskan cabaran kepada pelajar untuk memilih kandungan yang sesuai dan membantu pembelajaran mereka. Oleh itu, kajian ini bertujuan untuk mengkaji penggunaan media sosial sebagai alat pembelajaran dalam pendidikan kimia untuk tujuan visualisasi. Kajian ini menggunakan rekabentuk kaedah campuran jenis penjelasan berturutan yang dimulai oleh fasa kuantitatif diikuti oleh fasa kualitatif. Bagi fasa kuantitatif, soal selidik berskala likert 4 mata telah diedarkan kepada 76 orang murid Tingkatan 4 menggunakan teknik persampelan mudah. Bagi fasa kualitatif, sesi temu bual berstruktur telah dijalankan kepada enam orang murid yang dipilih melalui persampelan bertujuan. Data kuantitatif dianalisis secara deskriptif, manakala data kualitatif dianalisis menggunakan analisis tematik. Dapatan kajian menunjukkan TikTok merupakan platform yang paling dominan digunakan oleh murid sebagai alat pembelajaran kimia di luar bilik darjah (29%), diikuti oleh platform WhatsApp (23%) dan Telegram (20%). Dari aspek elemen multimedia, murid sangat menggemari elemen video transisi zoom-in daripada bahan nyata ke struktur zarah dan ilustrasi yang realistik manakala elemen kesan bunyi (sound effect) didapati kurang membantu kerana menganggu kognitif murid seperti mudah hilang fokus. Murid juga menunjukkan tahap kemahiran digital yang baik dengan mengutamakan kesahihan kandungan kimia seperti penggunaan istilah saintifik yang tepat dan selari dengan silibus di sekolah. Selain itu, analisis tematik merumuskan bahawa media sosial dapat menjadi transformasi konseptual melalui visualisasi mikroskopik, boleh mengatasi beban kognitif murid melalui pendekatan pembelajaran mikro dalam kandungan di media sosial serta menjadi medium sokongan komplementari bilik darjah. Kesannya, kajian ini membuktikan bahawa media sosial mampu bertindak sebagai platform pembelajaran tidak formal yang berkesan bagi memenuhi keperluan dan gaya pembelajaran generasi alfa di samping melengkapkan sistem pendidikan formal abad ke-21. Akhir sekali, kajian ini boleh ditambahbaik untuk penyelidikan masa hadapan dengan (i) menjalankan kajian perbandingan demografi antara murid kawasan bandar dan luar bandar bagi menilai pengaruh sosioekonomi terhadap kebolehpercayaan media sosial, (ii) menguji keberkesanan intervensi video pembelajaran berasaskan elemen multimedia terpilih terhadap pencapaian akademik bagi topik mikroskopik kimia serta (iii) membangunkan modul garis panduan mesra kognitif berlandaskan Teori Kognitif Pembelajaran Multimedia (CTML) dan integrasi Kecerdasan Buatan (AI) sebagai panduan

kepada guru dan pempengaruh akademik di media sosial.

Generation Alpha spends more than 4 hours a day on social media. Therefore, social media has the potential to be used as a learning platform, especially for visual content. This is because the formal approach to chemistry visualization in the classroom to explain the abstract chemical concepts at the microscopic level is still less effective in achieving the educational needs of Generation Alpha students. In addition, the overwhelming of multimedia elements on social media makes it challenging for students to choose suitable content that helps their learning. Therefore, this study aims to examine the use of social media as a learning tool in chemistry education for visualization purposes. This study used an explanatory sequential mixed-methods design, which started with quantitative phased followed by qualitative phase. For the quantitative phase, a 4-point Likert scale questionnaire was distributed to 76 Form 4 students using a simple random sampling technique. For the qualitative phase, structured interview sessions were conducted with six students selected through purposive sampling. Quantitative data were analysed descriptively, while qualitative data were analysed using thematic analysis. The findings show that TikTok is the most dominant platform used by students as chemistry learning tool outside the classroom (29%), followed by WhatsApp (23%) and Telegram (20%). In terms of multimedia elements, students highly favour video elements showing a zoom-in transition from real material to particle structures and realistic illustrations. Meanwhile, sound effects were found to be less helpful because they disrupt student's cognition, causing them to easily lose focus. Students also demonstrated good digital skills by prioritizing the accuracy of chemistry content such as using a correct scientific term that match the school syllabus. Additionally, the thematic analysis showed that social media can create conceptual transformation through microscopic visualisation, overcome students cognitive load through a micro-learning approach in social media content, and act as a complementary support medium for the classroom. In conclusion, this study proves that social media can serve as effective informal learning platform to meet the needs and learning styles of Generation Alpha students while complementing the 21st-century formal education system. Finally, this study suggests several improvements for future research, including (i) conducting a comparative demographic study between urban and ural students to evaluate how socioeconomic factors affect trust in social media, (ii) testing the actual effectiveness of learning video based on selected multimedia elements on academic achievement for microscopic chemistry topics, and (iii) developing a cognitive-friendly, Cognitive Theory of Multimedia Learning (CTML) module for guideline integrated with Artificial Intelligence (AI) as a guide for teachers and academic influencers on social media.

KEBERKESANAN PEMBELAJARAN BERASASKAN MASALAH PBM BERINTEGRASIKAN PRINSIP KIMIA HIJAU MENERUSI KOMIK DIGITAL TERHADAP KEFAHAMAN BERTOPIK "ASID DAN BES" PELAJAR TINGKATAN 4

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Kajian ini bertujuan untuk mereka bentuk, membangunkan dan menilai keberkesanan Modul Skuad Kimia Hijau yang mengintegrasikan Pembelajaran Berasaskan Masalah (PBM), Prinsip Kimia Hijau dan komik digital terhadap kefahaman pelajar Tingkatan 4 dalam topik Asid dan Bes. Kajian ini turut meneroka persepsi guru terhadap kesesuaian penggunaan modul dalam pengajaran dan pembelajaran Kimia. Pembangunan modul dilaksanakan berdasarkan model ADDIE yang merangkumi fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Kajian ini menggunakan reka bentuk pra-eksperimen satu kumpulan ujian pra dan ujian pasca. Sampel kajian terdiri daripada 20 orang pelajar Tingkatan 4 dan seorang guru Kimia. Intervensi menggunakan modul dilaksanakan selama satu minggu. Data kuantitatif dikumpulkan melalui ujian pra dan ujian pasca, manakala data kualitatif diperoleh melalui temu bual separa berstruktur bersama guru. Data kuantitatif dianalisis menggunakan statistik deskriptif, ujian normaliti Shapiro-Wilk, ujian-t berpasangan dan saiz kesan Cohen's dz. Data temu bual dianalisis secara tematik. Dapatan kajian menunjukkan bahawa modul Skuad Kimia Hijau berjaya dibangunkan sebanyak 51 halaman dengan kandungan yang selaras dengan topik Asid dan Bes. Min skor pelajar meningkat daripada 20.55 dalam ujian pra kepada 29.80 dalam ujian pasca. Keputusan ujian-t berpasangan menunjukkan perbezaan yang signifikan, $t(19) = -9.229$, $p < .001$, dengan saiz kesan yang sangat besar, Cohen's $dz = 2.06$. Dapatan temu bual pula menunjukkan guru berpandangan positif terhadap kesesuaian kandungan, jalan cerita, integrasi Prinsip Kimia Hijau dan penggunaan komik digital. Kesimpulannya, modul ini berpotensi membantu meningkatkan kefahaman pelajar serta sesuai digunakan sebagai bahan sokongan PdPc Kimia.

This study aimed to design, develop and evaluate the effectiveness of the Skuad Kimia Hijau Module, which integrates Problem-Based Learning (PBL), Green Chemistry Principles and digital comics, in enhancing Form 4 students' understanding of the topic Acids and Bases. This study also explored the teacher's perception of the suitability of using the module in Chemistry teaching and learning. The module was developed based on the ADDIE model, which consists of the analysis, design, development, implementation and evaluation phases. This study employed a one-group pre-test and post-test pre-experimental design. The sample consisted of 20 Form 4 students and one Chemistry teacher. The intervention using the module was carried out over one week. Quantitative data were collected through pre-test and post-test, while qualitative data were obtained through a semi-structured interview with the teacher. The quantitative data were analysed using descriptive statistics, the Shapiro-Wilk normality test, paired sample t-test and Cohen's dz effect size. The interview data were analysed thematically. The findings showed that the Skuad Kimia Hijau Module was successfully developed with 51 pages of content aligned with the topic of Acids and Bases. The students' mean score increased from 20.55 in the pre-test to 29.80 in the post-test. The paired sample t-test showed a significant difference, $t(19) = -9.229$, $p < .001$, with a very large effect size, Cohen's $dz = 2.06$. The interview findings indicated that the teacher had a positive perception of the module in terms of content suitability, storyline, integration of Green Chemistry Principles and use of digital comics. In conclusion, this module has the potential to enhance students' understanding and is suitable to be used as a supporting material in Chemistry teaching and learning.

DEVELOPING PROJECT-BASED LEARNING MODULE IN CHEMICAL BOND

TOPIC

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Konsep ikatan kimia merupakan topik asas namun sangat abstrak dalam kurikulum kimia sekolah menengah, yang memerlukan pelajar untuk menghubungkaitkan tahap perwakilan makroskopik, submikroskopik, dan simbolik. Kaedah pengajaran tradisional yang berpusatkan guru sering kali gagal merapatkan jurang tahap perwakilan ini, lantas menjurus kepada hafalan dan tahap penguasaan konsep yang rendah. Untuk mengatasi kelompangan pedagogi ini, kajian ini bertujuan untuk membangunkan dan mengesahkan modul Pembelajaran Berasaskan Projek (PjBL) yang disesuaikan untuk silibus Kimia Tingkatan 4 di bawah Kurikulum Standard Sekolah Menengah (KSSM). Berlandaskan teori konstruktivisme dan menggunakan metodologi Penyelidikan Reka Bentuk dan Pembangunan (DDR), kajian ini dilaksanakan dalam tiga fasa berurutan: reka bentuk, pembangunan, dan penilaian. Semasa fasa pembangunan, Kaedah Fuzzy Delphi (FDM) telah digunakan untuk mencapai kesepakatan dalam kalangan 10 orang pakar bidang mengenai penjajaran kefahaman konsep, reka bentuk pedagogi, kebolehgunaan, dan penjajaran kandungan kimia modul tersebut. Seterusnya, dalam fasa penilaian, modul bertemakan forensik yang telah dimuktamadkan disahkan oleh panel yang terdiri daripada 3 orang pakar menggunakan Indeks Kesahan Kandungan (CVI). Keputusan FDM menunjukkan persetujuan pakar secara mutlak, di mana kesemua 18 item mencapai nilai ambang ≤ 0.2, 100% kesepakatan kumpulan melebihi 75%, dan skor kabur A > 0.5. Penilaian tersebut menghasilkan skor matematik yang sempurna (I-CVI = 1.0 dan S-CVI = 1.0) merentas konstruk kesesuaian kandungan, kejelasan, dan kepraktisan. Kesimpulannya, dapatan kajian secara empirikal membuktikan bahawa modul PjBL yang dibangunkan adalah sangat sah, kukuh dari segi struktur, dan sesuai secara pedagogi sebagai intervensi pengajaran untuk meningkatkan kefahaman konsep pelajar Tingkatan 4 terhadap ikatan kimia.

The concept of chemical bonding is a fundamental yet highly abstract topic in the secondary chemistry curriculum, requiring students to navigate macroscopic, submicroscopic, and symbolic levels of representation. Traditional, teacher-centered instructional methods often fail to bridge these representational levels, leading to rote memorization and low conceptual mastery. To address this pedagogical gap, this study aimed to develop and validate a Project-Based Learning (PjBL) module tailored for the Form 4 Chemistry syllabus under the Kurikulum Standard Sekolah Menengah (KSSM). Grounded in the constructivist theory and utilizing the Design and Development Research (DDR) methodology, the study was executed in three sequential phases, which are design, development, and evaluation. During the development phase, the Fuzzy Delphi Method (FDM) was employed to establish a consensus among 10 subject matter experts regarding the module's conceptual understanding alignment, pedagogical design, usability, and chemistry content alignment. Subsequently, in the evaluation phase, the finalized forensic-themed module was validated by a panel of 3 experts using the Content Validity Index (CVI). FDM results indicated absolute expert agreement, with all 18 items achieving a threshold value of ≤ 0.2, a 100% group consensus exceeding 75%, and defuzzified scores of A > 0.5. The evaluation yielded perfect mathematical scores (I-CVI = 1.0 and S-CVI = 1.0) across content relevance, clarity, and practicality constructs. In conclusion, the findings empirically prove that the developed PjBL module is highly valid, structurally robust, and pedagogically suitable as an instructional intervention to enhance Form 4 students' conceptual understanding of chemical bonds.

TAHAP KESEDARAN DAN KESIAPAN PEDAGOGI BAKAL GURU KIMIA TERHADAP ISU KIMIA HIJAU

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Kajian ini bertujuan untuk mengenal pasti tahap kesedaran Kimia Hijau dalam konteks mikroplastik dan tahap kesiapan pedagogi Kimia Hijau dalam kalangan mahasiswa Guru Kimia, serta menentukan hubungan antara kedua-dua konstruk tersebut. Dalam kajian ini, Kimia Hijau didefinisikan secara operasi melalui isu mikroplastik yang merangkumi aspek pencegahan pencemaran, pengurangan sisa plastik, penggunaan bahan alternatif yang lebih lestari dan penerapan amalan mesra alam dalam pengajaran Kimia. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan keratan rentas. Seramai 52 orang mahasiswa Guru Kimia Tahun 3 dan Tahun 4 di sebuah universiti awam dipilih melalui kaedah pensampelan bertujuan. Instrumen kajian merupakan soal selidik berskala Likert lima mata yang mengandungi 23 item. Dapatan kajian menunjukkan bahawa tahap kesedaran Kimia Hijau dalam konteks pencemaran mikroplastik dan tahap kesiapan pedagogi mahasiswa guru Kimia berada pada tahap tinggi. Walau bagaimanapun, analisis korelasi Pearson menunjukkan terdapat hubungan positif yang sangat lemah dan tidak signifikan antara kesedaran Kimia Hijau dengan kesiapan pedagogi. Dapatan ini menunjukkan bahawa kesedaran terhadap isu kelestarian perlu disokong dengan latihan pedagogi, pengalaman praktikal dan pendedahan terhadap strategi pengajaran yang sesuai bagi memastikan isu Kimia Hijau dapat diintegrasikan secara berkesan dalam PdP Kimia. Secara keseluruhannya, kajian ini menunjukkan kepentingan memperkukuhkan pendidikan Kimia Hijau dalam latihan perguruan bagi melahirkan bakal guru Kimia yang mampu menghubungkan konsep kimia dengan isu kelestarian melalui pendekatan pembelajaran yang bermakna.

This study aimed to identify the level of green chemistry awareness in the context of microplastics and the level of green chemistry pedagogical readiness among chemistry education undergraduates, as well as to determine the relationship between the two constructs. In this study, green chemistry was operationally defined through the issue of microplastics, encompassing pollution prevention, plastic waste reduction, the use of more sustainable alternative materials, and the integration of environmentally responsible practices into chemistry teaching. A quantitative cross-sectional survey design was employed. A total of 52 third- and fourth-year chemistry education undergraduates from a public university were selected through purposive sampling. The research instrument was a five-point Likert-scale questionnaire consisting of 23 items. The findings revealed that the level of Green Chemistry awareness in the context of microplastic pollution and the pedagogical readiness among chemistry pre-service teachers were at a high level. However, Pearson correlation analysis showed a very weak positive and non-significant relationship between Green Chemistry awareness and pedagogical readiness. This finding indicates that awareness of sustainability issues needs to be supported by pedagogical training, practical teaching experiences, and exposure to appropriate instructional strategies to ensure that Green Chemistry issues can be effectively integrated into Chemistry teaching and learning. Overall, this study highlights the importance of strengthening Green Chemistry education within teacher training programmes to produce future chemistry teachers who are able to connect chemical concepts with sustainability issues through meaningful learning approaches.

PEMBANGUNAN KOMIK CHEMSTORY BERTERASKAN STRATEGI PEMBELAJARAN BERASASKAN PENCERITAAN TERHADAP APLIKASI KONSEP ALOI DALAM KEHIDUPAN SEHARIAN.

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Pengaplikasian konsep saintifik dalam kehidupan seharian merupakan salah satu matlamat pengajaran dan pembelajaran yang dapat membantu pelajar menjelaskan fenomena serta menyelesaikan masalah dalam konteks kehidupan sebenar. Walau bagaimanapun, pelajar sering menghadapi kesukaran untuk mengaplikasikan konsep saintifik, khususnya konsep kimia yang bersifat abstrak seperti konsep Aloi. Kajian ini bertujuan untuk mengenal pasti tahap pengaplikasian konsep Aloi dalam kehidupan seharian dalam kalangan pelajar, membangunkan Komik ChemStory berteraskan strategi pembelajaran berasaskan penceritaan serta menilai kesesuaiannya sebagai bahan pembelajaran. Kajian ini menggunakan pendekatan Penyelidikan dan Pembangunan (R&D) berpandukan Model Alessi dan Trollip, manakala reka bentuk tinjauan kuantitatif digunakan bagi pengumpulan data. Proses pembangunan melibatkan tiga fasa, iaitu perancangan, reka bentuk dan pembangunan. Dalam fasa reka bentuk, Model Bentuk Cerita Egan digunakan untuk mengorganisasikan kandungan pembelajaran, manakala Model Piramid Freytag digunakan untuk menyusun perkembangan plot naratif. Instrumen kajian terdiri daripada Ujian Diagnostik yang mengandungi 10 item, Borang Penilaian Kesahan Kandungan Komik dan Borang Penilaian Guru terhadap Kesesuaian Komik ChemStory. Kajian rintis melibatkan 30 orang pelajar Tingkatan 5, manakala kajian sebenar melibatkan 100 orang pelajar Tingkatan 5. Selain itu, tiga orang pakar terlibat dalam penilaian kesahan kandungan dan enam orang guru Kimia menilai kesesuaian komik. Nilai kebolehpercayaan KR-20 bagi Ujian Diagnostik ialah 0.741. Purata peratus jawapan betul ialah 49.4%, yang menunjukkan tahap pengaplikasian konsep Aloi dalam kehidupan seharian berada pada tahap sederhana dan menyokong keperluan pembangunan komik. Komik ChemStory yang mengandungi 25 muka surat telah dibangunkan dan dinilai sesuai dari aspek bahasa dan penyampaian, kandungan Kimia Aloi, aplikasi kontekstual serta struktur penceritaan. Secara keseluruhannya, Komik ChemStory berpotensi digunakan sebagai bahan pembelajaran sokongan bagi topik Aloi dan aplikasinya dalam kehidupan seharian.

The application of scientific concepts in daily life is an important aim of teaching and learning because it enables students to explain phenomena and solve problems in real-life contexts. However, students frequently experience difficulties in applying scientific concepts, particularly abstract chemistry concepts such as alloys. This study aimed to identify students' level of application of alloy concepts in daily life, develop a ChemStory Comic grounded in a storytelling-based learning strategy, and evaluate its suitability as a learning material. The study employed a research and development (R&D) approach guided by the Alessi and Trollip Model, while a quantitative survey design was used for data collection. The development process comprised three phases: planning, design, and development. During the design phase, Egan's Story Form Model was used to organize the learning content, whereas Freytag's Pyramid was applied to structure the development of the narrative plot. The research instruments consisted of a 10-item Diagnostic Test, a Comic Content Validation Form, and a Teacher Evaluation Form on the Suitability of the ChemStory Comic. The pilot study involved 30 Form Five students, while the actual study involved 100 Form Five students. In addition, three experts participated in the content validation process, and six Chemistry teachers evaluated the suitability of the comic. The KR-20 reliability coefficient for the Diagnostic Test was 0.741. The mean percentage of correct responses was 49.4%, indicating a moderate level of application of alloy concepts in daily life and supporting the need for comic development. The 25-page ChemStory Comic was developed and evaluated as suitable in terms of language and delivery, alloy chemistry content, contextual applications, and narrative structure. Overall, the ChemStory Comic has the potential to serve as

supplementary learning material for the topic of alloys and their applications in daily life.

KEBERKESANAN MODUL TETRACHEM BERASASKAN MODEL 5E BERINTEGRASIKAN PERMAINAN KAD TERHADAP PENGUASAAN KONSEP MOL, FORMULA DAN PERSAMAAN KIMIA DALAM KALANGAN PELAJAR TINGKATAN 4

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Kajian ini bertujuan untuk mereka bentuk dan membangunkan modul TetraChem berasaskan Model 5E serta mengkaji keberkesanannya terhadap penguasaan konsep mol, formula dan persamaan kimia dalam kalangan pelajar Tingkatan 4. Kajian ini juga meneroka persepsi pelajar terhadap pelaksanaan modul TetraChem berintegrasikan permainan kad. Reka bentuk pra-eksperimen satu kumpulan telah digunakan dengan sokongan data kualitatif melalui soalan terbuka. Seramai 28 orang pelajar Tingkatan 4 aliran sains dari sebuah sekolah menengah di Johor terlibat sebagai responden kajian. Permainan kad dalam modul TetraChem dibangunkan berdasarkan Model 5E dan mengandungi 4 jenis permainan kad, iaitu Tic-Tac-Mol, ChemBuzz, Bond or Bomb? dan Chemistry Family. Data kuantitatif dianalisis menggunakan statistik deskriptif dan Ujian Wilcoxon Signed-Rank, manakala data kualitatif dianalisis secara tematik. Dapatan kajian menunjukkan bahawa tahap penguasaan pelajar terhadap topik itu meningkat selepas pelaksanaan modul, dengan peningkatan min skor daripada 18.57 dalam ujian pra kepada 20.82 dalam ujian pasca. Keputusan Ujian Wilcoxon Signed-Rank menunjukkan terdapat perbezaan yang signifikan antara skor ujian pra dan ujian pasca, $z = -4.443$, $p < 0.05$. Dapatan kualitatif pula menunjukkan bahawa pelajar memberi persepsi yang positif terhadap modul TetraChem dari aspek interaksi sosial, penguasaan konsep dan kemahiran pengiraan. Ringkasnya, modul tersebut berpotensi digunakan sebagai bahan bantu mengajar alternatif dalam pembelajaran Kimia.

This study aims to design and develop the card-assisted 5E-based TetraChem module and to examine its effectiveness in enhancing Form Four students' mastery of the mole concept, chemical formula and chemical equation. This study also explored students' perceptions of the implementation of the module in Chemistry learning. A one-group pre-test and post-test pre-experimental design was used, supported by qualitative data obtained through open-ended questions. 28 Form Four science stream students from a secondary school in Johor participated in this study. The instructional content was organised according 5E Model and consisted of 4 types of card games which are Tic-Tac-Mol, ChemBuzz, Bond or Bomb? and Chemistry Family. Quantitative data were analysed using descriptive statistics and the Wilcoxon Signed-Rank Test, while qualitative data were analysed thematically. The findings showed that students' mastery level of the topic increased after the implementation of the module, with the pre-test mean score of 18.57 increasing to 20.82 in the post-test. The Wilcoxon Signed-Rank Test indicated a significant difference between the pre-test and post-test scores after the implementation of the TetraChem module, $z = -4.443$, $p < 0.05$. The qualitative findings also showed that students had positive perceptions of the TetraChem module in terms of social interaction, conceptual mastery and calculation skills. In conclusion, the TetraChem module has the potential to be used as an alternative interactive teaching aid in Chemistry learning.

PEMBANGUNAN MODUL BERINTEGRASI ETNOKIMIA DALAM PEMBELAJARAN BERASAKAN MASALAH (PBM) UNTUK KEFAHAMAN TOPIK ASID-BES BAGI PELAJAR TINGKATAN 4

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Kajian ini bertujuan membangunkan Modul Integrasi Etnokimia-PBL bagi topik Asid dan Bes Tingkatan 4 menggunakan pendekatan Design and Development Research (DDR). Kajian melibatkan tiga fasa iaitu analisis keperluan, reka bentuk dan pembangunan modul serta penilaian kesahan kandungan. Data diperoleh melalui temu bual pakar, soal selidik Fuzzy Delphi Method (FDM) dan Content Validity Index (CVI). Dapatan menunjukkan pakar bersetuju terhadap elemen modul, pendekatan PBL, integrasi etnokimia melalui konteks cencalok serta kesesuaian kandungan modul. Modul ini berpotensi membantu pembelajaran Asid dan Bes secara lebih kontekstual, aktif dan bermakna.

This study aims to develop an Ethnochemistry-PBL Integrated Module for the Form 4 Acid and Base topic using the Design and Development Research (DDR) approach. The study involved three phases: needs analysis, module design and development, and content validity evaluation. Data were collected through expert interviews, the Fuzzy Delphi Method (FDM) questionnaire and Content Validity Index (CVI) analysis. The findings show that experts agreed on the module elements, PBL approach, ethnochemistry integration through the cencalok context and the suitability of the module content. This module has the potential to support more contextual, active and meaningful learning.

PEMBANGUNAN MODUL "EQUATION EXPEDITION" BERPANDUKAN PEMBELAJARAN BERASASKAN PROJEK TERHADAP KEFAHAMAN KONSEP PERSAMAAN KIMIA DALAM KALANGAN PELAJAR TINGKATAN 4

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Topik Persamaan Kimia merupakan antara topik asas Kimia Tingkatan Empat yang sering menimbulkan kesukaran kepada pelajar kerana memerlukan kefahaman konseptual terhadap simbol kimia, formula, hukum pemuliharaan jisim dan hubungan stoikiometri. Sehubungan itu, kajian ini bertujuan membangunkan dan menilai kesesuaian Modul Equation Expedition Berpandukan Pembelajaran Berasaskan Projek (PjBL) bagi meningkatkan kefahaman konsep pelajar dalam topik Persamaan Kimia. Kajian ini menggunakan pendekatan Penyelidikan Reka Bentuk dan Pembangunan (Design and Development Research, DDR) Jenis I yang merangkumi tiga fasa, iaitu analisis keperluan, reka bentuk dan pembangunan, serta penilaian. Dalam fasa analisis keperluan, temu bual separa berstruktur melibatkan tiga orang guru Kimia berpengalaman mendapati bahawa pelajar menghadapi kesukaran memahami konsep asas persamaan kimia, menyeimbangkan persamaan kimia serta menghubungkaitkan konsep stoikiometri dengan situasi sebenar. Guru turut menekankan keperluan terhadap modul pembelajaran yang lebih interaktif, berpusatkan pelajar dan mengintegrasikan pendekatan Pembelajaran Berasaskan Projek (PjBL). Fasa reka bentuk dan pembangunan melibatkan penilaian menggunakan Fuzzy Delphi Method (FDM) dengan penyertaan 12 orang pakar. Dapatan menunjukkan semua komponen modul mencapai konsensus pakar yang tinggi (nilai ambang $d \leq 0.2$, persetujuan melebihi 75% dan skor defuzzifikasi $A \geq 0.5$). Seterusnya, penilaian kesahan kandungan menggunakan Content Validity Index (CVI) melibatkan tiga orang pakar menunjukkan nilai I-CVI dan S-CVI/Ave masing-masing mencapai 1.00 bagi semua konstruk yang dinilai. Secara keseluruhannya, Modul Equation Expedition didapati mempunyai tahap kesahan kandungan yang tinggi serta berpotensi menjadi bahan sokongan pengajaran dan pembelajaran Kimia bagi meningkatkan kefahaman konsep pelajar terhadap topik Persamaan Kimia.

The topic of Chemical Equations is one of the fundamental topics in Form Four Chemistry that students often find challenging as it requires a strong conceptual understanding of chemical symbols, formulae, the Law of Conservation of Mass, and stoichiometric relationships. Therefore, this study aimed to develop and evaluate the suitability of the Equation Expedition module based on Project-Based Learning (PjBL) to enhance students' conceptual understanding of Chemical Equations. This study adopted the Type I Design and Development Research (DDR) approach, which comprised three phases: (1) Needs Analysis, (2) Design and Development, and (3) Evaluation. During the needs analysis phase, semi-structured interviews involving three experienced Chemistry teachers revealed that students experienced difficulties in understanding the fundamental concepts of chemical equations, balancing chemical equations, and relating stoichiometric concepts to real-life situations. The teachers also highlighted the need for a more interactive, student-centred learning module that integrates the Project-Based Learning (PjBL) approach. The design and development phase involved evaluation using the Fuzzy Delphi Method (FDM) with the participation of 12 experts. The findings indicated that all proposed module components achieved a high level of expert consensus (threshold value $d \leq 0.2$, agreement level exceeding 75%, and defuzzification score $A \geq 0.5$). Subsequently, content validity was evaluated using the Content Validity Index (CVI) involving three experts. The results showed that both the I-CVI and S-CVI/Ave values reached 1.00 for all evaluated constructs. Overall, the Equation Expedition module demonstrated a high level of content validity and has strong potential to

serve as a supplementary teaching and learning resource in Chemistry to enhance students' conceptual understanding of the Chemical Equations topic.

MOLLA KIT INTERAKTIF BERINTEGRASIKAN PEMBELAJARAN BERASASKAN MASALAH BAGI MEMBANTU PEMAHAMAN KONSEPTUAL PELAJAR DALAM TOPIK KONSEP MOL DAN FORMULA KIMIA

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Kajian ini dilaksanakan bagi menangani masalah pemahaman konseptual pelajar Tingkatan 4 terhadap topik Konsep Mol dan Formula Kimia yang sering dianggap abstrak serta sukar dikuasai. Pendekatan pengajaran yang kurang interaktif turut menyumbang kepada kesukaran pelajar mengaitkan konsep dengan aplikasi sebenar. Oleh itu, kajian ini bertujuan mengenal pasti cabaran dalam pembelajaran dan pengajaran topik tersebut, mereka bentuk serta membangunkan MolLa Kit Interaktif berintegrasikan Pembelajaran Berasaskan Masalah (PBM), dan menilai kesesuaian kit yang dibangunkan. Kajian ini menggunakan pendekatan Design and Development Research (DDR) yang melibatkan tiga fasa, iaitu analisis keperluan, reka bentuk dan pembangunan, serta penilaian. Fasa analisis keperluan dijalankan menggunakan temu bual separa berstruktur dengan guru Kimia dan dianalisis secara tematik. Fasa reka bentuk dan pembangunan menggunakan Fuzzy Delphi Method (FDM) bagi mendapatkan kesepakatan pakar terhadap komponen dan aktiviti kit, manakala fasa penilaian menggunakan Content Validity Index (CVI) untuk menilai kesesuaian kit daripada aspek kebolehlaksanaan, kepraktisan, kebolehgunaan dan kualiti kandungan. Dapatan kajian menunjukkan bahawa pelajar menghadapi kesukaran memahami konsep mol dan formula kimia, manakala guru menyokong pembangunan bahan bantu mengajar yang lebih interaktif berasaskan PBM. Kesepakatan pakar mengesahkan bahawa komponen dan aktiviti MolLa Kit Interaktif adalah sesuai untuk dibangunkan, manakala penilaian CVI menunjukkan kit ini mempunyai tahap kesahan kandungan yang tinggi serta sesuai digunakan dalam proses pengajaran dan pembelajaran. Kesimpulannya, MolLa Kit Interaktif berpotensi menjadi bahan bantu mengajar yang dapat menyokong pelaksanaan pembelajaran berpusatkan pelajar serta membantu pemahaman konseptual pelajar dalam topik Konsep Mol dan Formula Kimia.

This study was conducted to address Form Four students' conceptual understanding of the Mole Concept and Chemical Formula topic, which is often regarded as abstract and difficult to master. Less interactive teaching approaches have also contributed to students' difficulties in relating the concepts to real-life applications. Therefore, this study aimed to identify the challenges in the teaching and learning of the topic, design and develop the Problem-Based Learning (PBL)- integrated MolLa Interactive Kit, and evaluate the suitability of the developed kit. The study employed the Design and Development Research (DDR) approach, which consisted of three phases: needs analysis, design and development, and evaluation. The needs analysis phase was conducted using semi-structured interviews with Chemistry teachers and analysed thematically. The design and development phase employed the Fuzzy Delphi Method (FDM) to obtain expert consensus on the kit components and learning activities, while the evaluation phase utilised the Content Validity Index (CVI) to assess the suitability of the kit in terms of feasibility, practicality, usability, and content quality. The findings revealed that students experienced difficulties in understanding the Mole Concept and Chemical Formula, while teachers supported the development of a more interactive PBL-based teaching aid. Expert consensus confirmed that the components and activities of the

MolLa Interactive Kit were suitable for development, whereas the CVI evaluation indicated that the kit possessed a high level of content validity and was suitable for use in the teaching and learning process. In conclusion, the MolLa Interactive Kit has the potential to serve as a teaching aid that supports student-centred learning and assists students' conceptual understanding of the Mole Concept and Chemical Formula topic.

PEMBANGUNAN MODUL REACTOON BERPANDUKAN PEMBELAJARAN BERASASKAN PROJEK TERHADAP KEMAHIRAN BERFIKIR ARAS TINGGI MURID DALAM TOPIK KADAR TINDAK BALAS

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Topik Kadar Tindak Balas merupakan antara topik Kimia Tingkatan Empat yang sukar dikuasai oleh murid kerana melibatkan konsep yang abstrak serta memerlukan penguasaan Kemahiran Berfikir Aras Tinggi (KBAT). Sehubungan itu, kajian ini bertujuan membangunkan dan menilai kesesuaian Modul ReacToon berpandukan Pembelajaran Berasaskan Projek (PjBL) bagi menyokong pembangunan KBAT murid dalam topik Kadar Tindak Balas. Kajian ini menggunakan pendekatan Penyelidikan Reka Bentuk dan Pembangunan (Design and Development Research, DDR) Jenis I yang merangkumi tiga fasa, iaitu analisis keperluan, reka bentuk dan pembangunan serta penilaian. Fasa analisis keperluan melibatkan temu bual separa berstruktur dengan tiga orang guru Kimia. Dapatan menunjukkan bahawa murid masih menghadapi kesukaran memahami konsep Teori Perlanggaran, tenaga pengaktifan dan faktor yang mempengaruhi kadar tindak balas. Guru juga menekankan keperluan terhadap modul pembelajaran yang lebih interaktif, berpusatkan murid dan mengintegrasikan elemen KBAT melalui pendekatan PjBL. Fasa reka bentuk dan pembangunan melibatkan penilaian sepuluh orang pakar menggunakan Fuzzy Delphi Method (FDM). Semua komponen Modul ReacToon memenuhi kriteria penerimaan dengan nilai threshold ($d \leq 0.2$), tahap kesepakatan pakar melebihi 75% dan nilai defuzzifikasi ($A \geq 0.5$). Seterusnya, fasa penilaian menggunakan Content Validity Index (CVI) melibatkan tiga orang pakar. Dapatan menunjukkan bahawa Modul ReacToon memperoleh nilai I-CVI dan S-CVI/Ave yang tinggi, sekali gus membuktikan bahawa modul mempunyai kesahan kandungan yang baik. Secara keseluruhannya, Modul ReacToon berpotensi menjadi bahan sokongan pengajaran dan pembelajaran Kimia yang dapat membantu guru melaksanakan PdP berasaskan KBAT dalam topik Kadar Tindak Balas.

The topic of Reaction Rate is one of the most challenging topics in Form Four Chemistry due to its abstract concepts and the need for students to apply Higher Order Thinking Skills (HOTS). Therefore, this study aimed to develop and evaluate the suitability of the ReacToon Module based on Project-Based Learning (PjBL) to support the development of students' HOTS in the topic of Reaction Rate. This study employed Type I Design and Development Research (DDR), which comprised three phases: needs analysis, design and development, and evaluation. The needs analysis phase involved semi-structured interviews with three experienced Chemistry teachers. The findings revealed that students experienced difficulties in understanding concepts related to Collision Theory, activation energy, and factors affecting reaction rate. The teachers also highlighted the need for an interactive, student-centred learning module that integrates HOTS through a Project-Based Learning (PjBL) approach. The design and development phase involved the evaluation of the module by ten experts using the Fuzzy Delphi Method (FDM). The findings indicated that all components of the ReacToon Module fulfilled the acceptance criteria, with a threshold value ($d \leq 0.2$), expert

consensus exceeding 75%, and a defuzzification value (A ≥ 0.5). Subsequently, the evaluation phase employed the Content Validity Index (CVI) involving three experts. The findings demonstrated that the ReacToon Module achieved high I-CVI and S-CVI/Ave values, indicating good content validity. Overall, the ReacToon Module has the potential to serve as a supporting teaching and learning resource that assists Chemistry teachers in implementing HOTS-oriented instruction for the topic of Reaction Rate.

KEBERKESANAN MODUL PEMBELAJARAN BERASASKAN MASALAH (PBM) MENERUSI PENDEKATAN KELAS TERBALIK TERHADAP PENGLIBATAN PELAJAR DALAM TAJUK KONSEP MOL, FORMULA DAN PERSAMAAN KIMIA

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Topik konsep mol, formula kimia dan persamaan kimia sering dianggap mencabar kerana melibatkan konsep abstrak, pengiraan serta pelbagai bentuk perwakilan kimia. Kajian ini bertujuan membangunkan modul Pembelajaran Berasaskan Masalah melalui pendekatan kelas terbalik, mengkaji perubahan tahap penglibatan pelajar sebelum dan selepas pelaksanaannya serta meneroka pandangan guru terhadap modul tersebut. Modul dibangunkan berdasarkan Model ADDIE dan lima peringkat PBM yang dicadangkan oleh Tan (2003). Kajian ini menggunakan reka bentuk satu kumpulan pra dan pasca yang disokong oleh temu bual separa berstruktur bersama seorang guru. Seramai 26 orang pelajar Tingkatan Empat terlibat dalam kajian sebenar, manakala 27 orang pelajar terlibat dalam kajian rintis. Penglibatan kognitif, emosi dan tingkah laku pelajar diukur menggunakan soal selidik skala Likert yang mengandungi 15 item. Data kuantitatif dianalisis menggunakan statistik deskriptif, ujian-t sampel berpasangan dan saiz kesan Cohen's dz, manakala data temu bual dianalisis secara tematik. Dapatan menunjukkan bahawa skor min penglibatan pelajar meningkat daripada 54.04 sebelum intervensi kepada 63.35 selepas intervensi. Perbezaan tersebut adalah signifikan secara statistik, $t(25) = 2.867$, $p = .008$, dengan saiz kesan sederhana, $dz = 0.56$. Temu bual guru menunjukkan bahawa modul menyokong perbincangan kumpulan, penyertaan aktif dan usaha pelajar dalam menyelesaikan tugasan. Namun begitu, pelaksanaannya dipengaruhi oleh perbezaan keupayaan pelajar, kejelasan arahan, keperluan bimbingan dan pengurusan masa. Secara keseluruhannya, modul PBM–kelas terbalik menunjukkan potensi untuk meningkatkan penglibatan pelajar, namun dapatan perlu ditafsirkan dengan berhati-hati kerana saiz sampel yang kecil dan ketiadaan kumpulan kawalan.

The topics of the mole concept, chemical formulae, and chemical equations are often considered challenging because they involve abstract concepts, calculations, and multiple forms of chemical representation. This study aimed to develop a Problem-Based Learning module using a flipped classroom approach, examine changes in students' engagement before and after its implementation, and explore the teacher's views on the module. The module was developed based on the ADDIE Model and the five stages of PBL proposed by Tan (2003). A one-group pre-test and post-test design was employed, supported by a semi-structured teacher interview. A total of 26 Form Four students participated in the main study, while 27 students were involved in the pilot study. Students' cognitive, emotional, and behavioural engagement was measured using a 15-item Likert-scale questionnaire. Quantitative data were analysed using descriptive statistics, a paired-samples t-test, and Cohen's dz effect size, while the interview data were analysed thematically. The findings showed that the mean engagement score increased from 54.04 before the intervention to 63.35 after the intervention. The difference was statistically significant, $t(25) = 2.867$, $p = .008$, with a moderate effect size, $dz = 0.56$. The teacher interview indicated that the module supported group discussion, active participation, and students' efforts in completing tasks. However, its implementation was influenced by differences in students' abilities, clarity of instructions, the need for guidance, and time management. Overall, the PBL–flipped classroom module showed potential to improve student engagement, although the findings should be interpreted cautiously due to the small sample size and the absence of a control group.

PEMBANGUNAN KOMIK CHEMSTORY BERASASKAN PENCERITAAN

SEBAGAI BAHAN BANTU MENGAJAR TOPIK ASID DAN ALKALI DALAM APLIKASI PERTANIAN

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Kajian ini bertujuan untuk membangunkan sebuah bahan bantu mengajar berbentuk komik Chemstory berasaskan penceritaan bagi topik Asid dan Alkali dalam aplikasi pertanian, khususnya konsep Peneutralan. Kajian ini dijalankan kerana terdapat kesukaran dalam kalangan pelajar untuk memahami konsep asas asid dan alkali seperti nilai pH, ion hidrogen, ion hidroksida serta aplikasi tindak balas peneutralan dalam kehidupan sebenar. Komik Chemstory ini dibangunkan berdasarkan pendekatan penceritaan dengan menggunakan struktur naratif yang membolehkan pelajar memahami konsep kimia melalui jalan cerita, watak, dialog dan situasi berkaitan tanah berasid dalam pertanian. Kajian ini menggunakan kaedah atau pendekatan kuantitatif dengan rekabentuk pembangunan yang melibatkan fasa perancangan, rekabentuk dan pembangunan. Fasa perancangan melibatkan usaha mengenal pasti tahap kefahaman pelajar terhadap topik yang dikaji serta menilai kesesuaian bahan bantu mengajar yang dibangunkan. Seramai 101 orang pelajar Tingkatan 4 yang mengambil mata pelajaran Kimia di kawasan Skudai terlibat dalam kajian ini. Instrumen kajian terdiri daripada set ujian kefahaman konsep. Dalam fasa pembangunan pula, kesesuaian komik dinilai oleh guru kimia menggunakan borang penilaian kesesuaian Chemstory dari aspek isi kandungan berdasarkan model Freytag, reka bentuk, bahasa, kebolehgunaan dan kesesuaian aktiviti pembelajaran. Kesahan instrumen dan bahan telah disemak oleh pakar.Dapatan kajian menunjukkan bahawa Chemstory berpotensi membantu pelajar memahami konsep peneutralan dalam konteks pertanian dengan lebih menarik, mudah difahami dan dekat dengan kehidupan sebenar. Kajian ini memberi implikasi untuk menggalakkan penggunaan bahan pembelajaran digital yang kreatif bagi meningkatkan minat dan penglibatan aktif pelajar dalam pembelajaran kimia.

This study aims to develop a storytelling-based comic learning material, Chemstory, for the topic of Acids and Alkalis in Agricultural Applications, with a particular focus on the concept of neutralisation. The study was conducted due to students' difficulties in understanding fundamental acid-base concepts, including pH values, hydrogen ions, hydroxide ions, and the application of neutralisation reactions in real-life situations. Chemstory was developed using a storytelling approach that incorporates a narrative structure, enabling students to understand chemical concepts through engaging storylines, characters, dialogues, and scenarios related to acidic soil in agriculture. This study employed a quantitative research approach using a developmental research design, which consisted of the planning, design, and development phases. During the planning phase, students' level of understanding of the selected topic was identified, and the suitability of the proposed teaching and learning material was evaluated. A total of 101 Form Four students taking Chemistry from schools in the Skudai area participated in the study. The research instrument consisted of a conceptual understanding test. In the development phase, the suitability of Chemstory was evaluated by Chemistry teachers using the Chemstory Suitability Evaluation Form, which assessed the comic in terms of content based on Freytag's narrative model, design, language, usability, and the appropriateness of the learning activities. The validity of both the research instruments and the learning material was verified by experts. The findings indicate that Chemstory has the potential to help students better understand the concept of neutralisation in the context of agriculture by presenting the content in a more engaging, comprehensible, and authentic manner. This study highlights the importance of incorporating creative digital learning materials to enhance students' interest and active engagement in Chemistry learning.

HUBUNGAN ANTARA KESEDIAAN MURID TERHADAP PEMBELAJARAN BERASASKAN PERMAINAN DENGAN MOTIVASI DAN PENGLIBATAN DALAM PEMBELAJARAN KIMIA

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Kajian ini dilakukan bertujuan mengkaji hubungan kesediaan pelajar terhadap pembelajaran berasaskan permainan dengan motivasi dan penglibatan dalam pembelajaran kimia. Pendekatan Pembelajaran Berasaskan Permainan (Game-Based Learning, GBL) merupakan salah satu pendekatan pedagogi inovatif abad ke-21 yang berpotensi meningkatkan kualiti pengajaran dan pembelajaran (PdP) sains. Namun begitu, hasil daripada pelaksanaannya juga bergantung kepada tahap kesediaan awal pelajar itu sendiri. Kajian tinjauan berbentuk kuantitatif deskriptif dan korelasi ini dijalankan untuk mengenal pasti tahap kesediaan murid Tingkatan 4 terhadap pembelajaran berasaskan permainan dalam subjek Kimia, serta meneliti hubungannya dengan motivasi dan penglibatan murid. Data dikumpul menggunakan instrumen soal selidik skala Likert empat mata yang diedarkan secara atas talian melalui platform Google Form. Responden kajian terdiri daripada 102 orang murid Tingkatan 4 yang mengambil mata pelajaran Kimia di beberapa buah sekolah menengah harian sekitar kawasan Skudai, Johor Bahru yang dipilih melalui kaedah persampelan rawak. Hasil dapatan data menunjukkan semua responden (100%) telah mempunyai pendedahan awal terhadap pendekatan GBL. Justeru, hasil analisis deskriptif mendedahkan bahawa tahap kesediaan murid terhadap pembelajaran berasaskan permainan berada pada tahap tinggi. Sementara itu, motivasi murid dalam pembelajaran Kimia berada pada tahap sederhana manakala tahap penglibatan murid juga berada pada tahap sederhana. Implikasi kajian ini memberi isyarat jelas kepada para pendidik kimia untuk mula mengubah strategi pengajaran tradisional konvensional kepada pendekatan yang lebih interaktif dan berpusatkan pelajar. Kajian ini mencadangkan agar pihak Kementerian Pendidikan Malaysia (KPM) mengintegrasikan panduan pembinaan modul GBL dalam kurikulum STEM bagi melonjakkan motivasi dan penglibatan aktif murid secara optimum.

This study was conducted to examine the relationship between students' readiness for game-based learning and their motivation and engagement in learning Chemistry. Game-Based Learning (GBL) is one of the innovative 21st-century pedagogical approaches that has the potential to enhance the quality of science teaching and learning. However, the effectiveness of its implementation largely depends on students' initial level of readiness. This quantitative descriptive-correlational survey was carried out to determine the level of Form 4 students' readiness for game-based learning in the Chemistry subject and to examine its relationship with students' motivation and engagement. Data were collected using a four-point Likert scale questionnaire distributed online via Google Forms. The respondents consisted of 102 Form 4 students taking Chemistry from several daily secondary schools in the Skudai area of Johor Bahru, selected through random sampling. The findings revealed that all respondents (100%) had prior exposure to the GBL approach. Furthermore, descriptive analysis indicated that students' readiness for game-based learning was at a high level. Meanwhile, students' motivation in learning Chemistry was at a moderate level, and their engagement in learning Chemistry was also at a moderate level. The findings of this study highlight the need for Chemistry educators to shift from conventional teacher-centred instructional strategies to more interactive and student-centred approaches. This study further recommends that the Ministry of Education Malaysia (MOE) integrate guidelines for the development of Game-

Based Learning (GBL) modules into the STEM curriculum to enhance students' motivation and promote active engagement in learning.

PEMBANGUNAN KOMIK CHEMSTORY BERASASKAN PENCERITAAN BAGI TOPIK KADAR TINDAK BALAS KIMIA TINGKATAN 4 DALAM KONTEKS KESELAMATAN MAKANAN

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Kajian ini bertujuan membangunkan Komik ChemStory berasaskan penceritaan bagi topik kadar tindak balas kimia Tingkatan 4 dalam konteks keselamatan makanan. Komik ini dibangunkan untuk membantu mengaplikasikan konsep Teori Perlanggaran dan faktor-faktor yang mempengaruhi kadar tindak balas melalui pendekatan visual, kontekstual dan penceritaan dalam kehidupan harian. Pembangunan komik berpandukan Model Alessi dan Trollip yang merangkumi fasa perancangan, reka bentuk dan pembangunan, manakala Piramid Freytag digunakan untuk menyusun struktur penceritaan. Kajian pembangunan ini menggunakan pendekatan kuantitatif dan rekabentuk pembangunan. Seramai 100 orang pelajar Tingkatan 5 daripada tiga buah sekolah terlibat dalam pengumpulan data menggunakan instrumen ujian diagnostik, manakala enam orang guru kimia menilai kesesuaian komik menggunakan instrumen soal selidik kesesuaian. Data dianalisis dengan menggunakan statistik deskriptif melibatkan min dan sisihan piawai bagi ujian diagnostik dan peratusan bagi soal selidik kesesuaian. Dapatan menunjukkan tahap pengaplikasian konsep pelajar berada pada tahap sederhana dengan skor min 5.60 dan sisihan piawai 2.482. Kesukaran utama dikenal pasti pada item berkaitan Teori Perlanggaran, bahan pengawet dan penebatan haba. Dapatan ini digunakan untuk membangunkan Komik ChemStory yang dibangunkan mengandungi 22 halaman yang merangkumi jalan cerita, nota, aktiviti eksperimen dan aktiviti pengukuhan. Dapatan kesesuaian pula menunjukkan kesemua 24 item penilaian memenuhi kriteria kesesuaian apabila sekurang-kurangnya 83.3% penilai memilih Setuju atau Sangat Setuju. Kajian ini memberikan implikasi terhadap pembangunan bahan pembelajaran kimia yang menggabungkan visual, penceritaan dan konteks kehidupan harian serta menyediakan asas untuk kajian keberkesanan pada masa akan datang.

This study aimed to develop and evaluate the suitability of ChemStory Comic, a storytelling-based learning material for the Form 4 Chemistry topic of rate of reaction within the context of food safety. The comic was developed to assist students in applying rate of reaction concepts, including Collision Theory and factors affecting the rate of reaction, to everyday situations through visual, contextual and storytelling approaches. The development of the comic was guided by the Alessi and Trollip Model, which comprises the planning, design and development phases, while Freytag's Pyramid was used to structure the storyline. This developmental study employed a quantitative approach. A total of 100 Form 5 students from three secondary schools participated in a diagnostic test, while six chemistry teachers evaluated the suitability of the comic using a suitability evaluation form. The diagnostic test data were analysed using frequency, percentage, mean and standard deviation, whereas the suitability evaluation data were analysed using frequency and percentage. The findings showed that the students' level of application of rate of reaction concepts was moderate, with a mean score of 5.60 and a standard deviation of 2.482. Items related to Collision Theory, the function of food preservatives and thermal insulation recorded lower percentages of correct responses. These findings were used as one of the foundations for developing the 22-

page ChemStory Comic, which includes a storyline, concise notes, an experimental activity and reinforcement activities. The suitability evaluation showed that all 24 items met the suitability criterion, as at least five out of six evaluators, equivalent to 83.3%, selected Agree or Strongly Agree. In conclusion, ChemStory Comic was systematically developed and evaluated as suitable for use as a supplementary learning material to support the presentation and application of rate of reaction concepts in the context of food safety. This study has implications for the development of chemistry learning materials that integrate visual elements, storytelling and everyday-life contexts, while providing a foundation for future effectiveness studies.

TINJAUAN TAHAP PENGETAHUAN, KEMAHIRAN DAN KEYAKINAN PENDEKATAN PEMIKIRAN REKA BENTUK TERHADAP PRA PERKHIDMATAN GURU KIMIA DALAMPEMBELAJARAN DAN PENGAJARAN KIMIA.

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Kajian ini bertujuan untuk mengenal pasti tahap pengetahuan, kemahiran dan keyakinan pra perkhidmatan guru Kimia terhadap penggunaan pendekatan Pemikiran Reka Bentuk (Design Thinking) dalam pengajaran dan pembelajaran Kimia. Pendekatan Pemikiran Reka Bentuk semakin diberi perhatian dalam pendidikan abad ke-21 kerana ia menekankan pembelajaran berpusatkan murid, penyelesaian masalah secara kreatif serta pembangunan kemahiran berfikir aras tinggi. Kajian ini dijalankan menggunakan pendekatan kuantitatif berbentuk tinjauan dengan menggunakan soal selidik sebagai instrumen utama kajian. Seramai 52 orang murid tahun tiga dan tahun empat Program Pendidikan Kimia di Universiti Teknologi Malaysia (UTM) telah dipilih sebagai responden melalui persampelan bertujuan. Data yang diperoleh dianalisis menggunakan perisian Statistical Package for Social Sciences (SPSS) versi 31.0 bagi mendapatkan nilai peratusan, min dan sisihan piawai. Dapatan kajian menunjukkan bahawa tahap pengetahuan, kemahiran dan keyakinan pra perkhidmatan guru Kimia terhadap pendekatan Pemikiran Reka Bentuk berada pada tahap tinggi. Konstruk kemahiran mencatatkan nilai min tertinggi diikuti keyakinan dan pengetahuan. Hal ini menunjukkan bahawa responden mempunyai keupayaan yang baik dalam mengaplikasikan elemen Pemikiran Reka Bentuk seperti mengenal pasti masalah, menjana idea, membina prototaip dan membuat refleksi dalam konteks pengajaran Kimia. Secara keseluruhannya, kajian ini menunjukkan bahawa pendekatan Pemikiran Reka Bentuk berpotensi untuk diterapkan dalam latihan perguruan Kimia bagi meningkatkan kualiti pengajaran berasaskan inovasi dan keperluan pendidikan abad ke-21. Kajian ini juga diharapkan dapat membantu institusi pendidikan tinggi dalam merancang kurikulum dan latihan yang lebih efektif bagi melahirkan guru Kimia yang kreatif, inovatif dan bersedia menghadapi cabaran pendidikan masa kini.

This study aims to identify the levels of knowledge, skills, and confidence among pre-service Chemistry teachers regarding the use of the Design Thinking approach in Chemistry teaching and learning. The Design Thinking approach is gaining increasing attention in 21st-century education as it emphasizes student-centered learning, creative problem-solving, and the development of higher-order thinking skills. This study employed a quantitative survey approach, utilizing a questionnaire as the primary research instrument. A total of 52 third- and fourth-year students from the Chemistry Education Program at Universiti Teknologi

Malaysia (UTM) were selected as respondents through purposive sampling. The data obtained were analyzed using the Statistical Package for the Social Sciences (SPSS) software (version 31.0) to determine percentages, means, and standard deviations. The findings indicate that the pre-service Chemistry teachers' levels of knowledge, skills, and confidence regarding the Design Thinking approach were high. The skills construct recorded the highest mean value, followed by confidence and knowledge. This demonstrates that the respondents possess a strong ability to apply Design Thinking elements—such as problem identification, idea generation, prototyping, and reflection—within the context of Chemistry instruction. Overall, the study suggests that the Design Thinking approach has the potential to be integrated into Chemistry teacher training to enhance teaching quality through innovation and meet the demands of 21st-century education. Furthermore, this study is expected to assist higher education institutions in designing more effective curricula and training programs to produce creative and innovative Chemistry teachers who are prepared to face contemporary educational challenges.

PERSEPSI TERHADAP TEKNOLOGI DIGITAL BERASASKAN MODEL TPACK DALAM PENGAJARAN DAN PEMBELAJARAN KIMIA DALAM KALANGAN MAHASISWA GURU KIMIA

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Kajian ini dijalankan untuk mengenal pasti persepsi terhadap teknologi digital berasaskan model TPACK (Technological Pedagogical Content Knowledge) dalam pengajaran dan pembelajaran (PdP) Kimia dalam kalangan mahasiswa guru Kimia di Universiti Teknologi Malaysia (UTM) serta menilai perbezaan tahap tersebut berdasarkan tahun pengajian responden. Menggunakan reka bentuk kuantitatif dengan kaedah tinjauan, kajian ini melibatkan seramai 56 orang mahasiswa guru Kimia (28 orang Tahun 3 dan 28 orang Tahun 4) yang dipilih melalui teknik persampelan bertujuan. Instrumen kajian terdiri daripada borang soal selidik Skala Likert 4-mata yang mengandungi 32 item dan data dianalisis secara deskriptif serta inferensi menggunakan perisian SPSS. Hasil analisis deskriptif menunjukkan bahawa mahasiswa guru mempunyai tahap penguasaan pengetahuan asas (CK, PK, TK) dan pengetahuan bersepadu (PCK, TCK, TPK) yang sangat positif dan cemerlang, dengan nilai median dan mod yang tekal pada skor tinggi. Walau bagaimanapun, terdapat sedikit kelemahan dikesan dalam aspek penyelesaian masalah teknikal digital. Keputusan statistik inferensi melalui Ujian-t Sampel Bebas membuktikan bahawa tidak terdapat perbezaan yang signifikan bagi persepsi terhadap teknologi digital antara mahasiswa guru Kimia Tahun 3 dan Tahun 4 ($p=0.148>0.05$). Secara keseluruhannya, dapatan ini menggambarkan bahawa struktur kurikulum latihan perguruan di universiti tersebut telah berjaya menyatukan elemen teknologi, pedagogi dan kandungan secara berkesan sejak peringkat awal pengajian lagi.

This study aims to identify the level of digital technology integration based on the TPACK model (Technological Pedagogical Content Knowledge) in Chemistry teaching and learning (T&L) among Chemistry pre-service teachers at Universiti Teknologi Malaysia (UTM) and to evaluate the differences in integration levels based on their year of study. Employing a quantitative survey design, the research involved 56 Chemistry pre-service teachers (28 from Year 3 and 28 from Year 4) selected through purposive sampling. The research instrument utilized a 32-item questionnaire on a 4-point Likert scale, and data were analyzed both descriptively and inferentially using SPSS software. Descriptive analysis results indicated that pre-service teachers possess a very positive and excellent level of mastery in both basic knowledge (CK, PK, TK) and integrated knowledge (PCK, TCK, TPK), with median and mode values consistently at high scores. However, a slight weakness was identified regarding digital technical troubleshooting. Inferential statistical results from the Independent Sample t-test confirmed that there is no significant difference in the level of digital technology integration between Year 3 and Year 4 Chemistry pre-service teachers ($p=0.148>0.05$). In conclusion, these findings illustrate that the teacher training curriculum structure at the university has successfully and effectively unified the elements of technology, pedagogy, and content since the early stages of study.

PEMBANGUNAN KOMIK CHEM-STORY BERASASKAN PEMBELAJARAN PENCERITAAN TERHADAP APLIKASI KONSEP IKATAN ION DALAM KEHIDUPAN SEHARIAN

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Kajian ini bertujuan membangunkan Komik Chem-Story berasaskan pembelajaran penceritaan bagi aplikasi konsep ikatan ion dalam kehidupan seharian serta menilai tahap kesesuaiannya sebagai bahan pembelajaran. Sifat konsep ikatan ion yang abstrak menyebabkan pelajar menghadapi kesukaran mengaplikasikan teori kepada fenomena kehidupan sebenar. Oleh itu, kajian ini menggunakan pembelajaran penceritaan bagi menangani masalah tersebut dengan menggunakan reka bentuk tinjauan melalui pendekatan kuantitatif deskriptif dalam kerangka Penyelidikan dan Pembangunan berpandukan Model Pembangunan Multimedia Alessi dan Trollip yang merangkumi fasa perancangan, reka bentuk dan Pembangunan. Dalam fasa perancangan, ujian diagnostik yang mengandungi 11 item ditadbir kepada 100 orang pelajar Tingkatan 4 selepas kajian rintis yang melibatkan 30 orang pelajar. Dapatan menunjukkan bahawa pelajar memperoleh pencapaian yang lebih baik bagi konsep asas ikatan ion berbanding item berbentuk aplikasi yang melibatkan baja, air tanah dan penyerapan nutrien, khususnya Soalan 4, 8 dan 11. Dapatan tersebut digunakan untuk mereka bentuk kandungan dan visual submikroskopik dalam Komik Chem-Story bertajuk Skuad Z-6: Misi Tanah Mati. Struktur jalan cerita disusun berdasarkan Model Piramid Freytag. Prototaip komik kemudiannya dinilai oleh tiga orang pakar dan memperoleh nilai kesahan keseluruhan sebanyak 90.58%. Penilaian kesesuaian oleh lima orang guru Kimia dan Sains menunjukkan respons positif bagi semua item yang melibatkan aspek struktur penceritaan, kandungan, bahasa, visual dan kebolehgunaan. Kesimpulannya, Komik Chem-Story sesuai digunakan sebagai bahan pembelajaran sokongan bagi membantu menghubungkan konsep abstrak ikatan ion dengan aplikasinya dalam kehidupan seharian.

This study aimed to develop the Chem-Story Comic based on storytelling learning for the application of ionic bonding concepts in daily life and to evaluate its suitability as a learning material. The abstract nature of ionic bonding concepts makes it difficult for students to apply the theory to real-life phenomena. Therefore, this study used storytelling learning to overcome this problem by using a survey design with a descriptive quantitative approach within a Research and Development framework, guided by the Alessi and Trollip Multimedia Development Model, which consists of the planning, design, and development phases. During the planning phase, an 11-item diagnostic test was administered to 100 Form Four students after a pilot study involving 30 students. The findings indicated that students performed better on basic ionic bonding concepts than on application-based items involving fertiliser, soil water, and nutrient absorption, particularly Questions 4, 8, and 11. These findings were used to design the content and sub microscopic visuals in the Chem-Story Comic entitled Squad Z-6: Mission Dead Soil. The storyline was organised according to Freytag's Pyramid Model. The comic prototype was subsequently evaluated by three experts and obtained an overall validity score of 90.58%. A suitability evaluation by five Chemistry and Science teachers showed positive responses for all items related to storytelling structure, content, language, visuals, and usability. In conclusion, the Chem-Story Comic is suitable as a supplementary learning material to support the connection between the abstract concept of ionic bonding and its applications in daily life.

GARIS PANDUAN UNTUK GURU BAGI PELAKSANAAN PEMBELAJARAN KIMIA BERDASARKAN KAEDAH PEMBELAJARAN KOLABORATIF

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Pembelajaran kolaboratif merupakan salah satu pendekatan yang ditekankan dalam Pendidikan Abad Ke-21 kerana berupaya meningkatkan penglibatan aktif pelajar, kemahiran komunikasi, pemikiran kritis dan pencapaian akademik. Walau bagaimanapun, kajian-kajian terdahulu menunjukkan bahawa guru masih menghadapi cabaran dalam melaksanakan pembelajaran kolaboratif secara sistematik, khususnya dalam mata pelajaran Kimia yang melibatkan konsep abstrak. Sehubungan itu, kajian ini bertujuan untuk mengenal pasti elemen-elemen pembelajaran kolaboratif dalam pelaksanaan pembelajaran Kimia dan membangunkan garis panduan pembelajaran kolaboratif yang sesuai digunakan oleh guru berdasarkan elemen-elemen yang telah dikenal pasti. Kajian ini menggunakan metodologi Penyelidikan Reka Bentuk dan Pembangunan yang melibatkan empat fasa: analisis literatur, penjanaan idea pakar menggunakan Idea Generation Form berasaskan Nominal Group Technique, pengesahan elemen melalui soal selidik persetujuan pakar menggunakan skala Likert tujuh mata dan Kaedah Fuzzy Delphi (FDM) serta pembangunan garis panduan berdasarkan elemen-elemen yang dipersetujui oleh pakar. Dapatan kajian menunjukkan bahawa enam faktor utama telah dikenal pasti sebagai komponen penting dalam pelaksanaan pembelajaran kolaboratif, iaitu persekitaran, ciri ahli, komunikasi, tujuan, proses dan sumber. Melalui analisis FDM, elemen-elemen yang memenuhi syarat penerimaan berdasarkan nilai ambang (threshold value) kurang daripada atau sama dengan 0.2 ($d \leq 0.2$), peratus persetujuan pakar sekurang-kurangnya 75% dan nilai penyahkaburan (defuzzification value) melebihi atau sama dengan 0.5 ($A \geq 0.5$) telah diterima dan dijadikan asas kepada pembangunan garis panduan. Hasil kajian menghasilkan satu garis panduan yang sistematik dan praktikal bagi membantu guru merancang dan melaksanakan pembelajaran Kimia berasaskan kaedah pembelajaran kolaboratif secara lebih berkesan. Kesimpulannya, garis panduan yang dibangunkan berpotensi menjadi bahan rujukan kepada guru Kimia dalam mengaplikasikan pembelajaran kolaboratif secara lebih tersusun di samping menyokong pelaksanaan Pendidikan Abad Ke-21 serta meningkatkan kualiti pengajaran dan pembelajaran Kimia di sekolah menengah.

Collaborative learning is one of the instructional approaches emphasised in 21st-century education due to its potential to enhance students' active participation, communication skills, critical thinking and academic achievement. However, previous studies have indicated that teachers continue to face challenges in implementing collaborative learning systematically, particularly in Chemistry which involves abstract concepts. Therefore, this study aimed to identify the elements of collaborative learning in the implementation of Chemistry instruction and to develop a collaborative learning guideline for teachers based on the identified elements. This study employed the Design and Development Research methodology which consisted of four phases: literature analysis, expert idea generation using the Idea Generation Form based on the Nominal Group Technique, validation of the identified elements through an expert consensus questionnaire using a seven-point Likert scale and the Fuzzy Delphi Method (FDM) and the development of the guideline based on the elements agreed upon by the expert panel. The findings revealed six main factors as essential components for the implementation of collaborative learning, namely environment, member characteristics, communication, purpose, process and resources. Through the Fuzzy Delphi analysis, elements satisfying the acceptance criteria, namely a threshold value of less than or equal to 0.2 ($d \leq 0.2$), an expert consensus of at least 75%, and a defuzzification value of greater than

or equal to 0.5 (A ≥ 0.5), were retained and served as the basis for the development of the guideline. The study successfully developed a systematic and practical guideline to assist teachers in planning and implementing Chemistry instruction based on the collaborative learning approach more effectively. In conclusion, the developed guideline has the potential to serve as a valuable reference for Chemistry teachers in implementing collaborative learning in a more structured manner while supporting the implementation of 21st-century education and enhancing the quality of Chemistry teaching and learning in secondary schools.

GARIS PANDUAN PENGGUNAAN ARTIFICIAL INTELLIGENCE BERASASKAN TEKS PADA TAHAP SUBMIKROSKOPIK DALAM KALANGAN PELAJAR KIMIA SEKOLAH MENENGAH

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Kajian ini meneroka penggunaan Kecerdasan Buatan (AI) sebagai alat bantu pembelajaran dalam pembelajaran kimia, khususnya dalam menyokong pemahaman pelajar tentang konsep submikroskopik. Masalah utama yang ditangani dalam kajian ini ialah miskonsepsi berterusan pelajar di peringkat submikroskopik, di mana fenomena kimia mesti difahami dari segi zarah seperti atom, ion, molekul, ikatan, dan daya tarikan. Kajian ini menggunakan pendekatan kaedah campuran penerokaan dua fasa. Dalam Fasa 1, tinjauan saringan akan dijalankan dengan 30 pelajar kimia sekolah menengah untuk mengenal pasti pengalaman, kekerapan dan tujuan mereka menggunakan AI dalam pembelajaran kimia. Data daripada tinjauan saringan akan dianalisis menggunakan statistik deskriptif, termasuk kekerapan, peratusan, min dan sisihan piawai. Dalam Fasa 2, enam peserta akan dipilih untuk mengambil bahagian dalam sesi Think-Aloud Protocol. Semasa sesi ini, para peserta akan menggunakan AI untuk menyelesaikan tugasan kimia yang melibatkan penaakulan submikroskopik sambil menyatakan pemikiran mereka secara lisan. Data kualitatif akan dianalisis menggunakan analisis tematik untuk mengenal pasti tingkah laku pembelajaran berbantukan AI pelajar, pemahaman submikroskopik, kaitan perwakilan, miskonsepsi, beban kognitif dan penilaian tindak balas AI. Dapatan utama kajian menunjukkan bahawa pelajar menggunakan AI untuk menyokong pemahaman tentang kimia pada peringkat mikroskopik namun bimbingan berstruktur diperlukan bagi membantu mereka mencari, memvisualisasikan dan mengesahkan maklumat yang dijana oleh AI secara berkesan. Dapatan kajian ini diharapkan dapat memberikan pandangan tentang cara pelajar menggunakan AI untuk menyokong pemahaman mereka tentang konsep kimia submikroskopik. Kajian ini juga akan menyumbang kepada pembangunan garis panduan praktikal untuk menggunakan AI secara berkesan dan kritis sebagai bantuan pembelajaran dalam pendidikan kimia.

This study explores the use of Artificial Intelligence (AI) as a learning aid in chemistry education, specifically in supporting students' understanding of submicroscopic concepts. The primary issue addressed is the persistence of student misconceptions at the submicroscopic level, where chemical phenomena must be understood in terms of particles such as atoms, ions, molecules, bonds, and forces of attraction. The study employs an exploratory two-phase mixed-methods approach. In Phase 1, a survey will be conducted with 30 secondary school chemistry students to identify their experiences, frequency of use, and purposes for using AI in learning chemistry. Data from the survey will be analyzed using descriptive statistics, including frequency, percentage, mean, and standard deviation. In

Phase 2, six participants will be selected to take part in Think-Aloud Protocol sessions. During these sessions, participants will use AI to complete chemistry tasks involving submicroscopic reasoning while verbalizing their thought processes. Qualitative data will be analyzed using thematic analysis to identify students' AI-assisted learning behaviors, submicroscopic understanding, representations, misconceptions, cognitive load, and evaluations of AI responses. Key findings indicate that while students use AI to support their understanding at the submicroscopic level, structured guidance is required to help them effectively locate, visualize, and verify AI-generated information. The study's findings are expected to provide insights into how students utilize AI to support their comprehension of submicroscopic chemistry concepts. Furthermore, the study will contribute to the development of practical guidelines for the effective and critical use of AI as a learning aid in chemistry education.

KEBERKESANAN MODUL PEMBELAJARAN BERASASKAN MASALAH (PBM) MELALUI PENGGUNAAN BAHAN KONTEKSTUAL SEBAGAI STIMULUS MASALAH AUTENTIK TERHADAP PEMAHAMAN PELAJAR DALAM TOPIK KONSEP MOL, FORMULA DAN PERSAMAAN KIMIA

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Kajian ini bertujuan untuk membangunkan modul Pembelajaran Berasaskan Masalah (PBM) melalui bahan kontekstual bagi topik Konsep Mol, Formula Kimia dan Persamaan Kimia dalam pendidikan Kimia. Kajian ini menggunakan pendekatan reka bentuk dan pembangunan yang berpandukan Model ADDIE, yang merangkumi fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Modul ini dibangunkan untuk membantu pelajar menghubungkan konsep Kimia yang abstrak dengan konteks kehidupan sebenar melalui senario masalah, aktiviti penyelesaian masalah secara berkumpulan, pembinaan peta minda, pembentangan, pentaksiran dan refleksi. Proses kesahan pakar telah dilaksanakan untuk menilai kesesuaian modul, instrumen ujian pra dan ujian pasca serta protokol temu bual. Maklum balas yang diperoleh digunakan untuk menambah baik modul dari aspek keselarasan kandungan, struktur soalan, kejelasan arahan dan peruntukan masa. Analisis kebolehpercayaan menunjukkan bahawa instrumen ujian pra dan ujian pasca yang telah ditambah baik mencapai tahap ketekalan dalaman yang boleh diterima, dengan nilai alfa Cronbach masing-masing sebanyak 0.735 dan 0.719. Bagi komponen kualitatif, analisis tematik menunjukkan tahap persetujuan pakar yang baik, dengan nilai persetujuan sebanyak 81% dan 96%. Secara keseluruhannya, dapatan kajian menunjukkan bahawa modul PBM bersepadu melalui bahan kontekstual adalah sah, boleh dipercayai dan sesuai digunakan sebagai bahan pengajaran dan pembelajaran Kimia Tingkatan Empat. Kajian lanjutan dicadangkan untuk menilai keberkesanan modul tersebut terhadap pemahaman konsep pelajar melalui pelaksanaan yang lebih meluas dalam konteks bilik darjah.

This study aimed to develop a Problem-Based Learning (PBL) module through contextual materials for Mole Concept, Chemical Formula and Chemical Equations topic for chemistry education. The study employed a design and development approach guided by the ADDIE model, which consists of analysis, design, development, implementation and evaluation phases. The module was developed to help students relate abstract chemistry concepts to real-life contexts through problem scenarios, group problem-solving activities, mind mapping, presentations, assessment and reflection. Expert validation was conducted to review the suitability of the module, pre-test and post-test instruments, and interview protocol. The feedback obtained was used to improve the module in terms of content alignment, question structure, clarity of instructions and time allocation. The reliability analysis showed that the refined pre-test and post-test instruments achieved acceptable internal consistency, with Cronbach's alpha values of 0.735 and 0.719, respectively. For the qualitative component, the thematic analysis showed good expert agreement, with agreement values of 81% and 96%. Overall, the findings indicate that the integrated PBL module through contextual materials is valid, reliable and suitable for use as a teaching and learning material in Form Four chemistry. Further research is recommended to examine its effectiveness on students' conceptual understanding through wider classroom implementation.

MODUL ORGANIQUEST BERINTEGRASIKAN PEMBELAJARAN

BERASASKAN MASALAH BAGI MEMBANTU PEMAHAMAN KONSEPTUAL DALAM TOPIK SIRI HOMOLOG

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Topik Siri Homolog dan Sifat Kimia merupakan topik dibawah tema Kimia Organik tingkatan lima yang sering menimbulkan kesukaran kepada pelajar kerana memerlukan pemahaman konseptual terhadap penamaan sistematik, kumpulan berfungsi serta hubungan antara struktur molekul dengan sifat kimia sesuatu sebatian. Keadaan ini menyebabkan pelajar cenderung menghafal fakta tanpa membina pemahaman konseptual yang kukuh. Oleh itu, kajian ini dijalankan bertujuan untuk membangunkan Modul OrganiQuest yang mengintegrasikan pendekatan Pembelajaran Berasaskan Masalah (PBM) bagi meningkatkan pemahaman konseptual pelajar dalam topik Siri Homolog dan Sifat Kimia. Kajian ini menggunakan pendekatan Design and Development Research (DDR) yang melibatkan tiga fasa utama iaitu 1) Analisis Keperluan, 2) Reka Bentuk dan Pembangunan serta 3) Penilaian. Dalam fasa analisis keperluan, temu bual separa berstruktur bersama tiga orang pakar guru Kimia telah dijalankan dan dianalisis menggunakan analisis tematik. Dalam fasa reka bentuk dan pembangunan pula, soal selidik fuzzy delphi digunakan yang melibatkan 12 orang pakar dan dianalisis menggunakan Fuzzy Delphi Method (FDM) . Seterusnya, fasa penilaian melibatkan penilaian kesahan kandungan menggunakan Content Validity Index (CVI) oleh tiga orang pakar. Dapatan kajian menunjukkan bahawa pelajar masih menghadapi kesukaran memahami konsep Siri Homolog dan Sifat Kimia, khususnya dalam aspek penamaan menggunakan sistem IUPAC, mengenal pasti kumpulan berfungsi serta menghubungkan struktur molekul dengan sifat kimia sesuatu sebatian. Analisis Fuzzy Delphi menunjukkan semua komponen dan aktiviti Modul OrganiQuest mencapai tahap kesepakatan pakar yang tinggi dengan memenuhi syarat penerimaan, iaitu nilai ambang (d) ≤ 0.20, peratus persetujuan pakar melebihi 75% dan nilai defuzzifikasi ≥ 0.50. Seterusnya, penilaian kesahan kandungan menunjukkan semua konstruk memperoleh nilai I-CVI dan S-CVI/Ave sebanyak 1.00. Hal ini membuktikan bahawa Modul OrganiQuest mempunyai tahap kesesuaian kandungan yang sangat tinggi dan sesuai digunakan sebagai bahan bantu mengajar bagi topik Siri Homolog dan Sifat Kimia. Kesimpulannya, Modul OrganiQuest berpotensi menyokong pelaksanaan pendekatan Pembelajaran Berasaskan Masalah (PBM) bagi membantu pemahaman konseptual pelajar dalam topik Siri Homolog dan Sifat Kimia.

The topic of Homologous Series and Chemical Properties is a topic under the theme of Organic Chemistry five that often causes difficulties for students because it requires a conceptual understanding of systematic naming, functional groups and the relationship between molecular structure and chemical properties of a compound. This situation causes students to tend to memorize facts without building a strong conceptual understanding. Therefore, this study was conducted to develop an OrganiQuest Module that integrates the Learning Based Approach (PBM) to improve students' understanding of conceptual problems in the topic of Homologous Series and Chemical Properties. This study used a Design and Development Research (DDR) approach which involved three main phases, namely 1) Needs Analysis, 2) Design and Development and 3) Evaluation. In the needs analysis phase, semistructured interviews with three Chemistry teacher experts were conducted and analyzed using thematic analysis. In the design and development phase, a fuzzy delphi questionnaire was used involving 12 experts and analyzed using the Fuzzy Delphi Method (FDM). Next, the evaluation phase involved assessing content validity using the Content Validity Index (CVI) by three experts. The findings of the study showed that students still face difficulties in understanding the concept of Homologous Series and Chemical Properties, especially in the

aspects of naming using the IUPAC system, identifying functional groups and linking molecular structures with chemical properties of a compound. Fuzzy Delphi analysis showed that all components and activities of OrganiQuest achieved a high level of expert consensus by meeting the acceptance criteria, namely the threshold value (d) ≤ 0.20, the percentage of expert agreement exceeding 75% and the defuzzification value ≥ 0.50. Next, the content assessment showed that all constructs obtained I-CVI and S-CVI/Ave values of 1.00. This proves that the OrganiQuest Module has a very high level of content suitability and is suitable for use as a teaching aid for the topic of Homologous Series and Chemical Properties. In conclusion, the OrganiQuest Module has the potential to support the implementation of the Problem-Based Learning (PBM) approach to the topic to assist students' conceptual understanding of Homologous Series and Chemical Properties.

DEVELOPING SOCRATIC QUESTIONING - CRITICAL THINKING INSTRUCTIONAL GUIDELINES IN NEUTRALISATION TOPIC

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Penerapan pemikiran kritis merupakan agenda utama dalam reformasi pendidikan global, namun murid kimia sekolah menengah di Malaysia masih menghadapi kesukaran menavigasi tiga aras representasi Johnstone (makroskopik, submikroskopik, dan simbolik) dalam topik Peneutralan. Kekurangan garis panduan instruksional yang berstruktur juga mengehadkan keupayaan guru untuk melaksanakan teknik penyoalan aktif secara berkesan dalam bilik darjah. Kajian ini bertujuan untuk membangun dan menilai kesesuaian Garis Panduan Instruksional Penyoalan Sokratik bagi memupuk pemikiran kritis murid berasaskan kemahiran kognitif Facione (1990) dan model representasi Johnstone. Memilih metodologi Penyelidikan Reka Bentuk dan Pembangunan (DDR) Tahap 1, kajian ini merangkumi tiga fasa sistematik: analisis keperluan berasaskan dokumen, fasa reka bentuk dan pembangunan menggunakan Kaedah Fuzzy Delphi (FDM) melibatkan 12 orang pakar, serta fasa penilaian melalui Indeks Kesahan Kandungan (CVI) bersama 3 orang pakar pendidikan kimia. Hasil FDM menunjukkan kesemua item reka bentuk mencapai konsensus matematik yang ketat dengan nilai ambang jarak item ($d \leq 0.2$), peratusan konsensus pakar melebihi 75%, dan skor Fuzzy dinyah-Fuzzy (A) melebihi nilai ambang α-cut 0.5. Seterusnya, penilaian kebolehlaksanaan praktikal melalui CVI mencatatkan nilai Indeks Kesahan Kandungan peringkat Item (I-CVI), Persetujuan Universal peringkat Skala (S-CVI/UA), dan Purata peringkat Skala (S-CVI/Ave) yang sempurna iaitu 1.00. Integrasi sistematik enam kategori penyoalan Sokratik dengan kemahiran kognitif primer-sekunder ini terbukti secara matematik menyediakan kerangka instruksional yang berstruktur, mesra kekangan masa, dan fleksibel untuk bilik darjah Program Dwibahasa (DLP). Kajian masa depan dicadangkan untuk menstransisikan garis panduan yang telah disahkan ini ke peringkat ujian lapangan kuasi-eksperimen secara longitudinal bagi menilai impak empirikalnya secara langsung terhadap pencapaian akademik dan pengekalan pemikiran kritis murid dalam bilik darjah kimia sebenar.

The cultivation of critical thinking is a top educational priority worldwide, yet Malaysian secondary chemistry students persistently underachieve in scientific literacy and face significant difficulties navigating Johnstone's triplet representation levels (macroscopic, submicroscopic, and symbolic) within the neutralization topic. Furthermore, chemistry teachers lack structured instructional guidelines to implement active inquiry strategies such

as Socratic questioning effectively in classrooms. This study aimed to develop and evaluate the suitability of Socratic Questioning-Critical Thinking Instructional Guidelines to enhance students' critical thinking in learning the neutralization topic. Adopting a descriptive design using Type 1 Design and Development Research (DDR) methodology, the study was executed across two main phases. In the design and development phase, the guidelines designed based on the needs identified from literature were gone through the Fuzzy Delphi Method (FDM) deploying with a homogeneous panel of 10 subject matter experts to validate a prototypical framework across four constructs: critical thinking alignment, representation levels integration, Socratic question flow, and chemistry content alignment. All design items were successfully accepted, satisfying the strict mathematical consensus criteria of an item threshold distance (d) ≤ 0.2, an expert group consensus rate exceeding 75%, and a defuzzified Fuzzy score (A) greater than the 0.5 α-cut threshold. In the final evaluation phase, a Content Validity Index (CVI) questionnaire was administered to 3 chemistry education specialists to establish practical viability. The developed guidelines achieved perfect validation metrics across content relevance, clarity, and practicality constructs, yielding an Item-level Content Validity Index (I-CVI), Scale-level Universal Agreement (S-CVI/UA), and Scale-level Average (S-CVI/Ave) of 1.00. The final output successfully integrates six structured Socratic question types with Facione's critical thinking dimensions and Johnstone's representational model. This tool provides a robust, practical, and low-resource instructional mechanism for secondary chemistry teachers to transition classrooms from passive rote learning toward active, contextual higher-order thinking (KBAT) within the Malaysian school curriculum. Future research should transition these validated guidelines into longitudinal, quasi-experimental field testing to directly evaluate their empirical impact on student critical thinking retention in live chemistry classrooms.

PERSEPSI GURU PRA-PERKHIDMATAN KIMIA TERHADAP PENGGUNAAN MODEL PEMBELAJARAN INKUIRI

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Kaedah pengajaran merupakan salah satu faktor utama dalam perancangan pengajaran yang dilakukan oleh bakal guru. Oleh itu, kajian ini dilakukan bagi mengkaji persepsi guru pra-perkhidmatan atau bakal guru kimia terhadap penggunaan model pembelajaran inkuiri dengan melihat hubungan antara pengetahuan guru pra-perkhidmatan terhadap Model Pembelajaran 5E dan penggunaannya. Kajian yang dilakukan menggunakan pendekatan kuantitatif dengan kaedah tinjauan. Seramai 61 orang guru pra-perkhidmatan yang merupakan mahasiswa tahun 3 dan tahun 4 Universiti Teknologi Malaysia yang telah menjalani latihan mengajar di sekolah dipilih sebagai responden dengan menggunakan kaedah persampelan bertujuan. Instrumen kajian yang digunakan soal selidik yang mengandungi tiga bahagian utama demografi responden, pengetahuan terhadap Model Pembelajaran 5E dan penggunaan Model Pembelajaran 5E. Hasil dapatan yang dianalisis menggunakan analisis statistik deskriptif yang melibatkan min, sisihan piawai serta analisis statistik inferensi bagi menguji hubungan antara pembolehubah dengan menggunakan korelasi Spearman Rho'. Hasil analisis kajian ini menunjukkan bahawa terdapat peningkatan pengetahuan terhadap Model Pembelajaran 5E dapat meningkatkan kecenderungan guru pra-perkhidmatan dalam mengaplikasikan model tersebut dalam pengajaran Kimia. Kesimpulannya, majoriti bakal guru mempunyai persepsi bahawa mereka akan mengaplikasikan model ini dalam pengajaran mereka. Oleh itu, latihan dan pendedahan yang meluas terhadap pembelajaran inkuiri harus dipertingkatkan dan dikukuhkan dalam program latihan perguruan bagi memastikan kompetensi guru terhadap pelaksanaan pengajaran berpusatkan murid.

One of the main factors to consider when new teachers design their lessons is their teaching style. Therefore, this study was conducted to study the perceptions of pre-service teachers or prospective chemistry teachers towards the use of inquiry learning models by looking at the relationship between the knowledge of the 5E Learning Model and its uses. This investigation was carried out using a quantitative approach with a survey method. A total of 61 pre-service teachers who were 3rd and 4th year students of Universiti Teknologi Malaysia who had undergone teaching training in school were selected as respondents using a purposive sampling method. A questionnaire with three main sections on respondent demographics, 5E Learning Model knowledge and 5E Learning Model application served as the research tool. Descriptive statistical analysis, which included mean and standard deviation, and inferential statistical analysis to test the relationship between variables using Spearman Rho' correlation. The analysis of this study's findings indicates that pre-service teachers are more likely to use the 5E Learning Model when teaching chemistry if they have a better understanding of it. In conclusion, most prospective teachers believe they will use this paradigm in their instruction. Therefore, extensive training and exposure to inquiry learning should be enhanced and strengthened in teacher training programs to ensure teacher competence in implementing student-centered teaching.

A CROSS-SECTIONAL STUDY ON PRE-SERVICE CHEMISTRY TEACHERS' READINESS TOWARD THE USE OF SIMULATION AND SIMULATION PRACTICES IN TEACHING CHEMISTRY

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Integrasi simulasi kimia dalam pengajaran di dalam kelas telah diiktiraf secara meluas sebagai satu pendekatan yang berkesan untuk menangani cabaran berterusan yang dihadapi oleh pelajar dalam memvisualisasikan konsep kimia yang abstrak dan sub-mikroskopik. Walau bagaimanapun, keberkesanan pengajaran berasaskan simulasi amat bergantung kepada kesediaan dan amalan pengajaran guru. Biarpun penekanan terhadap integrasi teknologi dalam pendidikan guru di Malaysia semakin meningkat, bukti empirikal yang terhad wujud mengenai kesediaan guru pelatih kimia terhadap penggunaan simulasi dan tahap amalan simulasi mereka, terutamanya dalam konteks sebuah universiti tunggal. Oleh itu, kajian ini memeriksa: (i) tahap kesediaan guru pelatih kimia terhadap penggunaan simulasi dalam pengajaran kimia; (ii) tahap amalan simulasi dalam kalangan guru pelatih kimia; (iii) hubungan antara kesediaan dengan amalan simulasi; dan (iv) perbezaan kesediaan antara guru pelatih kimia Tahun 3 dan Tahun 4. Pendekatan kuantitatif dengan reka bentuk tinjauan keratan rentas telah diguna pakai. Dengan menggunakan persampelan bancian, seramai 59 orang guru pelatih kimia (Tahun 3: n = 32; Tahun 4: n = 27) dari satu universiti awam di Malaysia telah mengambil bahagian dalam kajian ini. Satu soal selidik dalam talian kendiri yang mengukur tiga konstruk kesediaan (Penerimaan Simulasi, Kecekapan Simulasi, dan Kawalan Simulasi) serta tiga konstruk amalan simulasi (Kekerapan dan Penggunaan Biasa, Pelaksanaan dalam Kelas, dan Tindakan Susulan Selepas Penggunaan Simulasi) telah digunakan sebagai instrumen kajian. Data dianalisis menggunakan statistik deskriptif (median dan taburan kekerapan), korelasi pangkat-tertib Spearman, dan ujian U Mann-Whitney melalui IBM SPSS. Penemuan kajian mendedahkan bahawa guru pelatih kimia menunjukkan tahap kesediaan keseluruhan yang Sangat Bersedia (Mdn = 4.00), dengan Penerimaan Simulasi mencatatkan skor tertinggi manakala Kawalan Simulasi merupakan dimensi yang agak lemah. Tahap keseluruhan amalan simulasi pula berada pada tahap Kerap (Mdn = 3.25), dengan Pelaksanaan dalam Kelas Semasa Penggunaan Simulasi mencatatkan tahap amalan yang lebih tinggi (Sangat Kerap) berbanding Kekerapan dan Penggunaan Biasa (Kerap). Hubungan positif sederhana yang signifikan telah ditemui antara kesediaan keseluruhan dengan amalan simulasi keseluruhan ($\rho = .461$, $p < .001$), yang menunjukkan bahawa guru pelatih dengan kesediaan yang lebih tinggi cenderung memamerkan amalan simulasi yang lebih hebat. Walau bagaimanapun, tiada perbezaan yang signifikan secara statistik ditemui antara guru pelatih kimia Tahun 3 dan Tahun 4 dalam kesediaan keseluruhan mereka ($U = 348.500$, $Z = -1.418$, $p = .156$), sekali gus mencadangkan bahawa kemajuan program semata-mata tidak membezakan tahap kesediaan antara kedua-dua kohort tersebut. Penemuan ini menekankan kepentingan membangunkan pengalaman berstruktur dan berorientasikan amalan dalam program pendidikan guru bagi memperkukuh kawalan simulasi guru pelatih kimia serta meningkatkan konsistensi penggunaan simulasi merentasi konteks pembelajaran. Implikasinya, kesediaan individu perlu digandingkan dengan sokongan institusi dan infrastruktur bagi memastikan penerapan yang konsisten di dalam bilik darjah. Kajian pada masa hadapan harus memperluas sampel merentasi pelbagai institusi dan menggunakan kaedah campuran longitudinal untuk menjejaki perkembangan pedagogi jangka panjang.

The integration of chemistry simulations in classroom instruction has been widely recognised as an effective approach to address the persistent challenges students face in visualising abstract and sub-microscopic chemistry concepts. However, the effectiveness of simulation-

based instruction is highly dependent on teachers' readiness and instructional practices. Despite the growing emphasis on technology integration in Malaysian teacher education, limited empirical evidence exists regarding pre-service chemistry teachers' readiness towards simulation use and the extent of their simulation practices, particularly within a single university context. Therefore, this study examined: (i) the level of pre-service chemistry teachers' readiness towards the use of simulation in teaching chemistry; (ii) the extent of simulation practices among pre-service chemistry teachers; (iii) the relationship between readiness and simulation practices; and (iv) the difference in readiness between Year 3 and Year 4 pre-service chemistry teachers. A quantitative approach with a cross-sectional survey design was adopted. Using census sampling, a total of 59 pre-service chemistry teachers (Year 3: n = 32; Year 4: n = 27) from a public university in Malaysia participated in this study. A self-administered online questionnaire measuring three readiness constructs (Simulation Acceptance, Simulation Competence, and Simulation Control) and three simulation practice constructs (Frequency and Regular Use, Classroom Implementation, and Follow-up After Simulation Use) was used as the research instrument. Data were analysed using descriptive statistics (median and frequency distribution), Spearman rank-order correlation, and Mann-Whitney U test via IBM SPSS. The findings revealed that the pre-service chemistry teachers demonstrated a Highly Ready level of overall readiness (Mdn = 4.00), with Simulation Acceptance recording the strongest scores and Simulation Control being the relatively weakest dimension. The overall extent of simulation practices was at an Often level (Mdn = 3.25), with Classroom Implementation During Simulation Use recording a higher practice level (Very Often) compared to Frequency and Regular Use (Often). A significant moderate positive relationship was found between overall readiness and overall simulation practices ($\rho = .461$, $p < .001$), indicating that pre-service teachers with higher readiness tended to demonstrate greater simulation practices. However, no statistically significant difference was found between Year 3 and Year 4 pre-service chemistry teachers in their overall readiness ($U = 348.500$, $Z = -1.418$, $p = .156$), suggesting that programme progression alone does not differentiate readiness levels between the two cohorts. These findings highlight the importance of developing structured, practice-oriented experiences within teacher education programmes to strengthen pre-service chemistry teachers' simulation control and increase the consistency of simulation use across lesson contexts. Implicatively, individual readiness must be paired with institutional and infrastructural support to ensure consistent classroom adoption. Future research should expand the sample across multiple institutions and employ longitudinal mixed methods to track long-term pedagogical growth.

SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA TEKNOLOGI DENGAN PENDIDIKAN (KEJURUTERAAN ELEKTRIK DAN ELEKTRONIK) DENGAN KEPUJIAN
[SHPEH]

TAHAP KESEDIAAN PELAJAR KOLEJ VOKASIONAL BERDASARKAN KONSEP KENDIRI VOKASIONAL BAGI MELANJUTKAN PENGAJIAN KE UNIVERSITI AWAM DI MALAYSIA

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Kesediaan pelajar Kolej Vokasional untuk melanjutkan pengajian ke Universiti Awam merupakan salah satu aspek penting dalam usaha memperkasakan laluan pendidikan dan pembangunan modal insan TVET di Malaysia. Namun begitu, tahap kesediaan pelajar untuk menyambung pengajian ke peringkat yang lebih tinggi sering dipengaruhi oleh pelbagai faktor psikologi dan vokasional. Sehubungan itu, kajian ini dijalankan bagi mengenal pasti tahap konsep kendiri vokasional pelajar Diploma Teknologi Elektronik Kolej Vokasional berdasarkan tiga konstruk utama iaitu minat terhadap vokasional, kebolehan vokasional dan konsep kendiri, serta mengenal pasti tahap kesediaan mereka untuk melanjutkan pengajian ke Universiti Awam. Kajian ini juga bertujuan menentukan hubungan antara konsep kendiri vokasional dengan kesediaan pelajar untuk melanjutkan pengajian ke Universiti Awam. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan dengan melibatkan seramai 85 orang pelajar Diploma Teknologi Elektronik dari Kolej Vokasional sebagai sampel kajian. Instrumen kajian yang digunakan ialah soal selidik yang dibangunkan berdasarkan objektif kajian dan dianalisis menggunakan perisian IBM SPSS Statistics. Analisis data melibatkan statistik deskriptif yang merangkumi min dan sisihan piawai serta analisis Korelasi Pearson bagi menguji hubungan antara pemboleh ubah. Dapatan kajian menunjukkan bahawa tahap minat terhadap vokasional (M = 3.42, SP = 0.57), kebolehan vokasional (M = 3.21, SP = 0.61), konsep kendiri (M = 3.33, SP= 0.61) dan kesediaan melanjutkan pengajian ke Universiti Awam (M = 3.21, SP = 0.72) berada pada tahap tinggi. Analisis Korelasi Pearson pula menunjukkan terdapat hubungan positif yang signifikan antara minat terhadap vokasional ($r = 0.516$, $p < 0.001$), kebolehan vokasional ($r = 0.588$, $p < 0.001$) dan konsep kendiri ($r= 0.615$, $p < 0.001$) dengan kesediaan melanjutkan pengajian ke Universiti Awam. Dapatan ini menunjukkan bahawa konsep kendiri vokasional memainkan peranan penting dalam meningkatkan kesediaan pelajar untuk meneruskan pengajian ke peringkat yang lebih tinggi. Kajian ini diharapkan dapat membantu pihak Kolej Vokasional, institusi pengajian tinggi dan Kementerian Pendidikan Malaysia dalam merancang program pembangunan pelajar yang lebih berkesan bagi meningkatkan kesediaan pelajar TVET untuk melanjutkan pengajian ke Universiti Awam.

The readiness of Vocational College students to pursue higher education at Public Universities is an important aspect in strengthening the Technical and Vocational Education and Training (TVET) pathway and developing high-quality human capital in Malaysia. However, students' readiness to further their studies is often influenced by various psychological and vocational factors. Therefore, this study was conducted to determine the level of vocational self-concept among Diploma in Electronic Technology students at Vocational Colleges based on three main constructs, namely vocational interest, vocational ability, and self-concept, as well as to identify their level of readiness to pursue higher education at Public Universities. In addition, this study aimed to examine the relationship between vocational self-concept and students' readiness to continue their studies at Public Universities. A quantitative research approach using a survey design was employed, involving 85 Diploma in Electronic Technology students from Vocational Colleges as the research sample. Data were collected using a questionnaire developed based on the research objectives and analysed using IBM SPSS Statistics software. Descriptive statistics, including mean and standard deviation, were used to analyse the data, while Pearson Correlation

analysis was employed to examine the relationships among the variables. The findings revealed that the levels of vocational interest (M = 3.42, SD= 0.57), vocational ability (M = 3.21, SD = 0.61), self-concept (M = 3.33, SD = 0.61), and readiness to pursue higher education at Public Universities (M = 3.21, SD = 0.72) were all at a high level. Pearson Correlation analysis further indicated significant positive relationships between vocational interest (r = 0.516, p < 0.001), vocational ability (r = 0.588, p < 0.001), and self-concept (r = 0.615, p < 0.001) with students' readiness to pursue higher education at Public Universities. These findings suggest that vocational self-concept plays a significant role in enhancing students' readiness to continue their studies at the tertiary level. It is hoped that the findings of this study will assist Vocational Colleges, higher education institutions, and the Ministry of Education Malaysia in planning more effective student development programmes to enhance TVET students' readiness to pursue higher education at public universities.

TAHAP KESEDIAAN BAKAL GURU TVET (ELEKTRIK DAN ELEKTRONIK) DI UTM DALAM MENGINTEGRASIKAN TEKNOLOGI KECERDASAN BUATAN (AI) KE DALAM PENGAJARAN TEORI

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Seiring dengan kemajuan pesat Kecerdasan Buatan (AI) dalam institusi pendidikan, wujud kebimbangan mengenai isu pendedahan, kemahiran digital, dan tahap kesediaan bakal guru Pendidikan dan Latihan Teknikal dan Vokasional (TVET) untuk mengintegrasikan teknologi ini ke dalam bilik darjah secara berkesan. Oleh itu, kajian ini bertujuan untuk menilai tahap kesediaan teknologi, pedagogi, dan sikap bakal guru TVET dalam bidang Elektrik dan Elektronik (E&E) di Universiti Teknologi Malaysia (UTM) terhadap pengintegrasian AI dalam pengajaran teori. Penilaian ini sangat penting bagi menyediakan asas bukti empirikal untuk menambah baik modul latihan perguruan, kurikulum, serta sistem sokongan institusi agar selari dengan keperluan pendidikan Revolusi Industri 4.0 (IR4.0). Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan, melibatkan sampel seramai 45 orang pelajar prasiswazah dari Tahun 1 hingga Tahun 4 dalam program Sarjana Muda Teknologi Dengan Pendidikan (Kejuruteraan Elektrik dan Elektronik). Proses pengumpulan data dilaksanakan melalui soal selidik berstruktur 30 item yang dibangunkan berasaskan Model Penerimaan Teknologi (TAM) dan kerangka Pengetahuan Kandungan Pedagogi Teknologi (TPACK), dan kemudiannya dianalisis secara deskriptif menggunakan perisian SPSS. Hasil kajian mendapati tahap kesediaan responden berada pada tahap yang tinggi merangkumi dimensi kesediaan teknologi, pedagogi, dan sikap. Kesimpulannya, kajian ini berjaya merapatkan jurang literatur dengan membuktikan bahawa bakal guru E&E di UTM secara holistiknya telah bersedia, bermotivasi, dan kompeten untuk menyerap amalan digital moden ini. Implikasi praktikal daripada dapatan ini mencadangkan agar pihak pengurusan akademik universiti memformalkan topik aplikasi AI dalam reka bentuk kurikulum dan silabus latihan mengajar bagi memastikan kualiti graduan kekal relevan dengan tuntutan serta dinamika industri semasa.

In tandem with the rapid advancement of Artificial Intelligence (AI) in educational institutions, concerns exist regarding the lack of exposure, digital skills, and overall readiness of Technical and Vocational Education and Training (TVET) preservice teachers to effectively integrate this technology into the classroom. Therefore, this study aims to evaluate

the technological, pedagogical, and attitude readiness levels of TVET preservice teachers in the Electrical and Electronics (E&E) field at Universiti Teknologi Malaysia (UTM) toward the integration of AI in theoretical teaching. This evaluation is crucial to provide an empirical basis for improving teacher training modules, curricula, and institutional support systems to align with the educational demands of the Fourth Industrial Revolution (IR4.0). The study employed a quantitative survey approach, involving a sample of 45 undergraduate students from Year 1 to Year 4 in the Bachelor of Technology with Education (Electrical and Electronics Engineering) program. The data collection process was conducted using a 30-item structured questionnaire developed based on the Technology Acceptance Model (TAM) and the Technological Pedagogical Content Knowledge (TPACK) framework, which was then analyzed descriptively using SPSS software. The findings revealed that the respondents' readiness is at a high level across the dimensions of technology, pedagogy, and attitude. In conclusion, this study successfully bridges the literature gap by proving that E&E preservice teachers at UTM are holistically ready, motivated, and competent to assimilate these modern digital practices. The practical implications of these findings suggest that the university's academic management should formalize AI application topics within the curriculum design and teaching practicum syllabus to ensure graduates remain relevant to current industrial dynamics and demands.

KEMAHIRAN GENERIK BAGI PELAJAR TVET TERHADAP PENGGUNAAN KECERDASAN BUATAN (AI) CHATGPT BAGI KURSUS PENGATURCARAAN DI UNIVERSITI TEKNOLOGI MALAYSIA (UTM)

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Tujuan kajian ini adalah untuk mengenal pasti tahap kemahiran generik bagi pelajar TVET terhadap penggunaan kecerdasan buatan (AI) ChatGPT bagi kursus pengaturcaraan di UTM. Berdasarkan malaysian qualifications framework MQF 2.0 dan maklumat kursus (CI) kursus pengaturcaraan yang ditawarkan di UTM, kemahiran generik yang telah dipilih dan dianalisis adalah merangkumi kemahiran personal, komunikasi serta kemahiran kepimpinan, autonomi dan kebertanggungjawaban. Kajian ini menggunakan reka bentuk kajian tinjauan dengan pendekatan kuantitatif deskriptif. Instrumen kajian ialah soal selidik berstruktur menggunakan skala likert lima mata yang dibangunkan berdasarkan kemahiran generik yang telah dipilih. Responden kajian terdiri daripada pelajar TVET tahun 2, 3 dan 4 di Fakulti Sains Pendidikan Dan Teknologi (FEST) yang mengikuti kursus pengaturcaraan. Pemilihan responden dilakukan menggunakan teknik persampelan rawak mudah. Data yang dikumpulkan dianalisis menggunakan perisian Statistical Package for The Social Sciences (SPSS) melalui analisis statistik deskriptif yang melibatkan min dan sisihan piawai. Kebolehpercayaan instrumen pula ditentukan menggunakan pekali alpha cronbach. Dapatan kajian ini diharapkan dapat memberikan gambaran yang jelas tentang tahap kemahiran generik pelajar TVET dalam penggunaan AI serta membantu dalam pembangunan kaedah pengajaran dan pembelajaran berasaskan AI yang seimbang, beretika dan berkesan. Selain itu, kajian ini juga dijangka dapat membantu pihak universiti dalam menggubal polisi serta membangunkan modul penggunaan AI bagi memastikan penghasilan graduan TVET yang berdaya saing dan memenuhi keperluan industri.

The purpose of this study is to identify the level of generic skills of TVET students regarding the use of the Artificial Intelligence (AI) tool, ChatGPT, in programming courses at UTM. Based on the Malaysian Qualifications Framework (MQF 2.0) and the Course Information (CI) for programming courses offered at UTM, the selected and analysed generic skills encompass personal skills, communication skills, as well as leadership, autonomy, and responsibility skills. This study employs a survey research design with a quantitative descriptive approach. The research instrument consists of a structured questionnaire utilizing a five-point Likert scale, which was developed based on the selected generic skills. The respondents of the study comprise Year 2, 3, and 4 TVET students at the Faculty of Education and Technology Sciences (FEST) who are enrolled in programming courses. The selection of respondents was conducted using the simple random sampling technique. The collected data were analysed using the Statistical Package for the Social Sciences (SPSS) software through descriptive statistical analysis, which involved the mean and standard deviation. Meanwhile, the reliability of the instrument was determined using Cronbach's alpha coefficient. The findings of this study are expected to provide a clear overview of the level of generic skills among TVET students in using AI, as well as to assist in the development of balanced, ethical, and effective AI-based teaching and learning methods. Furthermore, this study is anticipated to assist the university in formulating policies and developing AI utilization modules to ensure the production of TVET graduates who are competitive and meet industry demands.

TAHAP KOMPETENSI ASAS DALAM KALANGAN PELAJAR LULUSAN KOLEJ VOKASIONAL BAGI PROGRAM TEKNOLOGI DENGAN PENDIDIKAN DI UTM

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Transisi pelajar lulusan Kolej Vokasional (KV) ke peringkat institusi pengajian tinggi sering kali mencabar keupayaan mereka dalam mengimbangi kemahiran psikomotor amali dengan tuntutan kognitif akademik yang rigid. Kajian ini bertujuan untuk mengenal pasti tahap kompetensi asas yang merangkumi tiga konstruk utama, iaitu literasi akademik, numerasi teknikal, dan kemahiran pemikiran kritikal dalam kalangan pelajar lulusan KV yang mengikuti Program Sarjana Muda Teknologi Serta Pendidikan (Pendidikan Mekanikal, Elektrik dan Elektronik, serta Awam) di Universiti Teknologi Malaysia (UTM). Kepentingan praktikal dan akademik kajian ini terletak pada usahanya untuk memetakan kesediaan kognitif sebenar pelajar aliran vokasional demi membantu pihak universiti merancang sokongan akademik yang bersasar serta merapatkan jurang antara kurikulum kolej vokasional dan pendidikan arus perdana. Dari segi metodologi, penyelidikan kuantitatif ini menggunakan reka bentuk tinjauan deskriptif melalui instrumen soal selidik digital. Seramai 31 orang responden daripada Tahun 1 hingga Tahun 4 telah dipilih menggunakan kaedah persampelan keseluruhan populasi. Fasa kajian rintis pula melibatkan 10 orang pelajar dengan nilai pekali Alpha Cronbach bagi ketekalan dalaman yang tinggi iaitu 0.873. Data mentah dianalisis menggunakan perisian SPSS versi 31.0 bagi mendapatkan nilai kekerapan, peratusan, skor min, dan sisihan piawai. Dapatan kajian menunjukkan bahawa purata skor min bagi keseluruhan konstruk berada pada tahap yang tinggi (M = 4.07, SP = 0.802). Secara khusus, tahap pemikiran kritikal mencatatkan purata skor min tertinggi (M = 4.38, SP = 0.632, Tahap Tinggi), diikuti oleh tahap kompetensi literasi akademik yang juga berada pada tahap tinggi (M = 4.34, SP = 0.693). Sebaliknya, tahap kompetensi numerasi teknikal mencatatkan purata skor min yang lebih rendah dan berada pada kategori tahap sederhana (M = 3.95, SP = 0.882). Sebagai kesimpulan, kajian ini memberikan sumbangan penting kepada korpus ilmu dengan mengisi lompang pengetahuan serta menyediakan bukti empirikal baharu yang menyangkal stereotaip kognitif tradisional yang sering menggambarkan pelajar vokasional lemah dalam penguasaan teori. Implikasi praktikal daripada dapatan kajian ini mengarah kepada keperluan mendesak bagi pihak fakulti untuk melaksanakan program pemantapan matematik khusus seperti bengkel asas kalkulus serta bengkel penulisan ilmiah secara berkala bagi mengecilkan jurang aplikasi teori abstrak dan mengurangkan tekanan beban kerja kognitif pelajar sepanjang fasa transisi akademik mereka di universiti penyelidikan.

The transition of Vocational College (KV) graduates into higher education institutions frequently challenges their capability to balance practical psychomotor skills with rigid academic cognitive demands. This study aims to identify the levels of basic competencies, comprising three main constructs: academic literacy, technical numeracy, and critical thinking skills, among KV graduates enrolled in the Bachelor of Technology with Education program (Mechanical, Electrical and Electronics, and Civil Education) at Universiti Teknologi Malaysia (UTM). The academic and practical importance of this study lies in its effort to map the actual cognitive readiness of vocational stream students to help universities design targeted academic support and bridge the gap between vocational education and mainstream higher education. In terms of methodology, this quantitative research adopted a descriptive survey design using a digital questionnaire. A total of 31 respondents from Year 1 to Year 4 were selected using the total population sampling technique. The pilot study phase involved 10 students, yielding a high Cronbach's Alpha internal consistency value of 0.873. The raw data were descriptively analyzed using SPSS version 31.0 to obtain frequencies,

percentages, mean scores, and standard deviations. The findings revealed that the overall cumulative mean score for all constructs was at a high level (M = 4.07, SD = 0.802). Specifically, the critical thinking level recorded the highest mean score (M = 4.38, SD = 0.632, High Level), followed closely by the academic literacy competency level, which was also high (M = 4.34, SD = 0.693). Conversely, the technical numeracy competency level recorded a lower score, falling into the moderate level category (M = 3.95, SD = 0.882). In conclusion, this study significantly contributes to the body of knowledge by filling literature gaps and providing new empirical evidence that refutes traditional cognitive stereotypes against vocational graduates, who are often mischaracterized as theoretically weak. The practical implications of these findings highlight an urgent need for the faculty to implement specialized mathematics empowerment programs, such as basic calculus workshops, alongside periodic academic writing sessions to narrow the abstract theory application gap and alleviate students' cognitive workload stress during their academic transition phase at a research university.

PEMBANGUNAN PANDUAN DAN HELAIAN KERJA BAGI KURSUS AMALI KAWALAN MOTOR DI BAWAH PROGRAM FEST UNIVERSITI TEKNOLOGI MALAYSIA

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Kursus Kawalan Motor Elektrik merupakan komponen teras dalam pendidikan teknikal yang menuntut pelajar menguasai kemahiran menterjemah litar skematik kepada pendawaian fizikal yang berfungsi. Walau bagaimanapun, permasalahan utama yang dihadapi oleh pelajar adalah kesukaran untuk memvisualisasikan sambungan komponen sebenar, yang mengakibatkan kegagalan litar dan risiko keselamatan. Justeru, kajian pembangunan ini dijalankan bertujuan untuk membangunkan dan menilai tahap kesahan kandungan dokumen Panduan dan Helaian Kerja Bagi Kursus Amali Kawalan Motor Elektrik di Universiti Teknologi Malaysia (UTM). Reka bentuk kajian ini menggunakan pendekatan penyelidikan pembangunan (developmental research) kuantitatif deskriptif yang mengadaptasi Model Pembinaan Modul Sidek (2005). Pembangunan lembaran kerja bertulis ini didasari oleh Teori Konstruktivisme dan Taksonomi Psikomotor Simpson bagi memastikan langkah kerja disusun secara sistematik. Penilaian kesahan kandungan produk telah dilaksanakan oleh tiga (3) orang panel pakar yang terdiri daripada tenaga pengajar dan ahli akademik berpengalaman dalam bidang Kejuruteraan Elektrik dan TVET. Data kuantitatif diperoleh menggunakan instrumen borang soal selidik berskala Likert 5 mata dan diproses menggunakan hamparan elektronik Microsoft Excel untuk mendapatkan nilai skor min keseluruhan bagi enam konstruk penilaian. Hasil dapatan kajian menunjukkan bahawa purata skor min keseluruhan bagi kesahan kandungan lembaran kerja amali berada pada tahap "Tinggi" (Min = 4.00). Kesimpulannya, dokumen Lembaran Kerja Amali Litar dan Panduan Kit yang dihasilkan mempunyai kualiti kesahan kandungan yang mantap, holistik, serta bersedia sepenuhnya untuk diintegrasikan sebagai bahan bantu mengajar bertulis yang relevan bagi memperkasakan penguasaan domain psikomotor pelajar di institusi pengajian tinggi.

Electric Motor Control course is a core component in technical education that requires students to master the skill of translating schematic circuits into functional physical wiring. However, the main problem faced by students is the difficulty in visualizing actual component connections, which results in circuit failures and safety risks. Therefore, this developmental study was conducted to develop and evaluate the content validity of the Practical Circuit Worksheet and Kit Guide document for the Electric Motor Control course at Universiti Teknologi Malaysia (UTM). The research design employed a quantitative descriptive developmental research approach, adapting Sidek's Module Development Model (2005). The development of this written worksheet was underpinned by Constructivism Theory and Simpson's Psychomotor Taxonomy to ensure that the work steps were systematically arranged. The product's content validity evaluation was evaluated by three (3) expert panels consisting of experienced instructors and academics in the field of Electrical Engineering and TVET. Quantitative data were gathered using a 5-point Likert scale questionnaire instrument and processed using Microsoft Excel electronic spreadsheet to determine the overall mean scores for six evaluation constructs. The research findings indicated that the overall mean score for the practical worksheet's content validity was at a "High" level (Mean = 4.00). In conclusion, the developed Practical Circuit Worksheet and Kit Guide document possesses a robust and holistic quality of content validity, making it fully ready to be integrated as a relevant written teaching aid to enhance students' psychomotor domain mastery in higher education institutions.

PERSEPSI KEBERKESANAN LATIHAN INDUSTRI TERHADAP PENINGKATAN

KEMAHIRAN TEKNIKAL PELAJAR

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Latihan Industri merupakan komponen wajib dalam kurikulum Pendidikan Teknikal dan Vokasional (TVET) yang bertujuan mendedahkan pelajar kepada persekitaran kerja sebenar serta meningkatkan kompetensi teknikal. Walau bagaimanapun, timbul isu mengenai ketidaksepadanan skop tugasan dan kurangnya pendedahan praktikal yang menyebabkan objektif latihan tidak tercapai sepenuhnya. Justeru, kajian ini dijalankan untuk mengenal pasti persepsi pelajar Tahun 4 Sarjana Muda dalam bidang TVET di Universiti Teknologi Malaysia terhadap keberkesanan latihan industri dalam meningkatkan kemahiran teknikal mereka. Kajian ini memfokuskan kepada tiga objektif utama iaitu mengenal pasti tahap peningkatan kemahiran teknikal, kesesuaian skop tugasan yang diberikan, serta peranan penyelia industri dalam membimbing pelajar. Kajian ini berbentuk tinjauan deskriptif dengan menggunakan pendekatan kuantitatif. Instrumen kajian adalah set borang soal selidik yang diedarkan secara atas talian kepada 48 orang responden yang terdiri daripada pelajar tahun akhir, UTM. Data yang diperolehi dianalisis menggunakan perisian Statistical Package for Social Science untuk mendapatkan nilai kekerapan, peratusan, dan min. Dapatan kajian menunjukkan bahawa tahap peningkatan kemahiran teknikal pelajar berada pada tahap Tinggi. Selain itu, kajian mendapati bahawa skop tugasan yang diberikan oleh pihak industri adalah sesuai dengan bidang pengajian pelajar. Hasil analisis juga menunjukkan bahawa penyelia industri memainkan peranan yang signifikan dalam proses pemindahan kemahiran. Kesimpulannya, latihan industri memberi impak positif terhadap kemahiran teknikal bakal guru TVET, namun penambahbaikan dari aspek penyeliaan dan penyusunan skop kerja perlu dipertingkatkan agar graduan yang dihasilkan lebih kompeten dan bersedia menghadapi cabaran kerjaya.

Industrial Training is a compulsory component in the Technical and Vocational Education and Training (TVET) curriculum, aimed at exposing students to the real working environment and enhancing technical competencies. However, issues regarding the mismatch of task scopes and lack of practical exposure have arisen, causing the training objectives to be partially unfulfilled. Therefore, this study was conducted to identify the perception of Year 4 students at Universiti Teknologi Malaysia regarding the effectiveness of industrial training in enhancing their technical skills. This study focuses on three main objectives: identifying the level of technical skill improvement, the suitability of the task scope given, and the role of the industry supervisor in guiding the students. This study employs a descriptive survey design with a quantitative approach. The research instrument is a set of questionnaires distributed online to 48 respondents consisting of final-year, UTM. The data obtained were analyzed using the Statistical Package for Social Science (SPSS) software to obtain frequency, percentage, and mean values. The findings show that the level of technical skill improvement among students is at a High level. Additionally, the study found that the task scope provided by the industry is suitable with the students' field of study. The analysis also indicates that industry supervisors play a significant role in the skill transfer process. In conclusion, industrial training has a positive impact on the technical skills of future TVET teachers; however, improvements in supervision and work scope arrangement need to be enhanced to produce more competent graduates ready to face career challenges.

PEMBANGUNAN MODUL KAWALAN MOTOR BAGI PELAJAR PROGRAM IJAZAH SARJANA MUDA TEKNOLOGI DENGAN PENDIDIKAN (KEJURUTERAAN ELEKTRIK DAN ELEKTRONIK) DENGAN KEPUJIAN DI UNIVERSITI TEKNOLOGI MALAYSIA (UTM)

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Kajian ini bertujuan untuk membangunkan dan menilai Modul Kawalan Motor bagi pelajar bidang elektrik dalam konteks Pendidikan dan Latihan Teknikal dan Vokasional (TVET). Pembangunan modul ini berasaskan Model Reka Bentuk Instruksional SIDEK yang menekankan dua peringkat utama, iaitu proses penjanaan draf modul dan proses penilaian modul. Kandungan modul merangkumi konsep asas kawalan motor, komponen utama litar kawalan, prinsip operasi, simbol piawai serta contoh aplikasi industri yang selaras dengan Standard Kemahiran Pekerjaan Kebangsaan (NOSS) Jabatan Pembangunan Kemahiran. Reka bentuk kajian ini menggunakan pendekatan kuantitatif dengan sokongan kaedah kualitatif. Instrumen kajian terdiri daripada protokol temu bual berstruktur dan borang soal selidik berskala Likert empat mata. Kesahan kandungan modul dan instrumen telah dinilai oleh pakar dalam bidang teknologi elektrik dan TVET. Kajian rintis dijalankan bagi menentukan kebolehpercayaan instrumen menggunakan pekali Cronbach's Alpha. Data dianalisis secara deskriptif menggunakan nilai min dan sisihan piawai. Dapatan kajian menunjukkan bahawa Modul Kawalan Motor yang dibangunkan mempunyai tahap kesahan dan kebolehpercayaan yang baik serta berpotensi meningkatkan kefahaman, minat dan penglibatan pelajar dalam pembelajaran kawalan motor. Secara keseluruhannya, kajian ini diharapkan dapat menyumbang kepada pengukuhan bahan pengajaran berstruktur dan sistematik dalam pendidikan TVET.

This study aims to develop and evaluate a Motor Control Module for students in the field of electricity in the context of Technical and Vocational Education and Training (TVET). The development of this module is based on the SIDEK Instructional Design Model which emphasizes two main stages, namely the process of generating a module draft and the process of evaluating the module. The content of the module includes the basic concepts of motor control, the main components of the control circuit, operating principles, standard symbols and examples of industrial applications that are in line with the National Occupational Skills Standards (NOSS) of the Skills Development Department. This study design uses a quantitative approach with the support of qualitative methods. The study instrument consists of a structured interview protocol and a four-point Likert scale questionnaire. The validity of the module content and instruments was assessed by experts in the field of electrical technology and TVET. A pilot study was conducted to determine the reliability of the instrument using Cronbach's Alpha coefficient. The data was analyzed descriptively using mean values and standard deviations. The study findings show that the developed Motor Control Module has a good level of validity and reliability and has the potential to increase students' understanding, interest and involvement in learning motor control. Overall, this study is expected to contribute to strengthening structured and systematic teaching materials in TVET education.

PEMBANGUNAN BAHAN BANTU MENGAJAR MODUL ASAS TEKNOLOGI ELEKTRIK (CEA1113) DALAM KALANGAN PELAJAR TEKNOLOGI ELEKTRIK DI KOLEJ VOKASIONAL KOTA TINGGI

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Pelajar Pendidikan Teknikal dan Vokasional (TVET) sering menghadapi kekeliruan kognitif dalam menguasai konsep abstrak litar elektrik. Penyelidikan pembangunan ini dijalankan bertujuan mewujudkan Modul Asas Teknologi Elektrik bagi mata pelajaran CEA1113 menggunakan kerangka Model Pembangunan Modul Sidek. Pelajar Kolej Vokasional didapati sering bergelut memahami parameter voltan, arus, serta analisis litar, yang diburukkan lagi oleh kekangan akses guru terhadap bahan bantu mengajar (BBM) bercetak yang tersusun untuk Hukum Ohm dan Hukum Kirchhoff. Kajian ini dilaksanakan berpandukan tiga objektif utama: mengenal pasti keperluan, membangunkan modul pengajaran, dan menilai kesesuaian aspek kandungan, strategi, bahasa, serta reka bentuk melalui penilaian pakar. Mengikut Metodologi Model Sidek, kajian dibahagikan kepada Fasa Penyediaan Draf dan Fasa Penilaian Modul, yang memfokuskan nota padat, jadual berkod warna, latihan bertingkat, dan teknologi kod QR. Data kuantitatif dikumpul menerusi soal selidik digital 22 item skala Likert lima mata daripada tiga pakar Kolej Vokasional, lalu dianalisis menggunakan statistik deskriptif. Dapatan menunjukkan draf modul mencapai indeks kesahan kandungan cemerlang dengan purata skor min keseluruhan 4.85 dan persetujuan pakar sebanyak 96.97%. Kajian ini berjaya mengisi kekosongan literatur menerusi modul hibrid yang menyatukan Teori Beban Kognitif, Behaviorisme, dan Konstruktivisme. Rumusannya, modul ini terbukti mempunyai kesahan instruksional yang kukuh sebagai rujukan guru untuk memantapkan pengajaran dan pemudahcaraan (PdPC), sekali gus menjadi asas persediaan pelajar sebelum memasuki peringkat Diploma Vokasional Malaysia (DVM).

Technical and Vocational Education and Training (TVET) students frequently face cognitive difficulties in mastering abstract basic electrical circuit concepts. This developmental research aimed to create a Basic Electrical Technology Module for the CEA1113 course using the Sidek Module Development Model framework. Vocational College students often struggle with conceptual understanding of voltage, current, and circuit characteristics, a challenge worsened by limited teacher access to structured printed teaching aids for Ohm's and Kirchhoff's Laws. This study addressed these issues through three objectives: identifying development needs, developing the instructional module, and evaluating its suitability via expert appraisal. Following the Sidek Model, the process involved Draft Preparation and Module Evaluation phases. The development integrates concise theory notes, color-coded tables, tiered exercises, and QR codes. Quantitative data were gathered using a 22-item digital questionnaire on a five-point Likert scale, distributed to three Vocational College experts, and analyzed using descriptive statistics. Findings revealed that the draft module achieved an excellent content validity index, with an overall mean score of 4.85 and 96.97% expert agreement. This study bridges literature gaps by producing a hybrid technical module structurally integrating Cognitive Load Theory, Behaviorisme, and Constructivism. In conclusion, the module demonstrates robust instructional validity as a teacher reference to enhance vocational electrical teaching and learning (PdPC), serving as a crucial foundational preparation before students advance to the Malaysian Vocational Diploma (DVM) level.

TAHAP KESEDIAAN GURU PELATIH TERHADAP PELAKSANAAN PEMBELAJARAN BERASASKAN PROJEK (PJBL) DALAM PENDIDIKAN TVET

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Kajian ini bertujuan untuk mengenal pasti tahap kesediaan guru pelatih terhadap pelaksanaan Pembelajaran Berasaskan Projek (PjBL) dalam Pendidikan dan Latihan Teknikal dan Vokasional (TVET) dari aspek pengetahuan, kemahiran dan sikap. Selain itu, kajian ini juga bertujuan untuk menentukan sama ada terdapat perbezaan tahap kesediaan guru pelatih berdasarkan bidang pengkhususan. Kajian ini menggunakan reka bentuk tinjauan dengan pendekatan kuantitatif. Seramai 70 orang guru pelatih tahun empat dalam bidang Pendidikan TVET di Universiti Teknologi Malaysia (UTM) yang telah menjalani latihan mengajar dipilih sebagai responden melalui kaedah pensampelan rawak mudah. Data dikumpulkan menggunakan borang soal selidik dan dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui analisis deskriptif dan inferensi iaitu min, sisihan piawai, kebolehpercayaan (Alpha Cronbach), ujian homogeniti varians dan ANOVA satu hala. Hasil kajian menunjukkan bahawa tahap kesediaan guru pelatih terhadap pelaksanaan PjBL dalam pendidikan TVET berada pada tahap tinggi. Aspek sikap mencatatkan nilai min tertinggi iaitu (M=3.69), diikuti aspek kemahiran (M=3.63) dan aspek pengetahuan (M=3.52). Purata min keseluruhan tahap kesediaan adalah (M=3.61). Dapatan juga menunjukkan bahawa tidak terdapat perbezaan yang signifikan tahap kesediaan guru pelatih berdasarkan bidang pengkhususan dari aspek pengetahuan, kemahiran dan sikap. Kesimpulannya, guru pelatih dalam bidang TVET di UTM mempunyai tahap kesediaan yang tinggi untuk melaksanakan Pembelajaran Berasaskan Projek dalam proses pengajaran dan pembelajaran

This study aims to identify the level of trainee teachers' readiness toward the implementation of Project-Based Learning (PjBL) in Technical and Vocational Education and Training (TVET) in terms of knowledge, skills, and attitude. In addition, this study also aims to determine whether there are differences in trainee teachers' readiness based on their field of specialization. This study employed a quantitative approach using a survey research design. A total of 70 final-year TVET trainee teachers from Universiti Teknologi Malaysia (UTM) who had completed their teaching practicum were selected as respondents using simple random sampling. Data were collected using questionnaires and analysed using the Statistical Package for the Social Sciences (SPSS) software through descriptive and inferential analyses, namely mean, standard deviation, Cronbach's Alpha reliability test, test of homogeneity of variance, and one-way ANOVA. The findings show that the level of trainee teachers' readiness toward the implementation of PjBL in TVET education is high. The attitude dimension recorded the highest mean score (M=3.69), followed by skills (M=3.63) and knowledge (M=3.52). The overall mean score of readiness is (M=3.61). The results also indicate that there is no significant difference in trainee teachers' readiness based on their field of specialization in terms of knowledge, skills, and attitude. In conclusion, TVET trainee teachers at UTM demonstrate a high level of readiness to implement Project-Based Learning in teaching and learning processes.

PEMBANGUNAN ALAT BANTU MENGAJAR INTERAKTIF BAGI KURSUS PENGENALAN LITAR LOGIK DI KOLEJ VOKASIONAL ZON JOHOR

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Kajian ini dijalankan bagi membangunkan Alat Bantu Mengajar (ABM) interaktif untuk topik pengenalan kepada litar logik bagi pelajar Program Teknologi Elektronik di Kolej Vokasional Zon Johor. Kajian ini dilaksanakan berikutan dapatan kajian awalan yang melibatkan 9 orang pensyarah Teknologi Elektronik dan mendapati bahawa litar logik merupakan antara tiga topik yang paling sukar difahami oleh pelajar.Kesukaran ini berpunca daripada cabaran pelajar untuk memvisualisasikan operasi sebenar litar serta memahami fungsi hubungan antara gate logik seperti AND, OR dan NOT. Selain itu, pendekatan pengajaran yang lebih berfokuskan teori didapati kurang membantu pelajar menguasai konsep asas dengan berkesan. Oleh itu, terdapat keperluan untuk membangunkan ABM interaktif yang lebih visual, praktikal dan mampu menyokong pemahaman pelajar. Kajian ini menggunakan pendekatan reka bentuk dan pembangunan berasaskan Model ADDIE yang melibatkan lima fasa, iaitu Analisis, Reka Bentuk, Pembangunan, Pelaksanaan dan Penilaian. Kajian awal dijalankan melalui temu bual bersama guru bagi mengenal pasti keperluan pembangunan ABM, diikuti dengan pembangunan ABM interaktif litar logik berdasarkan dapatan yang diperoleh. Kajian tahap kefahaman pelajar pula melibatkan 90 orang pelajar tahun dua SVM dan tahun satu DVM daripada dua buah Kolej Vokasional di zon Johor melalui kaedah soal selidik. Data kualitatif dianalisis menggunakan analisis tematik, manakala data kuantitatif dianalisis secara deskriptif menggunakan min, peratusan dan sisihan piawai. Hasil kajian membuktikan ABM interaktif ini berjaya meningkatkan kefahaman konsep asas litar logik, meningkatkan motivasi, serta meningkatkan penglibatan aktif pelajar dalam kelas. ABM ini juga berfungsi sebagai bahan pengajaran praktikal yang membantu guru menyampaikan kandungan silibus secara sistematik. Impak kajian ini menyumbang kepada pendidikan TVET melalui pembangunan ABM yang mampu menyokong pembelajaran topik teknikal yang bersifat abstrak serta meningkatkan kualiti pengajaran dan pemudahcaraan di Kolej Vokasional.

This study was conducted to develop an interactive instructional aid (ABM) for the introductory topic of logic circuits, specifically tailored for Electronic Technology Program students in Vocational Colleges within the Johor zone. The study was initiated based on preliminary research findings involving nine Electronic Technology teachers, which revealed that logic circuits rank among the top three most difficult topics for students to comprehend. This difficulty stems from the challenge students face in visualizing actual circuit operations and understanding the functional relationships between basic logic gates such as AND, OR, and NOT. Furthermore, pedagogical approaches that overemphasize theory were found to be less effective in helping students master core concepts. Consequently, there is a crucial need to develop an interactive instructional aid that is highly visual, practical, and capable of supporting student comprehension. This study adopted a research and development approach based on the ADDIE Model, which encompasses five distinct phases: Analysis, Design, Development, Implementation, and Evaluation. A preliminary study was conducted through interviews with educators to identify the developmental needs of the instructional aid, followed by the fabrication of the interactive logic circuit kit based on the gathered data. The evaluation of student comprehension levels involved 90 students consisting of second-year Vocational School Certificate (SVM) and first year Vocational Diploma (DVM) cohorts from two Vocational Colleges in the Johor zone using a survey method. Qualitative data were analyzed using thematic analysis, whereas quantitative data were descriptively analyzed using mean, percentage, and standard deviation. The research findings demonstrate that the

developed interactive instructional aid successfully enhances core logic circuit comprehension, boosts motivation, and stimulates active classroom engagement. This tool serves as a practical resource that assists educators in delivering syllabus content systematically. Ultimately, this study contributes to TVET education by providing instructional media that simplifies abstract technical topics, thereby elevating the quality of teaching and learning facilitation in Vocational Colleges.

PERSEPSI GURU PELATIH TVET BIDANG ELEKTRIK DAN ELEKTRONIK TERHADAP PENGGUNAAN ALAT AI DALAM PENGAJARAN SIMULASI LATIHAN AMALI

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Kajian mengenai penggunaan Kecerdasan Buatan (AI) dalam pendidikan TVET semakin mendapat perhatian berikutan potensinya dalam meningkatkan keberkesanan pengajaran dan pembelajaran, khususnya dalam simulasi latihan amali bidang Elektrik dan Elektronik. Kajian ini bertujuan untuk mengenal pasti persepsi guru pelatih TVET terhadap penggunaan alat AI, menilai persepsi mereka terhadap kegunaan alat AI dalam meningkatkan pengetahuan amali, serta mengenal pasti persepsi terhadap kemudahan penggunaan alat AI dalam proses latihan amali. Kepentingan kajian ini adalah untuk menyediakan bukti empirikal yang dapat membantu institusi TVET, guru pelatih dan pihak berkepentingan merancang strategi integrasi AI yang lebih berkesan dalam pengajaran amali. Kajian ini menggunakan pendekatan kuantitatif melalui kaedah tinjauan menggunakan soal selidik yang diedarkan kepada guru pelatih bidang Pendidikan Kejuruteraan Elektrik dan Elektronik di Universiti Teknologi Malaysia (UTM). Analisis data dijalankan menggunakan statistik deskriptif bagi menentukan tahap persepsi responden terhadap penggunaan AI berdasarkan konstruk penggunaan AI, kegunaan (perceived usefulness) dan kemudahan penggunaan (perceived ease of use) yang diadaptasi daripada Model Penerimaan Teknologi (TAM). Dapatan kajian menunjukkan bahawa guru pelatih mempunyai persepsi yang positif terhadap penggunaan alat AI dalam pengajaran simulasi latihan amali serta menganggap alat AI sebagai teknologi yang berguna dan mudah digunakan dalam meningkatkan pengetahuan amali. Kesimpulannya, kajian ini menyumbang kepada pengisian jurang literatur berkaitan persepsi guru pelatih TVET terhadap penggunaan AI dalam konteks latihan amali bidang Elektrik dan Elektronik serta memberikan implikasi kepada pembangunan kurikulum, latihan profesional dan pelaksanaan teknologi AI dalam pendidikan TVET.

The application of Artificial Intelligence (AI) in TVET education has gained increasing attention due to its potential to enhance teaching and learning effectiveness, particularly in practical training simulation within the Electrical and Electronics field. This study aims to identify TVET trainee teachers' perceptions towards the use of AI tools, evaluate their perceptions regarding the usefulness of AI tools in enhancing practical knowledge, and determine their perceptions of the ease of use of AI tools in practical training processes. The significance of this study lies in providing empirical evidence that can assist TVET institutions, trainee teachers, and relevant stakeholders in developing more effective AI integration strategies for practical teaching. A quantitative research approach was employed using a survey questionnaire distributed to trainee teachers from the Bachelor of Electrical and Electronic Engineering Education programme at Universiti Teknologi Malaysia (UTM). Data were analysed using descriptive statistics to determine respondents' perception levels based on the constructs of AI usage, perceived usefulness, and perceived ease of use, which were adapted from the Technology Acceptance Model (TAM). The findings are indicate that trainee teachers possess positive perceptions towards the use of AI tools in practical training simulation teaching and perceive AI tools as useful and easy to use in enhancing practical knowledge. In conclusion, this study contributes to filling the literature gap regarding TVET trainee teachers' perceptions of AI usage in practical training within the Electrical and Electronics field and provides implications for curriculum development, professional training, and AI implementation in TVET education.

PEMBANGUNAN MODUL KESELAMATAN DI TEMPAT KERJA BAGI PELAJAR ELEKTRIK DI KOLEJ VOKASIONAL TANJUNG PUTERI

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Kajian ini bertujuan membangunkan Modul Keselamatan di Tempat Kerja bagi pelajar Elektrik di Kolej Vokasional Tanjung Puteri. Subjek Keselamatan di Tempat Kerja merupakan komponen penting dalam Pendidikan dan Latihan Teknikal dan Vokasional (TVET) kerana menekankan aspek keselamatan diri, pencegahan risiko, pematuhan prosedur kerja dan pembentukan budaya kerja selamat dalam persekitaran bengkel serta industri. Walau bagaimanapun, pelaksanaan pengajaran bagi kursus ini masih bergantung kepada bahan rujukan dan nota individu pensyarah yang tidak seragam, sekali gus berpotensi mewujudkan ketidakkonsistenan dalam penyampaian kandungan pembelajaran. Kajian ini dibangunkan berpandukan berpandukan Model Pembangunan Modul Sidek. Proses pembangunan modul melibatkan fasa penyediaan draf modul, pembangunan kandungan, penilaian kesahan kandungan dan penilaian kesesuaian modul. Bagi menilai modul yang dibangunkan, dua orang pakar dalam bidang pendidikan teknikal dan vokasional dilibatkan bagi menilai kesahan kandungannya, manakala pensyarah bidang Elektrik yang mengajar kursus Keselamatan di Tempat Kerja menilai kesesuaiannya sebagai bahan sokongan pengajaran. Borang Penilaian Kesahan Kandungan Modul dan Soal Selidik Kesesuaian Modul merupakan instrumen yang digunakan dalam kajian ini. Data dianalisis berdasarkan statistik deskriptif yang berbentuk peratusan. Dapatan kajian menunjukkan modul yang dibangunkam mempunyai tahap kesahan kandungan yang tinggi berdasarkan penilaian pakar. Penilaian kesesuaian modul oleh pensyarah turut menunjukkan tahap kesesuaian yang tinggi bagi aspek kandungan, reka bentuk, penggunaan bahasa, grafik, aktiviti pembelajaran dan latihan yang disediakan. Dapatan yang diperoleh memperlihatkan bahawa Modul Keselamatan di Tempat Kerja yang dibangunkan memenuhi keperluan untuk digunakan sebagai bahan sokongan pengajaran dalam pelaksanaan kursus Keselamatan di Tempat Kerja di Kolej Vokasional.Secara keseluruhannya, kajian ini berjaya menghasilkan sebuah modul yang sistematik, tersusun dan selaras dengan keperluan kurikulum TVET. Modul yang dibangunkan berpotensi membantu pensyarah melaksanakan pengajaran secara lebih konsisten serta menyokong penguasaan pengetahuan dan amalan keselamatan dalam kalangan pelajar Elektrik di Kolej Vokasional.

The purpose of this study was to develop and evaluate a Workplace Safety Module for Electrical students at Kolej Vokasional Tanjung Puteri. Workplace Safety is an important component of Technical and Vocational Education and Training (TVET) as it emphasizes personal safety, risk prevention, compliance with work procedures, and the development of a safe working culture in workshop and industrial environments. However, the teaching and learning process for this course still relies heavily on non-standardized reference materials and lecturers' personal notes, which may lead to inconsistencies in the delivery of learning content. This study inspired by a module development and evaluation research design guided by the Sidek Module Development Model. The development process encompassed the preparation of the module draft, content development, content validity assessment, and module suitability evaluation. To evaluate the developed module, two experts in Technical and Vocational Education and Training (TVET) were engaged to review its content validity, while Electrical lecturers teaching the Workplace Safety course assessed its suitability for instructional use. The research instruments consisted of a Module Content Validity Evaluation Form and a Module Suitability Questionnaire. Data collected from the evaluation process were analyzed using descriptive statistics in the form of percentages. The results

demonstrated that the module achieved a high level of content validity based on expert assessment.The module suitability evaluation conducted by lecturers also revealed a high level of suitability in terms of content, design, language usage, graphics, learning activities, and exercises provided in the module. The findings indicate that the developed module is suitable for use as a supporting teaching resource for the Workplace Safety course in vocational colleges. Overall, this study produced a systematic and well-organized module that is aligned with the requirements of the TVET curriculum. The module can serve as a reference for lecturers in planning and delivering instruction more consistently, while supporting the learning of workplace safety concepts among Electrical students in vocational colleges.

HUBUNGAN ANTARA LITERASI DIGITAL DENGAN KEYAKINAN MENGAJAR DALAM KALANGAN PELAJAR PENDIDIKAN TVET DI UNIVERSITI TEKNOLOGI MALAYSIA (UTM)

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Kajian ini dihasilkan bertujuan untuk mengkaji tahap literasi digital, tahap keyakinan mengajar serta hubungan antara kedua-dua tahap ini dalam kalangan pelaja pendidikan TVET di Universiti Teknologi Malaysia (UTM). Kajian ini menggunakan pendekatan campuran (mixed-method) dengan pendekatan kuantitatif sebagai kaedah utama di mana data dikumpulkan melalui soal selidik dengan 102 responden daripada tahun 3 dan tahun 4 pelajar pendidikan TVET Fakulti sains Pendidikan dan Teknologi (FEST), UTM manakala pendekatan kualitatif disertakan di hujung borang soal selidik bagi meneroka cabaran menggunakan teknologi dalam pengajaran, faktor peningkatan keyakinan mengajar melalui literasi digital dan kaedah untuk meningkatkan tahap literasi digital dan teknik persampelan selesa telah dipilih. Instrumen kajian yang melibatkan borang soal selidik atas talian dibina melalui aplikasi Google Forms adalah berdasarkan Digital Literacy Questionnaire dan Teacher Confidence Scale. Analisis data deskriptif dan inferens telah dilakukan menggunakan perisian SPSS seperti nilai frekuensi, peratusan, min, ujian normaliti, korelasi Spearman serta ujian regresi. Kajian ini akan memberikan sumbangan dalam mengembangkan literatur tempatan berkaitan kompetensi digital khusus bagi bakal guru TVET di Malaysia, mengisi jurang kajian lepas yang banyak tertumpu kepada bidang pendidikan umum atau guru dalam perkhidmatan. Diharapkan hasil kajian akan dapat memberi panduan kepada pembuat dasar dan fakulti pendidikan untuk merombak reka bentuk kurikulum serta strategi latihan dengan memberikan penekanan utama kepada Pembangunan kemahiran kandungan kreatif dan komunikasi digital bagi meningkatkan efikasi kendiri profesional bakal guru TVET. Secara kesimpulannya, usaha memperkasakan literasi digital secara berterusan adalah kritikal bagi melahirkan guru pelatih TVET yang kompeten, berdaya saing serta bersedia mendepani cabarab pendidikan abad ke 21 dan Revolusi Industri 4.0.

This study aims to examine the level of digital literacy, the level of teaching confidence and the relationship between these two variables among Technical and Vocational Education and Training (TVET) students at Universiti Teknologi Malaysia (UTM). This study employs a mixed-methods approach with the quantitative method serving as the primary design. Data were collected through questionnaires from 102 third-year and fourth-year TVET education students at the Faculty of Educational Sciences and Technology (FEST), UTM, using a convenience sampling technique. Concurrently, a qualitative approach was integrated at the end of the questionnaire to explore the challenges of utilizing technology in teaching, the

contributing factors to increased teaching confidence through digital literacy and methods to enhance digital literacy levels. The research instrument, comprising an online questionnaire developed using Google Forms, was adapted from the Digital Literacy Questionnaire and the Teacher Confidence Scale. Descriptive and inferential data analyses were conducted using SPSS software, involving frequency, percentage, mean, normality tests, Spearman correlation, and regression analysis. This study contributes to the development of local literature regarding digital competencies specifically for pre service TVET teachers in Malaysia, thereby addressing a research gap as previous studies have predominantly focused on general education or in-service teachers. It is anticipated that the findings will guide policymakers and education faculties in restructuring curriculum design and training strategies, placing a primary emphasis on developing creative content and digital communication skills to boost the professional self-efficacy of future TVET teachers. In conclusion, continuous efforts to empower digital literacy are critical to producing TVET teacher trainees who are competent, competitive, and fully prepared to navigate the challenges of 21st-century education and the Industrial Revolution 4.0.

SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA SAINS DENGAN PENDIDIKAN (FIZIK) DENGAN KEPUJIAN [SHPFH]

TAHAP KEFAHAMAN DAN MISKONSEPSI BAKAL GURU FIZIK TERHADAP KONSEP IMPULS DAN DAYA IMPULS

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Kajian ini bertujuan untuk mengenal pasti tahap kefahaman dan miskonsepsi bakal guru Fizik terhadap konsep Impuls dan Daya Impuls. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Seramai 42 orang bakal guru Fizik daripada program Ijazah Sarjana Muda Pendidikan (Fizik), Universiti Teknologi Malaysia yang mengikuti kohort kemasukan tahun 2024 dan 2025 telah dipilih sebagai responden melalui kaedah persampelan bertujuan. Instrumen yang digunakan dalam kajian ini ialah Four-Tier Diagnostic Test (FTDT) yang mengandungi 15 item berkaitan konsep Impuls dan Daya Impuls. Data kajian dianalisis menggunakan Statistical Package for the Social Sciences (SPSS) bagi menilai tahap kefahaman responden serta mengenal pasti jenis miskonsepsi yang wujud. Hasil kajian menunjukkan bahawa tahap kefahaman keseluruhan bakal guru terhadap konsep Impuls dan Daya Impuls berada pada tahap sederhana dengan peratusan sebanyak 66.3%. Dari aspek yang dikaji, Mentafsir Persamaan mencatatkan tahap kefahaman tertinggi iaitu 78.6%, diikuti oleh Aplikasi Dunia Sebenar (73.8%) dan Perubahan Momentum (64.9%), manakala aspek Interpretasi Graf Daya–Masa merekodkan tahap kefahaman paling rendah iaitu 26.2%. Analisis kategori respons FTDT mendapati bahawa kategori Faham merupakan kategori yang paling dominan, namun masih terdapat responden yang berada dalam kategori Miskonsepsi, Miskonsepsi Positif, Miskonsepsi Negatif dan Faham Sebahagian Konsep. Seterusnya, analisis jenis miskonsepsi menunjukkan bahawa Salah Faham Konseptual merupakan jenis miskonsepsi yang paling dominan dengan peratusan sebanyak 77.9%, diikuti oleh Miskonsepsi Faktual (12.3%) dan Pemahaman Konsep Awal (9.7%). Secara keseluruhannya, dapatan kajian menunjukkan bahawa walaupun bakal guru mempunyai kefahaman yang memuaskan terhadap konsep Impuls dan Daya Impuls, masih terdapat beberapa miskonsepsi yang memerlukan perhatian, khususnya yang berkaitan dengan hubungan antara impuls, daya, masa dan perubahan momentum. Dapatan kajian ini diharapkan dapat membantu pensyarah dan pendidik dalam merancang strategi pengajaran yang lebih berkesan untuk meningkatkan kefahaman konseptual bakal guru Fizik.

This study aimed to identify the level of understanding and misconceptions among pre-service Physics teachers regarding the concepts of Impulse and Impulsive Force. The study employed a quantitative approach using a survey research design. A total of 42 pre-service Physics teachers from the Bachelor of Education (Physics) programme at Universiti Teknologi Malaysia, enrolled in the 2024 and 2025 cohorts, were selected as respondents through purposive sampling. The instrument used in this study was the Four-Tier Diagnostic Test (FTDT), which consisted of 15 items related to the concepts of Impulse and Impulsive Force. The data were analysed using the Statistical Package for the Social Sciences (SPSS) to assess the respondents' level of understanding and identify the types of misconceptions present. The findings revealed that the overall level of understanding of the pre-service teachers regarding the concepts of Impulse and Impulsive Force was moderate, with a percentage of 66.3%. Among the aspects examined, Interpreting Equations recorded the highest level of understanding (78.6%), followed by Real-World Applications (73.8%) and Change in Momentum (64.9%), while Force–Time Graph Interpretation recorded the lowest level of understanding at 26.2%. Analysis of the FTDT response categories indicated that the Understanding category was the most dominant; however, some respondents were still classified under the Misconception, Positive Misconception, Negative Misconception, and Partial Understanding categories. Furthermore, the analysis of misconception types revealed

that Conceptual Misunderstanding was the most dominant type of misconception (77.9%), followed by Factual Misconception (12.3%) and Preconceived Notions (9.7%). Overall, the findings indicate that although the pre-service teachers demonstrated a satisfactory understanding of the concepts of Impulse and Impulsive Force, several misconceptions still require attention, particularly those related to the relationship between impulse, force, time, and change in momentum. It is hoped that the findings of this study will assist lecturers and educators in designing more effective instructional strategies to enhance the conceptual understanding of pre-service Physics teachers.

PEMBELAJARAN BERASASKAN SIMULASI TERHADAP PEMAHAMAN KONSEPTUAL MURID FIZIK TINGKATAN EMPAT DALAM TOPIK OPTIK

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Kajian ini dijalankan bagi mengkaji kesan pembelajaran berasaskan simulasi terhadap pemahaman konseptual murid Fizik Tingkatan Empat dalam topik Optik. Kajian ini dilaksanakan berikutan tahap pemahaman konseptual murid yang masih rendah dalam topik Optik disebabkan sifat konsep yang abstrak dan sukar divisualisasikan melalui pengajaran tradisional. Kajian imengni gunakan reka bentuk kuasi-eksperimen yang melibatkan satu kumpulan eksperimen dan satu kumpulan kawalan dalam ujian pra dan pasca. Seramai 47 orang murid Tingkatan Empat daripada sebuah sekolah menengah di Johor Bahru dipilih menggunakan persampelan mudah, dengan 23 orang murid dalam kumpulan eksperimen dan 24 orang murid dalam kumpulan kawalan. Kumpulan eksperimen mengikuti pembelajaran berasaskan simulasi menggunakan simulasi PhET manakala kumpulan kawalan mengikuti pembelajaran tradisional. Data dikumpul menggunakan Ujian Pemahaman Konseptual Optik dan dianalisis menggunakan statistik deskriptif serta ujian-t sampel berpasangan dan ujian-t sampel bebas. Dapatan menunjukkan skor min kumpulan eksperimen meningkat daripada 9.78 (SP = 3.44) kepada 15.09 (SP = 2.09), dengan perbezaan yang signifikan, $t(22) = -7.720$, $p < .001$ dan saiz kesan yang sangat besar ($d = 1.61$). Sebaliknya, kumpulan kawalan hanya menunjukkan peningkatan kecil daripada 8.83 (SP = 2.57) kepada 9.42 (SP = 1.72), yang tidak signifikan, $t(23) = -0.965$, $p = .345$. Perbandingan skor pasca ujian antara kedua-dua kumpulan turut menunjukkan perbezaan yang signifikan memihak kepada kumpulan eksperimen, $t(45) = 10.190$, $p < .001$ dengan saiz kesan yang sangat besar ($d = 2.97$). Kesimpulannya, pembelajaran berasaskan simulasi berkesan dalam meningkatkan pemahaman konseptual murid terhadap topik Optik berbanding kaedah pengajaran tradisional. Kajian ini mencadangkan penggunaan simulasi sebagai pendekatan pedagogi yang dapat menyokong pembelajaran konsep fizik yang abstrak dalam bilik darjah sekolah menengah.

This study was conducted to investigate the effects of simulation-based learning on the conceptual understanding of Form Four Physics students in the topic of Optics. The study was motivated by students' low level of conceptual understanding in Optics due to the abstract nature of the concepts and the difficulty of visualising them through conventional instruction. A quasi-experimental design involving an experimental group and a control group with pre-test and post-test measures was employed. A total of 47 Form Four students from a secondary school in Johor Bahru were selected through convenience sampling, comprising 23 students in the experimental group and 24 students in the control group. The experimental group received simulation-based instruction using PhET simulations, while the control group received traditional instruction. Data were collected using an Optics Conceptual

Understanding Test and analysed using descriptive statistics, paired-samples t-tests and independent-samples t-tests. The findings revealed that the mean score of the experimental group increased from 9.78 (SD = 3.44) to 15.09 (SD = 2.09), with a significant difference, t(22)= -7.720, p < .001 and a very large effect size (d = 1.61). In contrast, the control group showed only a slight increase from 8.83 (SD = 2.57) to 9.42 (SD = 1.72), which was not statistically significant, t(23) = -0.965, p = .345. Comparison of post-test scores between the two groups also indicated a significant difference in favour of the experimental group, t(45) = 10.190, p < .001 with a very large effect size (d = 2.97). In conclusion, simulation-based learning was found to be effective in enhancing students' conceptual understanding of Optics compared to traditional teaching methods. The study suggests that simulation-based instruction can serve as an effective pedagogical approach for facilitating the learning of abstract physics concepts in secondary school classrooms.

PEMBANGUNAN DAN PENILAIAN MODUL PEMBELAJARAN KENDIRI STEM LUAR BILIK DARJAH TOPIK SEKTOR TENAGA SAINS TINGKATAN 4

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Kajian ini bertujuan untuk membangunkan dan menilai Modul Pembelajaran Kendiri STEM Luar Bilik Darjah Topik Sektor Tenaga Sains Tingkatan 4. Dengan mengguna pakai pendekatan penyelidikan Design and Development Research (DDR), kajian ini dilaksanakan melalui proses sistematik yang merangkumi fasa analisis keperluan, reka bentuk, pembangunan, dan penilaian. Kumpulan peserta terdiri daripada 34 orang pelajar Tingkatan 4 aliran sains teras di sebuah sekolah menengah awam di Johor Bahru. Sebagai sebahagian daripada penyelidikan, sebuah modul bertajuk "Lampu Jalan Tenaga Suria Mini (Solar Pintar)" telah dibangunkan selaras dengan kurikulum Sains Tingkatan 4 (Sektor Tenaga). Alat pengumpulan data merangkumi borang penilaian pakar (Indeks Kesahan Kandungan, CVI), soal selidik skala Likert lima mata untuk mengukur minat, motivasi, keberkesanan, dan cabaran, serta protokol temu bual berfokus. Data kuantitatif dianalisis menggunakan statistik deskriptif (min), manakala data kualitatif daripada temu bual tertakluk kepada analisis tematik. Hasil kajian menunjukkan modul mencapai tahap kesahan kandungan yang sederhana dengan nilai S-CVI 0.80. Tahap penerimaan pelajar bagi semua konstruk (minat, motivasi, keberkesanan, dan cabaran) berada pada tahap sederhana, dengan konstruk motivasi mencatatkan skor min tertinggi (M=4.39). Dapatan kualitatif menunjukkan tiga cabaran menggunakan modul iaitu cabaran kemahiran teknikal dan kreativiti, cabaran pengurusan logistik dan masa, cabaran koordinasi kumpulan dan cabaran dinamik kumpulan dan faktor luaran. Manakala lima cadangan penambahbaikan modul iaitu pendigitalan modul, penambahan elemen penceritaan dan watak, memperkayakan modul dengan lebih banyak ilustrasi, memanjangkan tempoh masa pelaksanaan modul dan integrasi sistem penyimpanan tenaga.

This study aims to develop and evaluate an Outdoor STEM Self-Learning Module for the Energy Sector topic in Form 4 Science. Adopting the Design and Development Research (DDR) approach, the study was conducted through a systematic process comprising the phases of needs analysis, design, development, and evaluation. The participants consisted of 34 Form 4 science stream students from a public secondary school in Johor Bahru. As part of the research, a module entitled Mini Solar Energy Street Light (Smart Solar) was developed in alignment with the Form 4 Science curriculum (Energy Sector). The data collection instruments included expert evaluation forms (Content Validity Index, CVI), a five-point Likert scale questionnaire to measure students' interest, motivation, effectiveness, and challenges, as well as a focused interview protocol. Quantitative data were analysed using descriptive statistics (mean), while qualitative data obtained from the interviews were subjected to thematic analysis. The findings showed that the module achieved a moderate level of content validity, with an S-CVI value of 0.80. Students' acceptance levels for all constructs (interest, motivation, effectiveness, and challenges) were at a moderate level, with the motivation construct recording the highest mean score (M = 4.39). The qualitative findings revealed four challenges in using the module: challenges related to technical skills and creativity, logistical and time management challenges, group coordination challenges, and group dynamics and external factors. Meanwhile, five recommendations for module improvement were identified: digitalisation of the module, incorporation of storytelling elements and characters, enrichment of the module with more illustrations, extension of the module implementation period, and integration of an energy storage system.

EFFECTIVENESS OF THE PERSONALIZED CHATGPT MODULE IN LEARNING FORCE AND MOTION AMONG FORM 4 PHYSICS STUDENTS

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Tujuan kajian ini adalah untuk menguji keberkesanan penggunaan ChatGPT Terperibadi bagi pembelajaran Fizik dalam meningkatkan kefahaman konseptual pelajar Fizik Tingkatan 4 bagi topik Daya dan Gerakan I. Modul pembelajaran ChatGPT Terperibadi telah dibangunkan berdasarkan model ADDIE, yang melibatkan proses menganalisis keperluan pembelajaran dan miskonsepsi pelajar, mereka bentuk prompt berstruktur berasaskan kurikulum Fizik KSSM Malaysia, membangunkan aktiviti pembelajaran serta soalan Fizik berdasarkan bidang miskonsepsi, melaksanakan penggunaan ChatGPT Terperibadi semasa proses pengajaran dan pembelajaran, serta menjalankan penilaian oleh pakar. Pelaksanaan ChatGPT Terperibadi adalah berasaskan pembelajaran yang disokong oleh kecerdasan buatan (AI), yang melibatkan tiga langkah utama iaitu prompt berstruktur, respons dan maklum balas dalam kalangan pelajar Fizik. Kajian ini menggunakan kaedah kuantitatif dengan reka bentuk kuasi eksperimen satu kumpulan pra-ujian dan pasca ujian. Sampel kajian terdiri daripada 30 orang pelajar Fizik Tingkatan 4 dari sebuah sekolah di daerah Johor Bahru. Instrumen kajian yang digunakan ialah soal selidik serta ujian pra dan pasca bagi mengukur kefahaman konseptual, manakala kebolehpercayaan instrumen ditentukan menggunakan Alpha Cronbach. Nilai kebolehpercayaan keseluruhan bagi item berskala Likert ialah 0.910, yang menunjukkan tahap ketekalan dalaman yang sangat baik. Data kajian dianalisis menggunakan analisis deskriptif dan statistik inferensi melalui ujian-t sampel berpasangan dengan menggunakan perisian Statistical Package for the Social Sciences (SPSS). Dapatan kajian menunjukkan bahawa pelajar berjaya meningkatkan kefahaman konseptual serta mengurangkan miskonsepsi dalam topik Daya dan Gerakan I selepas pelaksanaan modul pembelajaran ChatGPT Terperibadi di dalam bilik darjah Fizik. Kesimpulannya, penggunaan ChatGPT Terperibadi dalam pembelajaran Fizik berpotensi menjadi alternatif sebagai bahan bantu pembelajaran yang mampu meningkatkan kefahaman konseptual pelajar Tingkatan 4 melalui proses pengajaran dan pembelajaran yang berpandu, diperibadikan dan interaktif, sekali gus memberikan impak yang positif terhadap pembelajaran pelajar.

The purpose of this research study is to test the effectiveness of using personalized ChatGPT for Physics learning within the Malaysian curriculum in enhancing the conceptual understanding of Form 4 Physics students in the topic of Force and Motion I. The personalized ChatGPT learning module is built based on the ADDIE model, analysing students' learning needs and misconceptions, designing structured prompts based on the Malaysian KSSM Physics curriculum, developing learning activities and Physics questions based on the area of misconceptions, implementation by using personalized ChatGPT during the learning process and evaluation by experts. Implementation of personalized ChatGPT is based on AI supported learning which involves three steps, structured prompt, response and feedback among Physics students. Quantitative methods by using one group pre-test and post-test quasi experimental research design were conducted in this research. The research samples consist of thirty Form 4 Physics students from a school located in Johor Bahru district. The instrument used in this research study is questionnaire and conceptual understanding pre-test and post-test with reliability determined through Cronbach Alpha the reliability of the Likert-scale items was 0.910 with an overall value, indicating excellent internal consistency. The result of the data is analysed by using descriptive analysis and inferential statistic using paired t-test by using Statistical Package for the Social Sciences (SPSS). The finding showed students' improvement and reframed their misconception in Force and Motion I after the

implementation of the personalized ChatGPT learning module in the Physics classroom. In conclusion, personalized ChatGPT for Physics learning can act as an alternative learning aid and enhance students' conceptual understanding in Form 4 Physics within the Malaysian curriculum through a guided, personalized and interactive teaching and learning process among students produces a positive impact.

THE LEVEL OF READINESS IN IMPLEMENTING PROJECT-BASED LEARNING AMONG PRE-SERVICE TEACHERS AT UNIVERSITI TEKNOLOGI MALAYSIA

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Pembelajaran Berasaskan Projek (PjBL) diiktiraf secara meluas sebagai pendekatan pengajaran dan pembelajaran berpusatkan pelajar yang berkesan dalam memupuk kemahiran berfikir aras tinggi, kolaborasi, dan kompetensi abad ke-21. Namun begitu, kejayaan pelaksanaannya adalah sangat bergantung kepada kesediaan guru. Kajian ini bertujuan untuk menyelidiki tahap kesediaan guru pra-perkhidmatan Fizik di Universiti Teknologi Malaysia (UTM) dalam melaksanakan PjBL merangkumi tiga konstruk: pengetahuan, kemahiran, dan sikap. Reka bentuk tinjauan deskriptif kuantitatif telah digunakan, dengan data dikumpulkan daripada 33 orang guru pra-perkhidmatan Fizik menggunakan soal selidik 35 item yang telah disahkan (α = 0.978) dan diadaptasi daripada Ealangov dan Jamaludin (2024). Statistik deskriptif digunakan untuk menganalisis data. Dapatan kajian menunjukkan tahap kesediaan keseluruhan yang tinggi (M = 4.27), dengan Sikap mencatatkan min tertinggi (M = 4.39), diikuti oleh Pengetahuan (M = 4.27) dan Kemahiran (M = 4.17). Pengurusan bilik darjah semasa PjBL dikenal pasti sebagai aspek yang lebih lemah dalam kedua-dua konstruk Kemahiran dan Sikap. Dapatan ini menunjukkan bahawa walaupun guru praperkhidmatan Fizik UTM memiliki pemahaman teoritikal yang kukuh dan sikap positif terhadap PjBL, penambahbaikan yang lebih bersasar dalam fasilitasi bilik darjah dan reka bentuk pentaksiran adalah disyorkan bagi mengukuhkan kesediaan mereka.

Project-Based Learning (PjBL) is widely recognised as an effective student-centered teaching and learning approach that fosters higher-order thinking, collaboration, and 21st-century competencies. However, its successful implementation is critically dependent on teacher readiness. This study investigated the level of readiness of pre-service Physics teachers at Universiti Teknologi Malaysia (UTM) in implementing PjBL across three constructs: knowledge, skills, and attitude. A quantitative descriptive survey design was employed, with data collected from 33 pre-service Physics teachers using a validated 35-item questionnaire (α = 0.978) adapted from Ealangov and Jamaludin (2024). Descriptive statistics were used to analyse the data. The findings revealed a high level of overall readiness (M = 4.27), with Attitude recording the highest mean (M = 4.39), followed by Knowledge (M = 4.27) and Skills (M = 4.17). Classroom management during PjBL was identified as a comparatively weaker area across both Skills and Attitude constructs. These findings suggest that while UTM pre-service Physics teachers possess strong theoretical understanding and positive dispositions towards PjBL, targeted enhancements in practical classroom facilitation and assessment design are recommended to further strengthen their readiness.

KAJIAN KESEDIAAN BAKAL GURU FIZIK DI MALAYSIA TERHADAP PENGGUNAAN SIMULASI DALAM PENGAJARAN FIZIK

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Kajian ini bertujuan untuk mengenal pasti tahap kesediaan bakal guru fizik di Malaysia terhadap penggunaan simulasi dalam pengajaran fizik berdasarkan Model Penerimaan Teknologi (Technology Acceptance Model, TAM). Kajian ini memberi tumpuan kepada konstruk utama TAM iaitu Persepsi Kegunaan (perceived usefulness), Kemudahan Penggunaan yang Dialami (perceived ease of use), serta Pemboleh Ubah Luaran dalam menentukan tahap kesediaan bakal guru fizik untuk mengintegrasikan simulasi dalam pengajaran dan pembelajaran fizik. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Seramai 40 orang bakal guru fizik telah terlibat sebagai responden kajian, yang terdiri daripada pelajar dari Universiti Teknologi Malaysia (UTM). Pemilihan sampel dibuat menggunakan kaedah pensampelan bertujuan berdasarkan kesesuaian responden dengan objektif kajian. Data dikumpul menggunakan borang soal selidik yang diadaptasi daripada instrumen kajian terdahulu berkaitan penerimaan teknologi dan penggunaan simulasi dalam pendidikan sains dan fizik. Instrumen kajian merangkumi item berkaitan persepsi terhadap kegunaan simulasi, kemudahan penggunaannya, pemboleh ubah luaran, serta tahap kesediaan bakal guru fizik untuk menggunakan simulasi dalam pengajaran fizik. Kajian rintis dijalankan bagi memastikan kesahan kandungan dan kebolehpercayaan instrumen melalui analisis pekali Cronbach's Alpha. Data dianalisis menggunakan statistik deskriptif dan inferensi bagi menentukan tahap kesediaan responden serta mengenal pasti hubungan antara Persepsi Kegunaan, Kemudahan Penggunaan yang Dialami dan Pemboleh Ubah Luaran terhadap kesediaan bakal guru fizik menggunakan simulasi dalam pengajaran fizik. Dapatan kajian ini diharapkan dapat memberikan gambaran yang lebih jelas tentang tahap kesediaan bakal guru fizik di Malaysia terhadap penggunaan simulasi serta menyumbang kepada pengembangan latihan perguruan, pembangunan profesional dan pelaksanaan integrasi teknologi yang lebih berkesan dalam pengajaran fizik.

This study aims to identify the level of readiness among pre-service physics teachers in Malaysia towards the use of simulation in physics teaching based on the Technology Acceptance Model (TAM). The study focuses on the main constructs of TAM, namely Perceived Usefulness, Perceived Ease of Use, and External Variables in determining the overall readiness of pre-service physics teachers to integrate simulation into physics teaching and learning. This study employed a quantitative approach using a survey research design. A total of 40 pre-service physics teachers participated as respondents, from Universiti Teknologi Malaysia (UTM). The sample was selected using purposive sampling based on the suitability of respondents to the objectives of the study. Data were collected using a questionnaire adapted from existing instruments in previous studies related to technology acceptance and the use of simulation in science and physics education. The research instrument measured respondents' perceptions of the usefulness of simulation, ease of use, external variables, and their level of readiness to use simulation in physics teaching. A pilot study was conducted to ensure the content validity and internal reliability of the instrument through Cronbach's Alpha analysis. The data were analysed using descriptive and inferential statistics to determine the level of readiness among respondents and to identify the relationship between Perceived Usefulness, Perceived Ease of Use, and External Variables towards pre-service physics teachers' readiness to use simulation in physics teaching. The findings of this study are expected to provide a clearer understanding of the readiness of pre-service physics teachers in Malaysia towards the use of simulation and contribute to teacher

training development, professional development, and the implementation of more effective technology integration in physics teaching.

PENGGUNAAN VIDEO PENDEK CIPTAAN PELAJAR UNTUK MENINGKATKAN PEMAHAMAN KONSEPTUAL PELAJAR FIZIK TERHADAP HUKUM GERAKAN NEWTON

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Fizik secara umumnya dianggap sebagai subjek sains yang paling susah dan kurang diminati oleh pelajar, di mana sering dianggap membosankan, perkembangan topik-topik yang pantas boleh menjadi mencabar, dan kandungan kurikulum yang banyak juga mengelirukan. Walaupun platform media sosial dan video pendek berpotensi besar sebagai alat bantu mengajar, pelajar lazimnya hanya bertindak sebagai pengguna pasif dan bukannya pencipta aktif. Dengan itu, kajian ini bertujuan untuk menyelidik keberkesanan intervensi pedagogi berbentuk penciptaan video pendek dalam meningkatkan tahap pemahaman konseptual pelajar terhadap topik Hukum Gerakan Newton. Kajian ini menggunakan reka bentuk kuasi-eksperimen Ujian Pra-Pasca Satu Kumpulan yang melibatkan 30 orang pelajar Tingkatan Empat aliran sains tulen yang dipilih melalui kaedah persampelan bertujuan. Data dikumpul melalui instrumen Ujian Pemahaman Konsep Fizik Pra dan Pasca serta Rubrik Penilaian Video Pendek, kemudian dianalisis menggunakan Ujian-t Sampel Berpasangan dan analisis deskriptif. Hasil analisis menunjukkan terdapat peningkatan yang amat signifikan ($p < 0.001$) pada tahap pemahaman pelajar, dengan lonjakan min skor daripada 8.87 (ujian pra) kepada 15.30 (ujian pasca), di mana kesemua 100% responden mencatatkan kemajuan. Tambahan pula, analisis rubrik mendedahkan bahawa pelajar mempamerkan kemahiran literasi teknikal visual dan audio yang cemerlang, namun penguasaan mereka dari segi kecekapan penyampaian dan ketepatan fakta saintifik berada pada tahap yang sederhana. Kesimpulannya, penciptaan video pendek sebagai tugasan merupakan satu pendekatan pedagogi yang sangat berkesan bagi memperkukuhkan pemahaman konseptual, namun ia masih menuntut bimbingan berterusan daripada guru untuk memastikan kesahihan kandungan sains yang dihasilkan.

Physics is generally perceived as the most difficult and least favored science subject among students; it is often considered boring, the rapid progression of topics can be challenging, and the extensive curriculum content is confusing. Although social media platforms and short videos have great potential as teaching aids, students typically act merely as passive consumers rather than active creators. Therefore, this study aims to investigate the effectiveness of a pedagogical intervention in the form of student-created video in enhancing students' conceptual understanding of Newton's Laws of Motion. This study utilized a One-Group Pretest-Posttest quasi-experimental design involving 30 Form Four pure science stream students selected through purposive sampling. Data were collected using Pre- and Post-Physics Concept Understanding Test instruments as well as a Short Video Evaluation Rubric and subsequently analyzed using a Paired Samples t-Test and descriptive analysis. The analysis results demonstrated a highly significant improvement ($p < 0.001$) in the students' understanding, with a surge in the mean score from 8.87 (pre-test) to 15.30 (post-test), where 100% of the respondents showed progress. Furthermore, the rubric analysis revealed that students exhibited excellent visual and audio technical literacy skills, but their mastery in terms of delivery competency and scientific factual accuracy was at a moderate level. In conclusion, short video creation by student is a highly effective pedagogical approach for reinforcing conceptual understanding; however, it still requires continuous guidance from teachers to ensure the validity and accuracy of the scientific content produced.

EVALUATING THE EFFECTIVENESS OF A 5E-BASED GUIDED INQUIRY MODULE INTEGRATED WITH PHET SIMULATIONS IN IMPROVING FORM 4 STUDENTS' ACHIEVEMENT ON KEPLER'S LAWS OF PLANETARY MOTION.

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Hukum Kepler tentang Gerakan Planet secara konsisten dikenal pasti sebagai salah satu topik yang paling sukar dalam sukatan pelajaran Fizik Tingkatan 4 KSSM, kerana pelajar menghadapi kesukaran untuk menggambarkan orbit elips, mengaplikasikan hubungan pelbagai formula, serta menjawab soalan Kemahiran Berfikir Aras Tinggi (KBAT) berkaitan konsep graviti. Kajian ini bertujuan untuk membangunkan dan menilai keberkesanan Modul Inkuiri Berpandu berasaskan 5E yang diintegrasikan dengan simulasi PhET dalam meningkatkan pencapaian pelajar Tingkatan 4 dalam Hukum Kepler. Kajian ini menggunakan reka bentuk kaedah campuran yang berpandukan model reka bentuk instruksional ADDIE, melibatkan 30 orang pelajar Fizik Tingkatan 5 dari sebuah sekolah menengah di Johor Bahru sebagai responden analisis keperluan, tiga orang guru Fizik dari sekolah menengah di Johor sebagai peserta temu bual, dan 45 orang pelajar Fizik Tingkatan 4 dari dua buah sekolah menengah yang berbeza di Johor sebagai peserta penilaian keberkesanan modul. Data dikumpulkan menggunakan Soal Selidik Analisis Keperluan Pelajar, protokol temu bual separa berstruktur, serta instrumen ujian pra dan ujian pasca yang mengandungi lapan item, dengan data kuantitatif dianalisis menggunakan statistik deskriptif dan Ujian Wilcoxon Signed Rank, manakala data temu bual kualitatif dianalisis secara tematik. Dapatan analisis keperluan menunjukkan bahawa pelajar menghadapi tahap kesukaran pembelajaran yang tinggi, terutamanya dalam mengaplikasikan KBAT terhadap Hukum Kepler ke 3 dan dalam menangani kekeliruan formula, dengan min Bahagian B3 sebanyak 4.36 yang mencerminkan sokongan kuat pelajar terhadap pembelajaran berasaskan simulasi berpandu, manakala dapatan temu bual guru menghasilkan tiga tema utama, iaitu cabaran dalam pengajaran Hukum Kepler, simulasi PhET sebagai alat pedagogi yang berkesan apabila digunakan dengan tujuan yang jelas, dan Model Inkuiri 5E sebagai struktur modul yang paling sesuai, dengan kesemua tiga guru secara bebas menyokong model tersebut dan mengenal pasti fasa Explore dan Explain sebagai fasa yang paling selaras dengan penggunaan simulasi PhET. Penilaian keberkesanan modul menunjukkan peningkatan pencapaian pra ke pasca yang signifikan secara statistik dalam kajian rintis bersama Kelas A ($Z = -3.920$, $p < .001$; min peningkatan = +2.96) dan pengumpulan data sebenar bersama Kelas B ($Z = -4.015$, $p < .001$; min peningkatan = +2.61), dengan tiada seorang pun pelajar yang mencatat penurunan prestasi dalam mana mana fasa. Kesimpulannya, Modul Inkuiri Berpandu berasaskan 5E yang diintegrasikan dengan simulasi PhET telah meningkatkan pencapaian pelajar Tingkatan 4 dalam Hukum Kepler secara signifikan, dan disokong oleh data keperluan empirikal serta prinsip pedagogi yang diakui secara langsung oleh guru yang mengamalkannya, dengan implikasi yang jelas kepada guru Fizik yang memerlukan alternatif digital berstruktur dan berkos rendah berbanding pengajaran statik konvensional, serta kepada pembangun kurikulum yang bertujuan menghasilkan sumber pengajaran berasaskan inkuiri untuk topik topik abstrak.

Kepler's Laws of Planetary Motion is consistently identified as one of the most difficult topics in the Form 4 KSSM Physics syllabus, as students struggle to visualise elliptical orbits, apply multi formula relationships, and answer Higher Order Thinking Skills (HOTS) questions related to gravitational concepts. This study aimed to develop and evaluate the effectiveness of a 5E based Guided Inquiry Module integrated with PhET simulations in improving Form 4 students' achievement in Kepler's Laws. The study employed a mixed methods research

design guided by the ADDIE instructional design model, involving 30 Form 5 Physics students from a secondary school in Johor Bahru as respondents for the needs analysis, three Physics teachers from secondary schools in Johor as interview participants, and 45 Form 4 Physics students from two different secondary schools in Johor as participants for the module effectiveness evaluation. Data were collected using a Student Needs Analysis Questionnaire, semi structured interview protocols, and an eight item pre test and post test achievement instrument, with quantitative data analysed using descriptive statistics and the Wilcoxon Signed Rank Test, while qualitative interview data were analysed thematically. The needs analysis revealed that students faced high levels of learning difficulty, particularly in applying HOTS to Kepler's 3rd Law and in dealing with formula confusion, with a Section B3 mean of 4.36 reflecting strong student support for simulation based guided learning, while teacher interviews produced three main themes: the challenges of teaching Kepler's Laws, PhET simulation as an effective pedagogical tool when used with clear purpose, and the 5E Inquiry Model as the preferred module structure, with all three teachers independently endorsing the model and identifying the Explore and Explain phases as most naturally suited to PhET use. The module effectiveness evaluation showed statistically significant pre to post achievement gains in both the pilot study with Class A ($Z = -3.920$, $p < .001$; mean gain = +2.96) and the actual data collection with Class B ($Z = -4.015$, $p < .001$; mean gain = +2.61), with no student recording a decline in performance in either phase. In conclusion, the 5E based Guided Inquiry Module integrated with PhET simulations significantly improved Form 4 students' achievement in Kepler's Laws and is supported by both empirical needs data and pedagogical principles endorsed directly by practising teachers, with clear implications for Physics teachers seeking structured, low cost digital alternatives to conventional static instruction, and for curriculum developers aiming to build inquiry based teaching resources for abstract topics within the KSSM Physics syllabus.

PEMBANGUNAN MODUL STEM BAGI KIT GERAKAN LINEAR BERASASKAN ARDUINO

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Topik Gerakan Linear diperkenalkan dalam silibus Fizik Tingkatan 4 di bawah Dokumen Standard Kurikulum dan Pentaksiran (DSKP) Malaysia, dengan memberikan tumpuan kepada konsep asas seperti sesaran, halaju, pecutan dan graf gerakan. Walau bagaimanapun, topik ini kekal mencabar bagi kebanyakan murid disebabkan sifatnya yang abstrak serta kesukaran untuk memvisualisasikan fenomena gerakan melalui pendekatan pengajaran konvensional. Kaedah instruksional tradisional sering kali berpusatkan guru, bersifat prosedural, serta terhad dalam pengalaman berbentuk amali (hands-on) dan berasaskan inkuiri. Oleh itu, ia membawa kepada penglibatan murid yang rendah serta pemahaman konseptual yang dangkal. Kajian ini mencadangkan pembangunan modul pembelajaran berasaskan Arduino yang diintegrasikan dengan pendekatan Design Thinking dan Pembelajaran Berasaskan Projek (PjBL) bagi meningkatkan pemahaman murid terhadap Gerakan Linear melalui pengalaman pembelajaran yang aktif, autentik dan berorientasikan masalah. Penyelidikan ini menerapkan metodologi Penyelidikan Berasaskan Reka Bentuk (DBR) dengan pembangunan modul yang dipandu oleh Successive Approximation Model (SAM) bagi memastikan kit pembelajaran tersebut adalah mantap dari segi pedagogi dan boleh dilaksanakan secara praktikal. Satu analisis keperluan yang melibatkan guru fizik dan murid telah dijalankan untuk mengenal pasti cabaran pembelajaran dan keperluan reka bentuk. Modul yang dibangunkan telah dinilai oleh panel pakar dan kesepakatan pakar diperoleh menggunakan Kaedah Fuzzy Delphi (FDM). Dapatan kajian menunjukkan bahawa kit pembelajaran berasaskan Arduino adalah sah, praktikal dan berkesan dalam meningkatkan pemahaman konseptual, penglibatan, serta kemahiran penyelesaian masalah murid dalam topik Gerakan Linear. Persetujuan pakar melebihi nilai ambang yang diterima, sekali gus menyokong kesesuaian modul pembelajaran ini sebagai alat instruksional yang inovatif untuk pendidikan fizik sekolah menengah.

The topic of Linear Motion is introduced in the Form 4 Physics syllabus under the Malaysian Curriculum and Assessment Standard Document (DSKP), focusing on fundamental concepts such as displacement, velocity, acceleration and motion graphs. However, this topic remains challenging for many students due to its abstract nature and the difficulty in visualising motion phenomena through conventional teaching approaches.
Traditional instructional methods are often teacher-centred, procedural and limited in hands-on and inquiry-based experiences, leading to low student engagement and superficial conceptual understanding. This study proposes the development of an Arduino-based learning module integrated with Design Thinking and Project-Based Learning (PjBL) approaches to enhance students' understanding of Linear Motion through active, authentic and problem-oriented learning experiences. The research adopts a Design-Based Research (DBR) methodology with iterative development guided by the Successive Approximation Model (SAM) to ensure the learning module is pedagogically robust and practically feasible. A needs analysis involving physics teachers and students was conducted to identify learning challenges and design requirements. The developed kit was evaluated by a panel of experts, and expert consensus was obtained using the Fuzzy Delphi Method (FDM). The findings indicate that the Arduino-based learning kit is valid, practical and effective in improving students' conceptual understanding, engagement and problem-solving skills in the topic of Linear Motion. Expert agreement exceeded the accepted threshold, supporting the suitability of the learning module as an innovative instructional tool for secondary school physics education.

DEVELOPMENT OF AN INTERACTIVE QUANTUM PHYSICS MODULE FOR FORM 5 STUDENTS

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Fizik Kuantum merupakan topik yang paling mencabar dalam kurikulum Fizik Tingkatan 5 kerana sifatnya yang abstrak serta sukar untuk pelajar memvisualisasikan fenomen mikroskopik. Khususnya, topik Kesan Fotoelektrik memerlukan pelajar memahami konsep seperti tenaga foton, fungsi kerja dan pancaran elektron, yang sering sukar difahami melalui pendekatan pengajaran tradisional. Oleh itu, kajian ini bertujuan membangunkan Modul Fizik Kuantum Interaktif yang mengintegrasikan Pembelajaran Berasaskan Masalah dan Isu Sosiosaintifik bagi menyokong pengajaran dan pembelajaran topik Kesan Fotoelektrik dalam kalangan pelajar Tingkatan 5. Kajian ini menggunakan pendekatan Penyelidikan Berasaskan Reka Bentuk dengan mengaplikasikan model SAM. Dalam fasa persediaan, analisis keperluan telah dijalankan melibatkan pelajar Tingkatan 6 melalui soal selidik dan guru fizik melalui soalan temu bual terbuka. Dapatan analisis keperluan menunjukkan bahawa pelajar menghadapi kesukaran memahami konsep abstrak berkaitan Kesan Fotoelektik dan menunjukkan persepsi positif terhadap penggunaan bahan pembelajaran interaktif. Guru pula menekankan keperluan terhadap sumber pembelajaran yang mengintegrasikan simulasi, konteks dunia sebenar dan pendekatan pembelajaran berpusatkan pelajar. Seterusnya, dalam fasa reka bentuk iteratif, prototaip modul dibangunkan dengan mengintegrasikan Pembelajaran Berasaskan Masalah, Isu Sosiosaintifik serta simulasi interaktif yang dibangunkan secara khusus bagi menyediakan pengalaman pembelajaran yang bermakna dan berkonteks. Akhir sekali, dalam fasa pembanguan iteratif, prototaip akhir modul telah menjalani penilaian pakar menggunakan kaedah Fuzzy Delphi bagi memperoleh pengesahan dan maklum balas daripada pakar untuk penambahbaikan modul. Dapatan penilaian pakar menunjukkan bahawa semua item penilaian memenuhi kriteria penerimaan kaedah Fuzzy Delphi, iaitu nilai ambang $d \leq 0.2$, peratus persetujuan akhir pakar melebihi 75% dan nilai penyahkaburan melebihi nilai α-cut 0.5. Dapatan ini menunjukkan bahawa modul yang dibangunkan adalah sah dan sesuai dari segi ketepatan kandungan serta reka bentuk pengajaran. Kesimpulannya, Modul Fizik Kuantum Interaktif yang mengintegrasikan Pembelajaran Berasaskan Masalah dan Isu Sosiosaintifik merupakan satu sumber pengajaran dan pembelajaran yang inovatif serta sah digunakan abgi menyokong pengajaran dan pembelajaran topik Kesan Fotoelektrik. Modul ini berpotensi meningkatkan pemahaman konseptual, kemahiran berfikir kritis dan penglibatan pelajar.

Quantum Physics is one of the most challenging topics in the Form 5 Physics curriculum due to its abstract nature and the limited opportunities for students to visualize microscopic phenomena. Particularly, the Photoelectric Effect requires students to understand concepts such as photon energy, work function and electron emission, which are often difficult to comprehend using traditional teaching approaches. Therefore, this study aimed to develop an Interactive Quantum Physics Module integrating Problem-Based Learning (PBL) and Socio-Scientific Issues (SSI) to support the teaching and learning of the Photoelectric Effect among Form 5 students. The study adopted a Design-Based Research (DBR) approach using the Successive Approximation Model, which consists of the preparation phase, iterative design phase and iterative development phase. During the preparation phase, a needs analysis was conducted involving Form 6 students through questionnaire and physics teachers through open-ended interview questions. Based on the needs analysis findings,

students experienced difficulties in understanding abstract concepts related to Photoelectric Effect and show positive perceptions towards the use of interactive learning material. Teachers also highlighted the need for learning resources that incorporate simulations, real-world contexts and student-centred learning approaches. Hence, in the iterative design phase, the prototype of the module was developed by incorporating Problem-Based Learning (PBL), Socio-Scientific Issues (SSI) and customized interactive simulations to provide meaningful and contextualized learning experiences. Finally, in the iterative development phase, the final prototype undergone expert evaluation through the Fuzzy Delphi Method to receive validation and feedbacks from experts for further improvements on the module. The expert evaluation findings show that all evaluation items fulfilled the Fuzzy Delphi acceptance criteria, with threshold value $d \leq 0.2$, expert consensus percentages exceeding 75% and defuzzification values greater than the α-cut value of 0.5. These findings indicate that the developed module is valid and suitable in terms of content accuracy and instructional design. In conclusion, the Interactive Quantum Physics Module integrating Problem-Based Learning (PBL) and Socio-Scientific Issues (SSI) provides an innovative and valid instructional resource for supporting the teaching and learning of the Photoelectric Effect, hence, has the potential to enhance students conceptual understanding, critical thinking and engagement.

PENERIMAAN DAN PERSEPSI GURU TERHADAP PENGGUNAAN TEKNOLOGI KECERDASAN BUATAN SEMASA PENGAJARAN DAN PEMBELAJARAN FIZIK

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Tujuan kajian ini adalah untuk menentukan persepsi dan tahap penerimaan teknologi kecerdasan buatan (AI) oleh guru Fizik terhadap penggunaan teknologi ini dalam pendidikan Fizik. Ia juga ingin menentukan bagaimana kedua-dua faktor ini berkaitan antara satu sama lain. Reka bentuk kuantitatif tinjauan digunakan dalam kajian ini, yang melibatkan 30 guru Fizik dari sekolah menengah di Johor Bahru, Malaysia. Data dikumpul melalui soal selidik berasaskan Skala Likert lima mata. Soal selidik terdiri daripada tiga bahagian, demografi responden, penerimaan oleh guru terhadap kecerdasan buatan, dan persepsi guru terhadap penggunaan kecerdasan buatan dalam latihan pekerjaan fizikal. Data dianalisis menggunakan statistik deskriptif seperti frekuensi, peratusan, min dan sisihan piawai, serta statistik inferensial menggunakan ujian t-ujian satu sampel dan korelasi Pearson. Hasil kajian menunjukkan, berdasarkan nilai min yang diperoleh, guru Fizik menerima dan melihat penggunaan AI dengan baik. Ini menunjukkan bahawa pendidik melihat AI sebagai alat yang berguna untuk meningkatkan pengajaran Fizik, terutamanya dengan membantu pelajar memahami konsep abstrak dan menjadikan pembelajaran lebih interaktif. Analisis korelasi juga menunjukkan bahawa terdapat hubungan yang sangat kuat dan penting antara penerimaan dan persepsi guru tentang AI. Kesimpulannya, penggunaan AI dalam pengajaran Fizik boleh diterima dengan baik oleh pengajar dan mempunyai kemungkinan untuk meningkatkan kualiti pengajaran dan pembelajaran. Walau bagaimanapun, untuk memastikan pelaksanaan AI dalam sekolah menengah berkesan dan berterusan, latihan profesional yang berterusan, sokongan teknikal dan infrastruktur yang mencukupi adalah penting.

The purpose of this study is to investigate the level of acceptability and perception of Artificial Intelligence (AI) in Physics instruction by Physics teachers and to explore the relationship between these two factors. The research strategy used was quantitative survey research method and 30 Physics instructors from secondary schools in Johor Bahru, Malaysia were selected. Data were collected using a structured questionnaire developed on a five-point Likert scale and comprised three sections, demographic profile, teachers' acceptance of AI, and teachers' impression of AI in teaching and learning. Data was analysed by utilising descriptive statistics such as frequency, percentage, mean and standard deviation and inferential statistics using One-Sample t-test and Pearson Correlation analysis. The results suggest that the level of acceptance and perception of AI among Physics teachers are high as seen by the calculated mean scores. This indicates that teachers typically see AI as a helpful and positive tool for improving Physics teaching, notably in strengthening conceptual understanding and facilitating interactive learning. Additionally, the results demonstrate a very substantial and statistically significant favourable association between teachers' acceptance and perception of AI. In conclusion, teachers are quite receptive to the use of AI in Physics education and it has a great potential for improving the effectiveness of teaching and student involvement. But, to be successful and sustainable in the deployment of AI in classroom practice in secondary school environments, constant professional growth, adequate training and increased technology infrastructure are necessary.

PEMBANGUNAN DAN PENILAIAN MODUL PEMBELAJARAN KENDIRI STEM LUAR BILIK DARJAH DALAM TOPIK PENJANAAN TENAGA ELEKTRIK TINGKATAN 3

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Kajian ini bertujuan untuk membangunkan Modul Pembelajaran Kendiri STEM Luar Bilik Darjah berasaskan model Problem-Based Design Thinking (PBDT) melalui projek reka bentuk kereta solar serta menilai tahap penerimaan pelajar. Penyelidikan ini menggunakan reka bentuk Penyelidikan Reka Bentuk dan Pembangunan (DDR) yang melibatkan fasa asas pembangunan modul, penterjemahan model PSLBD kepada rekabentuk modul, fasa pembangunan modul, penilaian kesalahan pakar, pelaksanaan dan penilaian pengguna serta pemurnian modul. Seramai tiga orang pakar terlibat dalam fasa validasi kandungan, manakala 30 orang pelajar Tingkatan 3 di sebuah sekolah di daerah Johor Bahru dipilih sebagai responden untuk menilai tahap penerimaan. Data dikumpul melalui borang penilaian pakar (Content Validity Index - CVI), soal selidik skala Likert 4-mata, dan temubual kumpulan fokus. Hasil analisis menunjukkan modul mempunyai kesahan kandungan yang tinggi dengan nilai S-CVI antara 0.80 hingga 1.00 bagi kebanyakan konstruk. Tahap penerimaan pelajar terhadap keberkesanan modul berada pada tahap tertinggi keberkesanan (min=3.22). Dapatan analisis kualitatif pula menunjukkan terdapat lima cabaran modul iaitu kekurangan pengalaman teknikal, faktor cuaca, dan keperluan sokongan visual multimedia nyatakan keempat-empat. Manakala terdapat 4 cadangan penambahbaikan modul iaitu menambah kod QR yang menunjukkan video tutorial pemasangan, menyediakan format dwibahasa bagi ayat sains yang kompleks, penyediaan templat jadul data serta panduan langkah demi langkah dan menstruktur semula aktiviti kepada sesi yang lebih fleksibel.

This study aims to develop an Out-of-Classroom STEM Self-Learning Module based on the Problem-Based Design Thinking (PBDT) model through a solar car design project and to evaluate student acceptance levels. The research adopts a Design and Development Research (DDR) design, encompassing the foundational module development phase, the translation of the PSLBD model into module design, the module development phase, expert evaluation, user implementation and evaluation, and module refinement. Three experts were involved in the content validation phase, while 30 Form 3 students from a school in the Johor Bahru district were selected as respondents to evaluate acceptance levels. Data were collected using an expert evaluation form (Content Validity Index - CVI), a 4-point Likert scale questionnaire, and focus group interviews. Analysis results revealed high content validity, with S-CVI values ranging from 0.80 to 1.00 across most constructs. The student acceptance level regarding the module's effectiveness was at a high level (mean = 3.22). Qualitative findings identified four key challenges in module implementation, which include a lack of technical experience, weather factors, time constraints during testing, and the need for multimedia visual support. Furthermore, four recommendations for improvement were highlighted, namely adding QR codes linking to installation tutorial videos, providing a bilingual format for complex scientific terminology, supplying data table templates alongside step-by-step guidance, and restructuring activities into more flexible sessions.

PERSEPSI MURID TINGKATAN 4 TERHADAP KEBERKESANAN CHATGPT DALAM MEMBANTU KEFAHAMAN DAN TUGASAN DALAM TAJUK FIZIK KUANTUM

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Kajian ini dijalankan untuk mengenal pasti persepsi murid Tingkatan 4 terhadap keberkesanan penggunaan ChatGPT dalam membantu kefahaman dan penyediaan tugasan bagi tajuk Fizik Kuantum. Seiring dengan perkembangan teknologi kecerdasan buatan (Artificial Intelligence, AI) dalam bidang pendidikan, ChatGPT semakin digunakan sebagai alat sokongan pembelajaran yang berpotensi membantu murid memahami konsep yang kompleks serta menyelesaikan tugasan akademik dengan lebih berkesan. Walau bagaimanapun, kajian berkaitan penggunaan ChatGPT dalam kalangan murid sekolah menengah, khususnya bagi mata pelajaran Fizik, masih terhad. Oleh itu, kajian ini dilaksanakan untuk mengenal pasti tahap kekerapan penggunaan ChatGPT dalam kalangan murid Tingkatan 4 bagi tujuan pembelajaran Fizik Kuantum, mengenal pasti persepsi murid terhadap keberkesanan ChatGPT dalam meningkatkan kefahaman konsep Fizik Kuantum, dan mengenal pasti persepsi murid terhadap keberkesanan ChatGPT dalam membantu penyediaan tugasan berkaitan topik tersebut.Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan. Data dikumpulkan melalui soal selidik yang diedarkan kepada murid Tingkatan 4 sebagai responden kajian. Data yang diperoleh dianalisis menggunakan statistik deskriptif yang melibatkan kekerapan, peratusan, min dan sisihan piawai bagi menjawab persoalan kajian yang telah ditetapkan.Hasil kajian menunjukkan bahawa tahap penggunaan ChatGPT dalam kalangan murid Tingkatan 4 bagi pembelajaran Fizik Kuantum berada pada tahap yang tinggi. Selain itu, murid menunjukkan persepsi yang positif terhadap keberkesanan ChatGPT dalam membantu meningkatkan kefahaman konsep Fizik Kuantum. Dapatan kajian turut menunjukkan bahawa ChatGPT membantu murid dalam penyediaan tugasan dengan memberikan maklumat, penerangan, idea dan panduan yang diperlukan semasa proses pembelajaran. Secara keseluruhannya, kajian ini membuktikan bahawa ChatGPT mempunyai potensi sebagai alat sokongan pembelajaran yang berkesan dalam membantu murid memahami konsep dan menyiapkan tugasan bagi tajuk Fizik Kuantum.Implikasi kajian menunjukkan bahawa penggunaan ChatGPT secara beretika dan terkawal boleh menyokong pelaksanaan pendidikan digital serta meningkatkan keberkesanan proses pengajaran dan pembelajaran.
Kajian ini diharapkan dapat menjadi rujukan kepada guru, pihak sekolah dan Kementerian Pendidikan Malaysia dalam memperluaskan penggunaan teknologi kecerdasan buatan dalam pendidikan.

This study was conducted to identify the perceptions of Form 4 students on the effectiveness of using ChatGPT in assisting in understanding and preparing assignments for the topic of Quantum Physics. Along with the development of artificial intelligence (AI) technology in the field of education, ChatGPT is increasingly being used as a learning support tool that has the potential to help students understand complex concepts and complete academic assignments more effectively. However, studies related to the use of ChatGPT among secondary school students, especially for the subject of Physics, are still limited. Therefore, this study was conducted to identify the frequency of use of ChatGPT among Form 4 students for the purpose of learning Quantum Physics, identify students' perceptions of the effectiveness of ChatGPT in improving understanding of Quantum Physics concepts, and identify students' perceptions of the effectiveness of ChatGPT in assisting in preparing assignments related to the topic. This study used a quantitative survey approach. Data were collected through questionnaires

distributed to Form 4 students as study respondents.
The data obtained were analyzed using descriptive statistics involving frequency, percentage, mean and standard deviation to answer the research questions that had been set. The results of the study showed that the level of use of ChatGPT among Form 4 students for learning Quantum Physics was at a high level. In addition, students showed a positive perception of the effectiveness of ChatGPT in helping to improve understanding of Quantum Physics concepts. The study findings also showed that ChatGPT assisted students in preparing assignments by providing information, explanations, ideas and guidance needed during the learning process. Overall, this study proved that ChatGPT has the potential as an effective learning support tool in helping students understand concepts and complete assignments for the topic of Quantum Physics. The implications of the study show that the ethical and controlled use of ChatGPT can support the implementation of digital education and increase the effectiveness of the teaching and learning process. This study is hoped to be a reference for teachers, schools and the Ministry of Education Malaysia in expanding the use of artificial intelligence technology in education.

TAHAP KESEDIAAN BAKAL GURU FIZIK TERHADAP ISU SOSIOSAINTIFIK DALAM PEMBELAJARAN FIZIK

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Kajian ini dijalankan untuk meninjau tahap pengetahuan dan kesediaan bakal guru fizik terhadap pengintegrasian isu sosiosaintifik (SSI) dalam proses pengajaran dan pembelajaran fizik. Isu sosiosaintifik merupakan cabaran dunia nyata yang menggabungkan aspek saintifik dengan implikasi sosial, moral, dan etika, seperti perubahan iklim, tenaga boleh diperbaharui, dan pandemik. Pernyataan masalah kajian ini berpusat pada kekurangan kaedah pengajaran tradisional dalam menunjukkan perkaitan fizik dengan kehidupan harian, serta kurangnya keyakinan dan pengetahuan pedagogi dalam kalangan bakal guru untuk mengendalikan perbincangan SSI. Objektif utama kajian adalah untuk mengenal pasti tahap pengetahuan, tahap kesediaan, serta hubungan antara pengetahuan dan kesediaan bakal guru fizik terhadap pendekatan ini. Metodologi kajian ini melibatkan bakal guru yang sedang menjalani latihan profesional di institusi pendidikan di Malaysia. Kerangka teori kajian dibina berasaskan konsep persepsi dan literasi saintifik untuk melahirkan modal insan yang berfikiran kritis dan bertanggungjawab. Kepentingan kajian ini diharapkan dapat memberikan sumbangan dalam mempertingkatkan kualiti pendidikan fizik di Malaysia selari dengan Kurikulum Standard Sekolah Menengah (KSSM) dan Matlamat Pembangunan Lestari (SDG).

This study aims to examine the level of knowledge and readiness of pre- service physics teachers regarding the integration of socio-scientific issues (SSI) in the physics teaching and learning process. Socio-scientific issues are real-world challenges that interweave scientific aspects with social, moral, and ethical implications, such as climate change, renewable energy, and pandemics. The problem statement highlights the failure of traditional teaching methods to demonstrate the relevance of physics to daily life, alongside a lack of confidence and pedagogical knowledge among pre-service teachers in handling SSI discussions. The primary objectives are to identify the level of knowledge, readiness, and the relationship between knowledge and readiness among pre-service physics teachers toward this approach. The research methodology involves pre-service teachers undergoing professional training at educational institutions in Malaysia. The theoretical framework is built upon the concepts of perception and scientific literacy to develop critical and responsible human capital. The significance of this study lies in its contribution to enhancing the quality of physics education in Malaysia, in alignment with the Secondary School Standard Curriculum (KSSM) and Sustainable Development Goals (SDG).

PEMBANGUNAN MODUL PENGAJARAN BERASASKAN MODEL 5E BAGI TOPIK HUKUM KEPLER

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Kajian ini bertujuan untuk membangunkan Modul Pengajaran Berasaskan Makmal Maya Menggunakan Model 5E Bagi Topik Hukum Kepler menggunakan pendekatan Kajian Reka Bentuk dan Pembangunan (DDR). kajian ini menangani jurang dalam sumber pengajaran yang menyokong integrasi simulasi PhET dalam pengajaran konsep fizik yang abstrak. Kaedah Fuzzy Delphi (FDM) digunakan untuk mendapatkan persetujuan daripada 7 pakar tentang kandungan dan struktur modul untuk menambah baik pengajaran konsep Kepler. Data analisis menggunakan FDM dan semua elemen memenuhi keperluan FDM, iaitu nilai ambang kurang daripada 0.2, persetujuan pakar melebihi 75% dan nilai skor Fuzzy melebihi 0.5. Pembangunan modul ini diharapkan dapat menyokong guru dan meningkatkan pemahaman murid tentang konsep Kepler.

This study aims to develop a Virtual Laboratory-Based Teaching Module Using the 5E Model for Kepler's Laws, employing the Design and Development Research (DDR) approach. The study addresses the gap in instructional resources that support the integration of PhET simulations in teaching abstract physics concepts. The Fuzzy Delphi Method (FDM) was utilized to obtain consensus from seven experts regarding the module's content and structure to improve the teaching of Keplerian concepts. Data were analyzed using FDM, and all elements met the required FDM thresholds, namely a threshold value (d) of less than 0.2, expert consensus exceeding 75%, and a defuzzification score (A max) higher than 0.5. The development of this module is expected to support teachers and enhance students' understanding of Kepler's concepts.

SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA PENDIDIKAN (PENGAJIAN ISLAM) DENGAN KEPUJIAN [SHPIH]

PENGETAHUAN MAHASISWA UTM TENTANG HUKUM HAKAM AL- QURAN BERDASARKAN KITAB AL-TIBYAN OLEH IMAM NAWAWI

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Kajian ini dijalankan untuk meneliti pengetahuan mahasiswa Universiti Teknologi Malaysia (UTM) terhadap hukum-hakam al-Quran berdasarkan kitab al- Tibyan fi Adab Hamalat al-Quran karya Imam al-Nawawi. Kajian ini mempunyai tiga objektif utama, iaitu mengenal pasti hukum-hakam berkaitan al-Quran yang dihuraikan dalam kitab al-Tibyan, menilai tahap pengetahuan mahasiswa terhadap hukum-hakam tersebut, serta meneroka strategi pengukuhan kefahaman mahasiswa dalam berinteraksi dengan al-Quran. Kajian ini menggunakan reka bentuk kaedah campuran yang menggabungkan pendekatan kuantitatif dan kualitatif. Data kuantitatif diperoleh melalui soal selidik berbentuk ujian pengetahuan yang melibatkan 50 orang mahasiswa Sarjana Muda Pendidikan Pengajian Islam UTM. Data dianalisis menggunakan analisis deskriptif dan Model Rasch melalui perisian Winsteps. Data kualitatif pula diperoleh melalui temu bual separa berstruktur bersama tiga orang pakar dan dianalisis secara tematik. Dapatan kajian menunjukkan bahawa hukum-hakam al- Quran dalam kitab al-Tibyan merangkumi aspek adab membaca al-Quran, adab seluruh manusia terhadap al-Quran, serta penulisan al-Quran dan pemuliaan mushaf. Dapatan kuantitatif menunjukkan bahawa tahap pengetahuan mahasiswa secara keseluruhannya berada pada tahap sederhana. Analisis Model Rasch mendapati seramai 35 orang responden bersamaan 70.0% berada pada tahap sederhana, 7 orang bersamaan 14.0% berada pada tahap tinggi, manakala 8 orang bersamaan 16.0% berada pada tahap rendah. Dapatan kualitatif pula menghasilkan tiga strategi utama pengukuhan kefahaman, iaitu pengukuhan ilmu melalui sumber sahih dan bimbingan guru, penghayatan melalui amalan rutin, refleksi kendiri dan mujahadah, serta pembudayaan kefahaman melalui bi'ah solehah, sokongan rakan sebaya dan peranan institusi. Kesimpulannya, mahasiswa mempunyai asas pengetahuan terhadap hukum-hakam al-Quran, namun kefahaman mereka masih perlu diperkukuh melalui pendekatan yang lebih tersusun, praktikal, berterusan dan berpandukan sumber ilmu yang sahih.

This study was conducted to examine the knowledge of Universiti Teknologi Malaysia (UTM) students regarding the rulings related to the Quran based on al- Tibyan fi Adab Hamalat al-Quran by Imam al-Nawawi. The study has three main objectives: to identify the Quran-related rulings discussed in al-Tibyan, to assess students' level of knowledge of these rulings, and to explore strategies to strengthen students' understanding of proper interaction with the Quran. This study employed a mixed-methods research design, combining both quantitative and qualitative approaches. Quantitative data were collected through a knowledge-based questionnaire involving 50 undergraduate students from the Islamic Education programme at UTM. The data were analysed using descriptive analysis and the Rasch Model through Winsteps software. Meanwhile, qualitative data were obtained through semi-structured interviews with three experts and analysed thematically. The findings show that the Quran-related rulings in al-Tibyan cover aspects such as the etiquette of reciting the Quran, general etiquette towards the Quran, as well as the writing of Quranic verses and the proper honouring of the mushaf. The quantitative findings indicate that the students' overall level of knowledge was moderate. Based on the Rasch Model analysis, 35 respondents, representing 70.0%, were at the moderate level, 7 respondents, representing 14.0%, were at the high level, while 8 respondents, representing 16.0%, were at the low level. The qualitative findings revealed three main strategies for strengthening understanding: reinforcing knowledge through authentic sources and teacher guidance, internalising knowledge through daily routines, self- reflection and spiritual effort, and cultivating understanding through a

righteous environment, peer support and the role of the institution. In conclusion, the students have a basic level of knowledge regarding the Quran-related rulings, but their understanding still needs to be strengthened through a more structured, practical, continuous approach guided by authentic sources of knowledge.

PENGARUH LATIHAN KETENTERAAN TERHADAP PEMBENTUKAN AKHLAK ISLAMIAH DALAM KALANGAN PEGAWAI KADET PASUKAN LATIHAN PEGAWAI SIMPANAN UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini bertujuan untuk menentukan tahap pembentukan akhlak Islamiah melalui latihan ketenteraan, menganalisis hubungan antara latihan ketenteraan dengan pembentukan akhlak Islamiah serta menilai sumbangan (pengaruh) latihan ketenteraan dalam meramalkan pembentukan akhlak Islamiah dalam kalangan pegawai kadet Pasukan Latihan Pegawai Simpanan Universiti Teknologi Malaysia (PALAPES UTM). Kajian ini menggunakan pendekatan kuantitatif melalui reka bentuk tinjauan keratan rentas. Seramai 118 orang pegawai kadet beragama Islam dipilih daripada populasi seramai 169 orang melalui kaedah persampelan rawak berstrata. Data dikumpulkan menggunakan soal selidik berskala Likert lima mata yang mengandungi 35 item, terdiri daripada 20 item latihan ketenteraan dan 15 item pembentukan akhlak Islamiah. Data dianalisis menggunakan statistik deskriptif, korelasi Pearson dan regresi linear mudah melalui perisian Statistical Package for the Social Sciences (SPSS). Analisis kebolehpercayaan menunjukkan bahawa semua konstruk mempunyai konsistensi dalaman yang baik hingga sangat tinggi dengan nilai Cronbach's Alpha antara .884 hingga .955. Dapatan menunjukkan bahawa tahap pembentukan akhlak Islamiah secara keseluruhan berada pada tahap tinggi (M = 4.4441, SP = .59992). Dimensi akhlak terhadap Allah SWT dan akhlak terhadap alam sekitar mencatatkan min tertinggi yang sama (M = 4.4983), manakala akhlak terhadap sesama manusia turut berada pada tahap tinggi (M = 4.3356). Analisis korelasi Pearson menunjukkan terdapat hubungan positif yang sangat kuat dan signifikan antara latihan ketenteraan dengan pembentukan akhlak Islamiah ($r = .897$, $p < .001$). Analisis regresi linear mudah pula menunjukkan bahawa latihan ketenteraan merupakan peramal statistik yang signifikan dan menerangkan sebanyak 80.4 peratus varians pembentukan akhlak Islamiah, $F(1,116) = 476.319$, $p < .001$. Kesimpulannya, latihan ketenteraan mempunyai perkaitan dan sumbangan ramalan yang sangat kuat terhadap pembentukan akhlak Islamiah berdasarkan persepsi pegawai kadet PALAPES UTM. Elemen kerohanian, teladan jurulatih, komunikasi beradab serta penjagaan aurat dan batas pergaulan disarankan untuk terus diperkukuh dalam pelaksanaan latihan.

This study aims to determine the level of Islamic moral development through military training, analyse the relationship between military training and Islamic moral development, and assess the contribution (influence) of military training in predicting Islamic moral development among officer cadets of the Reserve Officer Training Unit at Universiti Teknologi Malaysia (PALAPES UTM). This study employed a quantitative approach using a cross-sectional survey design. A total of 118 Muslim officer cadets were selected from a population of 169 through stratified random sampling. Data were collected using a five-point Likert-scale questionnaire consisting of 35 items, comprising 20 items on military training and 15 items on Islamic moral development. The data were analysed using descriptive statistics, Pearson correlation and simple linear regression through the Statistical Package for the Social

Sciences (SPSS). The reliability analysis showed that all constructs had good to very high internal consistency, with Cronbach's Alpha values ranging from .884 to .955. The findings indicated that the overall level of Islamic moral development was high (M = 4.4441, SD = .59992). The dimensions of morals towards Allah SWT and morals towards the environment recorded the same highest mean score (M = 4.4983), while morals towards fellow human beings were also at a high level (M = 4.3356). Pearson correlation analysis revealed a very strong and significant positive relationship between military training and Islamic moral development (r = .897, p < .001). Simple linear regression analysis further showed that military training was a significant statistical predictor and explained 80.4 per cent of the variance in Islamic moral development, F (1,116) = 476.319, p < .001. In conclusion, military training has a very strong association and predictive contribution to Islamic moral development based on the perceptions of PALAPES UTM officer cadets. Spiritual elements, exemplary conduct among instructors, respectful communication, as well as the observance of modesty and appropriate boundaries between genders should continue to be strengthened in the implementation of training.

STRATEGI PEMERKASAAN PENDEKATAN DAKWAH KONTEMPORARI PERSATUAN ISLAM UTM BAGI MEMENUHI KEPERLUAN ROHANI MAHASISWA GENERASI Z

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Kajian ini dijalankan bagi mengkaji strategi pemerkasaan pendekatan dakwah kontemporari persatuan Islam Universiti Teknologi Malaysia (UTM) dalam memenuhi keperluan rohani mahasiswa Generasi Z. Secara khususnya, kajian ini bertujuan mengenal pasti kesesuaian pendekatan dakwah kontemporari persatuan Islam UTM dengan gaya hidup dan keperluan rohani mahasiswa Generasi Z, mengenal pasti faktor-faktor yang menyumbang kepada minat mahasiswa terhadap program dakwah kontemporari serta mengenal pasti strategi pemerkasaan pendekatan dakwah kontemporari bagi meningkatkan penglibatan dan penghayatan rohani mahasiswa di UTM. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Instrumen kajian berbentuk soal selidik telah diedarkan kepada mahasiswa Muslim prasiswazah UTM dan data dianalisis secara deskriptif menggunakan kekerapan, peratusan, min dan sisihan piawai. Dapatan kajian menunjukkan bahawa pendekatan dakwah kontemporari yang bersifat kreatif, interaktif santai dan berasaskan media digital adalah bersesuaian dengan gaya hidup serta keperluan rohani mahasiswa Generasi Z. Kajian juga mendapati bahawa minat mahasiswa terhadap program dakwah dipengaruhi oleh beberapa faktor utama seperti keperluan mencari ketenangan jiwa, pengisian yang relevan dengan isu semasa, penggunaan media sosial, pendekatan pendakwah yang terbuka serta kemampuan dakwah mengaitkan ajaran Islam dengan realiti kehidupan mahasiswa. Selain itu, strategi pemerkasaan yang dikenal pasti merangkumi penggunaan elemen interaktif, penyediaan rakaman dakwah seperti podcast, poster yang kreatif, kolaborasi antara persatuan, bimbingan susulan, aktiviti berbentuk healing session, penglibatan pempengaruh Muslim, program kesukarelawanan sosial serta keseimbangan antara pendekatan logik dan sokongan emosi. Secara keseluruhannya, kajian ini menunjukkan bahawa pendekatan dakwah kontemporari perlu diperkasakan secara lebih fleksibel, mesra generasi muda dan berpaksikan keperluan rohani mahasiswa agar mampu meningkatkan penglibatan, penghayatan Islam serta pembentukan sahsiah mahasiswa Generasi Z di UTM.

This study was conducted to examine the empowerment strategies of contemporary da'wah

approaches adopted by Islamic Associations at Universiti Teknologi Malaysia (UTM) in fulfilling the spiritual needs of Generation Z students. Specifically, this study aims to identify the suitability of contemporary da'wah approaches employed by Islamic Associations at UTM in relation to the lifestyle and spiritual needs of Generation Z students, identify the factors contributing to students' interest in contemporary da'wah programmes, and analyse strategies for empowering contemporary da'wah approaches to enhance students' participation and spiritual appreciation at UTM. This study employed a quantitative approach using a survey design. A questionnaire was distributed to Muslim undergraduate students at UTM, and the data were analysed descriptively using frequency, percentage, mean and standard deviation. The findings indicate that contemporary da'wah approaches that are creative, interactive, relaxed and based on digital media are suitable for the lifestyle and spiritual needs of Generation Z students. The study also found that students' interest in da'wah programmes is influenced by several key factors, including the need for spiritual tranquillity, content that is relevant to current issues, the use of social media, an open and approachable style of da'wah delivery, and the ability of da'wah to relate Islamic teachings to students' real-life experiences. In addition, the empowerment strategies identified include the use of interactive elements, the provision of recorded da'wah content such as podcasts, creative posters, collaboration among associations, follow-up guidance, healing-oriented activities, the involvement of Muslim influencers, social volunteerism programmes, and a balance between logical approaches and emotional support. Overall, this study demonstrates that contemporary da'wah approaches need to be empowered in a more flexible and youth-friendly manner, while remaining grounded in students' spiritual needs, in order to enhance participation, strengthen Islamic appreciation and support the character development of Generation Z students at UTM.

TAHAP KESEDARAN MAHASISWA UNIVERSITI TEKNOLOGI MALAYSIA TERHADAP PENGHAYATAN AKHLAK ISLAM DAN TINGKAH LAKU BULI SECARA ATAS TALIAN

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Kajian ini dilakukan bertujuan mengkaji tahap kesedaran mahasiswa Universiti Teknologi Malaysia terhadap penghayatan akhlak Islam dan tingkah laku buli secara atas talian. Hal ini kerana, sejak kebelakangan ini mahasiswa cenderung untuk menyebarkan fitnah, penyebaran maklumat palsu, dan komen yang bersifat negatif di media sosial yang berpotensi menjejaskan reputasi atau moral rakan sebaya serta membentuk persepsi negatif dalam kalangan komuniti digital. Objektif kajian ini adalah untuk mengenal pasti tahap kesedaran mahasiswa UTM terhadap penghayatan akhlak Islam, mengenal pasti tahap dan bentuk tingkah laku buli secara atas talian dalam kalangan mahasiswa UTM serta menganalisis faktor-faktor yang mempengaruhi tahap penghayatan akhlak Islam dan kecenderungan buli secara atas talian dalam kalangan mahasiswa UTM. Kajian ini menggunakan pendekatan kuantitatif secara analisis deskriptif kepada 379 orang mahasiswa Universiti Teknologi Malaysia. Dapatan kajian menunjukkan bahawa majoriti mahasiswa mempunyai tahap penghayatan akhlak Islam yang tinggi, manakala faktor dalaman dan luaran seperti, keimanan, nilai diri, pengaruh rakan sebaya dan penggunaan media sosial memberi kesan signifikan terhadap tingkah laku etika digital. Daripada kajian ini, saya mengharapkan agar pihak yang bertanggungjawab termasuk diri mahasiswa sendiri, pihak universiti, pensyarah, Kerajaan dan pembuat dasar untuk merancang strategi Pendidikan dan pendekatan yang lebih berkesan bagi membimbing mahasiswa menjadi individu yang berakhlak, bertanggungjawab dan celik digital.

This study was conducted with the aim of examining the level of awareness among Universiti Teknologi Malaysia (UTM) students regarding the internalization of Islamic values and the prevalence of online bullying behavior. This is due to the recent tendency among students to disseminate slander, spread false information, and post negative comments on social media, which have the potential to damage the reputation or morale of peers and shape negative perceptions within the digital community. The objectives of this study were to identify the level of awareness among UTM students regarding the internalization of Islamic values, to determine the level and forms of online bullying behavior among UTM students, and to analyze the factors influencing the internalization of Islamic values and the tendency to engage in online bullying among the students. This study employed a quantitative approach using descriptive analysis involving 379 Universiti Teknologi Malaysia students. The findings indicate that the majority of students demonstrate a high level of internalization of Islamic values, while internal and external factors such as faith, self-values, peer influence, and social media usage have a significant impact on ethical behavior in digital interactions. Based on these findings, it is expected that responsible parties, including the students themselves, the university, lecturers, the government, and policymakers, will develop more effective educational strategies and approaches to guide students in becoming individuals who are morally upright, responsible, and digitally literate.

PERSEPSI GURU DAN PELAJAR TERHADAP PELAKSANAAN TALAQQI AL-QURAN SECARA ATAS TALIAN

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Kajian ini bertujuan untuk mengkaji persepsi guru dan pelajar terhadap pelaksanaan talaqqi al-Quran secara atas talian. Secara khususnya, kajian ini dijalankan untuk mengenal pasti bentuk dan pelaksanaan talaqqi al-Quran secara atas talian, menganalisis persepsi guru dan pelajar terhadap keberkesanannya serta menilai cabaran dan peluang yang wujud dalam pelaksanaannya. Kajian ini menggunakan pendekatan kualitatif berbentuk deskriptif. Data kajian diperoleh melalui temu bual separa berstruktur yang melibatkan enam orang responden, iaitu tiga orang guru al-Quran dan tiga orang pelajar yang mempunyai pengalaman dalam pelaksanaan atau pembelajaran talaqqi al-Quran secara atas talian. Data temu bual dianalisis menggunakan kaedah analisis tematik. Dapatan kajian menunjukkan bahawa talaqqi al-Quran secara atas talian dilaksanakan secara individu antara guru dan pelajar dengan menggunakan platform digital seperti Google Meet, Zoom dan WhatsApp. Fokus utama pengajaran adalah kepada pembetulan bacaan, tahsin, tajwid, makhraj huruf serta interaksi langsung antara guru dan pelajar. Dari aspek keberkesanan, dapatan menunjukkan bahawa talaqqi al-Quran secara atas talian berfungsi sebagai alternatif yang berkesan kepada talaqqi bersemuka, khususnya dalam membantu pelajar memperbaiki bacaan dan meningkatkan kefahaman tajwid. Walau bagaimanapun, kaedah ini tidak dapat menggantikan sepenuhnya talaqqi secara bersemuka kerana terdapat batasan dari aspek pemerhatian makhraj, kualiti audio, penggunaan kamera, suasana pembelajaran dan pemeliharaan adab. Antara cabaran utama yang dikenal pasti ialah masalah capaian internet, gangguan audio, kekangan masa, komitmen pelajar, fokus, disiplin dan gangguan keluarga. Namun begitu, talaqqi secara atas talian turut menawarkan peluang yang besar dari aspek fleksibiliti masa dan tempat, penjimatan masa serta akses pembelajaran yang lebih luas. Kesimpulannya, talaqqi al-Quran secara atas talian sesuai dilaksanakan sebagai alternatif dan pelengkap kepada talaqqi bersemuka, selagi prinsip asas talaqqi seperti bimbingan guru, semakan bacaan, pembetulan tajwid dan adab menuntut ilmu terus dipelihara.

This study aims to examine teachers' and students' perceptions of the implementation of online talaqqi al-Quran. Specifically, this study seeks to identify the forms and implementation of online talaqqi al-Quran, analyse teachers' and students' perceptions of its effectiveness, and evaluate the challenges and opportunities involved in its implementation. This study employed a qualitative approach with a descriptive research design. The data were obtained through semi-structured interviews involving six respondents, comprising three al-Quran teachers and three students who had experience in conducting or participating in online talaqqi al-Quran. The interview data were analysed using thematic analysis. The findings show that online talaqqi al-Quran is implemented individually between teacher and student through digital platforms such as Google Meet, Zoom and WhatsApp. The main focus of teaching is on correcting recitation, tahsin, tajwid, makhraj of letters, and direct interaction between teacher and student. In terms of effectiveness, the findings indicate that online talaqqi al-Quran functions as an effective alternative to face-to-face talaqqi, particularly in helping students improve their recitation and enhance their understanding of tajwid. However, this method cannot fully replace face-to-face talaqqi due to several limitations, particularly in observing makhraj, audio quality, camera usage, learning environment and the preservation of adab. The main challenges identified include internet connectivity issues, audio disruptions, time constraints, student commitment, focus, discipline and family distractions. Nevertheless, online talaqqi also offers significant opportunities in

terms of time and location flexibility, time saving and wider access to learning. In conclusion, online talaqqi al-Quran is suitable to be implemented as an alternative and complement to face-to-face talaqqi, as long as the fundamental principles of talaqqi, such as teacher guidance, recitation review, tajwid correction and the adab of seeking knowledge, are continuously preserved.

KURIKULUM YAKIN DAN TAWAKAL SERTA KAEDAH PENGAJARAN AL-QURAN DAN HADIS DALAM RIYAD AL-SALIHIN KARYA IMAM AL-NAWAWI

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Kajian ini bertujuan menganalisis kurikulum yakin dan tawakal serta kaedah pengajaran al-Quran dan hadis berdasarkan Bab Fi al-Yaqin wa al-Tawakkal dalam kitab Riyad al-Salihin karya Imam al-Nawawi. Kajian ini memfokuskan kepada analisis konsep yakin dan tawakal serta penelitian kaedah pengamalan nilai-nilai tersebut berdasarkan al-Quran dan hadis, di samping meneroka kaedah pengajaran yang sesuai untuk diterapkan dalam proses pendidikan Islam. Kajian menggunakan pendekatan kualitatif melalui analisis kandungan terhadap enam ayat al-Quran dan sebelas hadis dengan bantuan perisian NVivo. Dapatan kajian menunjukkan bahawa konsep yakin dan tawakal berteraskan kebergantungan kepada Allah SWT, penyerahan diri, keyakinan terhadap janji-Nya serta keseimbangan antara usaha dan tawakal. Dari aspek pengamalan, lapan tema utama dikenal pasti, manakala kaedah pengajaran dan pembelajaran turut memperlihatkan pelbagai pendekatan seperti perintah langsung, dialog, penceritaan, perbandingan, tarbiyah, motivasi dan qudwah. Berdasarkan dapatan kajian, tiga model utama telah dibangunkan iaitu Model Kurikulum Yakin dan Tawakal, Model Kaedah Pengamalan Yakin dan Tawakal serta Model Kaedah Pengajaran dan Pembelajaran Yakin dan Tawakal. Ketiga-tiga model ini membuktikan bahawa pendekatan Imam al-Nawawi dan syarah Ibn ‘Alan bersifat menyeluruh serta relevan untuk diaplikasikan dalam pendidikan Islam kontemporari. Kajian ini mencadangkan agar model-model yang dihasilkan dijadikan rujukan dalam pembangunan kurikulum Pendidikan Islam, latihan guru dan program pembangunan sahsiah pelajar.

This study aims to analyse the curriculum of yaqin (certainty) and tawakkal (reliance upon Allah) as well as the teaching methods derived from the Qur’an and Hadith in the chapter Fi al-Yaqin wa al-Tawakkal of Riyad al-Salihin by Imam al-Nawawi. This study focuses on analysing the concepts of yaqīn (certainty) and tawakkul (reliance upon Allah), as well as examining the methods of practising these values based on the Quran and Hadith, while exploring appropriate teaching methods for their implementation in Islamic education. A qualitative approach was employed through content analysis of six Qur’anic verses and eleven hadiths using NVivo software. The findings reveal that the concepts of yaqin and tawakkal are founded upon complete reliance on Allah SWT, self-surrender, confidence in His promises, and the balance between effort and reliance upon Him. In terms of practice, eight major themes were identified, while the teaching and learning methods encompass various approaches, including direct instruction, dialogue, storytelling, comparison, tarbiyah (spiritual nurturing), motivation, and qudwah (exemplary role modelling). Based on the findings, three major models were developed, namely the Yaqin and Tawakkal Curriculum Model, the Yaqin and Tawakkal Practice Model, and the Yaqin and Tawakkal Teaching and Learning Model. These models demonstrate that Imam al-Nawawi’s approach and Ibn ‘Alan’s commentary are holistic in nature and remain relevant for application in contemporary Islamic education. The study recommends that these models be utilised as references in the development of Islamic Education curricula, teacher training programmes, and student character development initiatives.

TAHAP KEFAHAMAN, AMALAN DAN FAKTOR YANG MEMPENGARUHI PENGURUSAN KEWANGAN PATUH SYARIAH DALAM KALANGAN MAHASISWA

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Kajian ini bertujuan untuk menilai tahap kefahaman, perbezaan pengetahuan, amalan serta faktor yang mempengaruhi pengurusan kewangan patuh syariah dalam kalangan mahasiswa Universiti Teknologi Malaysia (UTM). Kajian ini menggunakan kaedah kuantitatif melalui soal selidik terhadap 382 orang responden. Dapatan kajian menunjukkan tahap keseluruhan adalah tinggi bagi semua bahagian iaitu kefahaman asas kewangan patuh syariah (min=4.34), perbezaan produk kewangan Islam dan konvensional (min=4.24), amalan kewangan patuh syariah (min=4.18), serta faktor pengaruh (min=4.28). Hasil kajian menunjukkan bahawa mahasiswa mempunyai kefahaman yang baik dan mengamalkan pengurusan kewangan berasaskan prinsip Islam. Faktor keluarga, pendidikan agama, rakan sebaya dan media sosial didapati mempengaruhi tingkah laku kewangan mereka. Kesimpulannya, tahap literasi kewangan patuh syariah dalam kalangan mahasiswa adalah baik namun masih boleh dipertingkatkan melalui pendidikan dan pendedahan berterusan.

This study aims to examine the level of understanding, knowledge differentiation, practices, and influencing factors of Shariah-compliant financial management among students of Universiti Teknologi Malaysia (UTM). A quantitative approach was employed using a questionnaire involving 382 respondents. The findings indicate a high overall level across all sections, including basic understanding of Shariah finance (mean=4.34), differentiation between Islamic and conventional financial products (mean=4.24), Shariah-compliant financial practices (mean=4.18), and influencing factors (mean=4.28). The results show that students have good understanding and practice Islamic financial principles in their daily lives. Key influencing factors include family, religious education, peers, and social media. In conclusion, the level of Shariah financial literacy among students is good but can be further improved through continuous education and exposure.

FAKTOR-FAKTOR YANG MEMPENGARUHI KEMAHIRAN BERFIKIR ARAS TINGGI DALAM PENGAJARAN SIRAH TERHADAP PELAJAR DI SEKOLAH MENENGAH

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Kajian ini berada dalam bidang Pendidikan Islam dengan memberi tumpuan kepada penerapan Kemahiran Berfikir Aras Tinggi (KBAT) dalam pengajaran Sirah di sekolah menengah. Masalah kajian ini berpunca daripada cabaran guru dalam melaksanakan pengajaran Sirah yang bukan sahaja menekankan penguasaan fakta sejarah, tetapi juga memerlukan murid berfikir secara kritis, analitis dan aplikatif. Oleh itu, kajian ini bertujuan untuk meneroka faktor-faktor yang mempengaruhi penerapan KBAT dalam pengajaran Sirah, mengenal pasti kaedah pengajaran yang digunakan oleh guru Pendidikan Islam serta meneliti cabaran yang dihadapi dalam pelaksanaannya. Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk kajian kes. Data kajian diperoleh melalui temu bual separa berstruktur bersama tiga orang guru Pendidikan Islam yang dipilih secara pensampelan bertujuan. Data temu bual dianalisis menggunakan pendekatan analisis tematik bagi mengenal pasti tema-tema utama yang berkaitan dengan objektif kajian. Dapatan kajian menunjukkan bahawa penerapan KBAT dalam pengajaran Sirah dipengaruhi oleh peranan guru, faktor murid dan minat pelajar. Kaedah pengajaran yang digunakan pula merangkumi penyoalan, pembelajaran berasaskan pertanyaan, pembelajaran kolaboratif, pendekatan PAK21, penggunaan bahan bantu mengajar dan teknologi, simulasi serta kajian kes. Cabaran utama yang dikenal pasti ialah kandungan Sirah yang bersifat fakta dan sejarah lampau, perbezaan keupayaan murid, kekangan masa dan silibus serta minat pelajar. Secara keseluruhannya, kajian ini merumuskan bahawa keberkesanan penerapan KBAT dalam pengajaran Sirah bergantung kepada kesiapsiagaan guru, kesesuaian kaedah pengajaran dan tahap kesediaan murid dalam pembelajaran.

This study is situated in the field of Islamic Education, focusing on the implementation of Higher Order Thinking Skills (HOTS) in the teaching of Sirah at secondary schools. The research problem arises from the challenges faced by teachers in teaching Sirah, which should not only emphasise the mastery of historical facts but also encourage students to think critically, analytically and applicatively. Therefore, this study aims to explore the factors influencing the implementation of HOTS in Sirah teaching, identify the teaching methods used by Islamic Education teachers, and examine the challenges faced in its implementation. This study employed a qualitative approach with a case study design. Data were collected through semi-structured interviews with three Islamic Education teachers selected through purposive sampling. The interview data were analysed using thematic analysis to identify the main themes related to the research objectives. The findings show that the implementation of HOTS in Sirah teaching is influenced by the role of teachers, student factors and students' interest. The teaching methods used include questioning, inquiry-based learning, collaborative learning, 21st-century learning approaches, the use of teaching aids and technology, simulation and case studies. The main challenges identified are the factual and historical nature of Sirah content, differences in students' abilities, time and syllabus constraints, and students' interest. Overall, this study concludes that the effectiveness of HOTS implementation in Sirah teaching depends on teachers' readiness, the suitability of teaching methods and students' preparedness in learning.

KAJIAN KES PENGURUSAN ZAKAT UNTUK PENDIDIKAN DI MAJLIS AGAMA ISLAM NEGERI

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Kajian ini bertujuan mengenal pasti cabaran, pelaksanaan dan keberkesanan agihan zakat pendidikan di Majlis Agama Islam Negeri Johor (MAIJ), Majlis Agama Islam Melaka (MAIM) dan Majlis Agama Islam Negeri Sembilan (MAINS). Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk kajian kes. Data dikumpulkan melalui temu bual separa berstruktur yang melibatkan tiga orang pegawai yang bertanggungjawab dalam pengurusan zakat pendidikan di ketiga-tiga institusi tersebut. Data temu bual dianalisis menggunakan kaedah analisis tematik bagi mengenal pasti tema dan subtema yang berkaitan dengan objektif kajian. Hasil kajian menunjukkan bahawa pengurusan zakat pendidikan di ketiga-tiga institusi dilaksanakan secara sistematik melalui proses permohonan, penilaian, kelulusan dan agihan bantuan. Walau bagaimanapun, beberapa cabaran dikenal pasti, antaranya kekangan sistem dan operasi, pengurusan maklumat pemohon serta faktor kewangan dan dasar. Dapatan kajian turut menunjukkan bahawa bantuan zakat pendidikan memberi kesan positif kepada pelajar asnaf dengan membantu mengurangkan beban kewangan, meningkatkan motivasi untuk meneruskan pengajian serta menyokong pembangunan masa hadapan mereka. Secara keseluruhannya, kajian ini menunjukkan bahawa pengurusan zakat pendidikan yang cekap dan tersusun mampu meningkatkan keberkesanan agihan bantuan kepada pelajar asnaf. Kajian ini diharapkan dapat menjadi rujukan kepada Majlis Agama Islam Negeri (MAIN), penyelidik serta pihak berkepentingan dalam usaha memperkukuh pengurusan zakat pendidikan di Malaysia.

This study aims to identify the challenges, implementation, and effectiveness of educational zakat management at the Johor Islamic Religious Council (MAIJ), Melaka Islamic Religious Council (MAIM), and Negeri Sembilan Islamic Religious Council (MAINS). A qualitative approach employing a case study design was adopted. Data were collected through semi-structured interviews involving three officers who were directly responsible for managing educational zakat in the respective institutions. The interview data were analysed using thematic analysis to identify themes and subthemes related to the research objectives. The findings indicate that the management of educational zakat in the three institutions is carried out systematically through application, assessment, approval, and distribution processes. Nevertheless, several challenges were identified, including system and operational constraints, applicant information management, as well as financial and policy-related issues. The findings also reveal that educational zakat assistance has a positive impact on asnaf students by reducing their financial burden, encouraging them to continue their studies, and supporting their future educational and personal development. In conclusion, this study demonstrates that an efficient and well-organised educational zakat management system enhances the effectiveness of zakat distribution to eligible asnaf students. It is hoped that the findings of this study will serve as a useful reference for the State Islamic Religious Councils (MAIN), researchers, and other relevant stakeholders in strengthening the management of educational zakat in Malaysia.

PENGHAYATAN ISLAM SEBAGAI AD-DIN DALAM PEMBENTUKAN SAHSIAH PELAJAR

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Kajian ini bertujuan untuk menganalisis pengaruh penghayatan Islam sebagai Ad-Din dalam pembentukan sahsiah pelajar di peringkat sekolah menengah, dengan fokus kepada kefahaman dan amalan pelajar serta implikasinya terhadap tingkah laku, hubungan sosial, dan akhlak harian. Kajian ini menggunakan pendekatan kualitatif melalui temu bual separa berstruktur yang melibatkan lapan pelajar dari sekolah terpilih untuk mendapatkan data yang komprehensif dan mendalam. Analisis data dijalankan dengan menggunakan kaedah tematik, memfokuskan kepada tema penghayatan Islam dan kesannya terhadap sahsiah pelajar, termasuk hubungan mereka dengan Allah, diri sendiri, keluarga, rakan sebaya dan masyarakat. Dapatan kajian menunjukkan bahawa pelajar yang memahami dan mengamalkan prinsip Islam sebagai Ad-Din mempamerkan tingkah laku yang positif, berdisiplin, amanah, menghormati guru dan rakan sebaya, tahap tanggungjawab sosial yang tinggi, dan interaksi yang harmoni dalam komuniti sekolah dan keluarga. Pengamalan Islam juga meningkatkan akhlak mulia, kesedaran etika, dan perkembangan akhlak yang bertanggungjawab, sekali gus menyumbang kepada penciptaan masyarakat yang lebih harmoni. Kajian ini menekankan kepentingan pendekatan pengajaran Islam yang komprehensif di sekolah untuk meningkatkan akhlak pelajar dan memupuk individu yang beretika, bertanggungjawab, dan memiliki sifat-sifat mulia.

This study aims to analyze the influence of the appreciation of Islam as Ad-Dīn in the formation of students' personalities at the secondary school level, with a focus on students' understanding and practice as well as its implications for behavior, social relationships, and daily morality. This study uses a qualitative approach through semistructured interviews involving eight students from selected schools to obtain comprehensive and in-depth data. Data analysis was conducted using thematic methods, focusing on the theme of the appreciation of Islam and its impact on students' personalities, including their relationships with Allah, themselves, family, peers, and society. The study findings show that students who understand and practice the principles of Islam as Ad-Dīn exhibit positive behavior, discipline, trust, respect for teachers and peers, a high level of social responsibility, and harmonious interactions in the school and family community. The practice of Islam also improves moral character, ethical awareness, and the development of responsible morals, thus contributing to the creation of a more harmonious society. This study emphasizes the importance of a comprehensive approach to teaching Islam in schools to improve students' moral character and cultivate individuals who are ethical, responsible, and have noble qualities.

PENGARUH PERANAN GURU PENDIDIKAN ISLAM TERHADAP AKHLAK PELAJAR DI SEKOLAH

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Kajian ini bertujuan mengenal pasti pengaruh peranan Guru Pendidikan Islam terhadap akhlak pelajar di sekolah. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Soal selidik digunakan sebagai instrumen kajian dan melibatkan 35 orang Guru Pendidikan Islam daripada lima buah sekolah menengah kebangsaan di Johor Bahru. Data dianalisis menggunakan perisian IBM SPSS Statistics versi 29.0.2.0 melalui analisis deskriptif dan korelasi Pearson. Dapatan kajian menunjukkan bahawa tahap kaedah pengajaran, amalan teladan guru, motivasi guru dan akhlak pelajar berada pada tahap tinggi. Analisis korelasi Pearson menunjukkan terdapat hubungan yang signifikan antara kaedah pengajaran, amalan teladan guru dan motivasi guru dengan akhlak pelajar. Kaedah pengajaran menunjukkan hubungan yang paling kuat dengan akhlak pelajar berbanding amalan teladan guru dan motivasi guru. Kesimpulannya, peranan Guru Pendidikan Islam mempunyai hubungan yang signifikan dengan akhlak pelajar di sekolah.

This study aims to identify the influence of the role of Islamic Education teachers on students' moral character in schools. A quantitative approach with a survey research design was employed. A questionnaire was used as the research instrument, involving 35 Islamic Education teachers from five national secondary schools in Johor Bahru as respondents. The data were analysed using IBM SPSS Statistics Version 29.0.2.0 through descriptive analysis and Pearson correlation analysis. The findings indicate that the levels of teaching methods, teachers' role modelling, teacher motivation, and students' moral character are high. The Pearson correlation analysis shows significant relationships between teaching methods, teachers' role modelling, teacher motivation, and students' moral character. Among the three variables, teaching methods demonstrate the strongest relationship with students' moral character. In conclusion, the role of Islamic Education teachers has a significant relationship with students' moral character in schools.

PENGARUH PEGANGAN AGAMA DAN RASUAH AKADEMIK KEPADA AMALAN INTEGRITI DALAM KALANGAN MAHASISWA PENDIDIKAN TAHUN AKHIR DI UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini bertujuan mengenal pasti tahap dan pengaruh pegangan agama serta persepsi rasuah akademik terhadap amalan integriti dalam kalangan mahasiswa pendidikan tahun akhir di Universiti Teknologi Malaysia (UTM). Kajian kuantitatif berbentuk tinjauan ini menggunakan instrumen soal selidik. Seramai 181 responden daripada populasi 244 mahasiswa dipilih melalui teknik persampelan rawak mudah. Analisis data menggunakan perisian SPSS mendedahkan tahap persepsi rasuah berada pada tahap tinggi (Min = 3.86), namun kesediaan membudayakan amalan integriti hanya di tahap sederhana (Min = 3.44). Ujian Regresi Pelbagai membuktikan gabungan kedua-dua pemboleh ubah menyumbang sebanyak 44.6 peratus terhadap kesediaan integriti. Pegangan agama dikenal pasti sebagai peramal paling dominan dan positif, manakala persepsi rasuah memberikan pengaruh negatif apabila diuji secara serentak. Kesimpulannya, pemahaman teori mengenai rasuah semata-mata tidak memadai untuk membentuk pendidik beretika jika tidak dipasak dengan kerohanian. Latihan perguruan sewajarnya mengintegrasikan elemen penghayatan agama secara holistik.

This study aims to identify the level and influence of religious beliefs and perceptions of academic corruption on the willingness to cultivate integrity practices among final year education students at Universiti Teknologi Malaysia (UTM). This quantitative survey study used a questionnaire instrument. A total of 181 respondents from a population of 244 students were selected through simple random sampling techniques. Data analysis using SPSS software revealed that the level of corruption perception was at a high level (Mean = 3.86), but the willingness to cultivate integrity practices was only at a moderate level (Mean = 3.44). Multiple Regression Tests proved that the combination of both variables contributed 44.6 percent to integrity readiness. Religious beliefs were identified as the most dominant and positive predictor, while perceptions of corruption had a negative influence when tested simultaneously. In conclusion, theoretical understanding of corruption alone is not sufficient to form ethical educators if not seasoned with spirituality. Teacher training should integrate elements of religious appreciation holistically.

FAKTOR YANG MEMPENGARUHI KEBERKESANAN PENGGUNAAN CHATGPT DALAM KALANGAN MAHASISWA PENGAJIAN ISLAM DI UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini dijalankan bagi mengenal pasti faktor yang mempengaruhi keberkesanan Penggunaan ChatGPT dalam kalangan mahasiswa Pengajian Islam di Universiti Teknologi Malaysia. Secara khususnya, kajian ini bertujuan menilai persepsi mahasiswa terhadap penggunaan ChatGPT sebagai alat bantu pembelajaran, menentukan tahap penggunaan dan penerimaan ChatGPT, mengenal pasti cabaran utama dalam penggunaannya serta menganalisis faktor yang mempengaruhi keberkesanan penggunaan ChatGPT sebagai sokongan pembelajaran. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan deskriptif. Instrumen kajian berbentuk soal selidik telah diedarkan kepada mahasiswa Pengajian Islam di Universiti Teknologi Malaysia dan data yang diperoleh telah dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS). Analisis data melibatkan statistik deskriptif seperti kekerapan, peratusan, min dan sisihan piawai, serta analisis regrasi linear berganda bagi mengenal pasti faktor yang mempengaruhi keberkesanan penggunaan ChatGPT. Dapatan kajian menunjukkan bahawa persepsi mahasiswa terhadap penggunaan ChatGPT berada pada tahap tinggi dengan nilai min 4.02. Tahap penggunaan dan penerimaan ChatGPT juga berada pada tahap tinggi dengan nilai min 4.05. Seterusnya, cabaran penggunaan ChatGPT mencatatkan nilai min tertinggi, iaitu 4.08, yang menunjukkan mahasiswa mempunyai kesedaran tinggi terhadap isu ketepatan maklumat agama, risiko plagiarisme, kebergantungan terhadap teknologi dan keperluan bimbingan pensyarah. Hasil analisis regrasi menunjukkan bahawa model regrasi adalah signifikan dengan nilai $R^2 = .447$, iaitu sebanyak 44.7% perubahan dalam keberkesanan penggunaan ChatGPT dapat dijelaskan oleh faktor persepsi, tahap penggunaan dan penerimaan serta cabaran penggunaan ChatGPT. Dapatan juga menunjukkan bahawa persepsi terhadap penggunaan ChatGPT merupakan faktor paling dominan, diikuti tahap penggunaan dan penerimaan ChatGPT. Walau bagaimanapun, cabaran penggunaan ChatGPT tidak menunjukkan pengaruh yang signifikan. Kesimpulannya, ChatGPT berpotensi menjadi alat sokongan pembelajaran yang berkesan sekiranya digunakan secara beretika, berpandu dan selari dengan nilai Pengajian Islam.

This study was conducted to identify the factors influencing the effectiveness of ChatGPT integration among Islamic Studies students at Universiti Teknologi Malaysia. Specifically, this study aims to assess student's perceptions of ChatGPT as a learning support tool, determine the level of ChatGPT usage and acceptance, identify the main challenges in its integration, and analyse the factors influencing the readiness and effectiveness of ChatGPT as a learning support tool. This study employed a quantitative approach using a descriptive survey design. A questionnaire was distributed to Islamic Studies students at Universiti Teknologi Malaysia, and the data obtained were analysed using the Statistical Package for the Social Sciences (SPSS). The data analysis involved descriptive statistics, including frequency, percentage, mean and standard deviation, as well as multiple linear regression analysis to identify the factors influencing the effectiveness of ChatGPT integration. The findings revealed that student's perceptions of ChatGPT were at a high level, with a mean score of 4.02. The level of ChatGPT usage and acceptance was also high, with a mean score of 4.05. Furthermore, the challenges of ChatGPT integration recorded the highest mean score of 4.08, indicating that students demonstrated a high level of awareness regarding issues such as the accuracy of religious information, the risk of plagiarism, dependence on technology and the need for lecturer guidance. The regression analysis showed that the regression model

was significant, with an R^2 value of .447, indicating that 44.7% of the variance in the effectiveness of ChatGPT integration was explained by student's perceptions, level of usage and acceptance, and challenges of ChatGPT integration. The findings also revealed that perception towards ChatGPT usage was the most dominant factor, followed by the level of ChatGPT usage and acceptance. However, the challenges of ChatGPT integration did not show a significant influence. In conclusion, ChatGPT has the potential to serve as an effective learning support tool when used ethically, with proper guidance and in accordance with the values of Islamic Studies.

KURIKULUM TAKWA DAN KAEDAH PENGAJARAN AL-QURAN DAN HADITH DALAM RIYAD AL-SALIHIN KARYA IMAM AL-NAWAWI

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Kajian ini bertujuan meneroka kurikulum takwa dan kaedah pengajaran al-Quran dan hadith dalam Riyad al-Salihin karya Imam al-Nawawi dengan merujuk kepada syarah Dalil al-Falihin oleh Ibn 'Alan. Kajian ini dilaksanakan berasaskan tiga objektif utama, iaitu meneroka konsep takwa berdasarkan ayat al-Quran dan hadis yang dihimpunkan oleh Imam al-Nawawi, meneliti cara pengamalan nilai takwa menurut panduan al-Quran dan hadis, serta menganalisis kaedah pengajaran nilai takwa yang ditampilkan dalam Riyad al-Salihin dan Dalil al-Falihin. Kajian ini menggunakan pendekatan kualitatif melalui kaedah analisis kandungan terhadap teks hadis, ayat al-Quran dan syarah yang berkaitan dengan tema takwa. Dapatan kajian menunjukkan bahawa kurikulum takwa menurut paradigma Imam al-Nawawi terbina daripada lima komponen utama, iaitu definisi takwa, asas takwa, ciri takwa, aspek larangan dan kesan takwa. Pengamalan takwa pula merangkumi lapan aspek utama yang melibatkan pembinaan keimanan, hati dan rohani, akhlak, pertimbangan tindakan, kesabaran menghadapi ujian, istiqamah dalam amalan, hubungan sosial serta orientasi akhirat. Sementara itu, kaedah pengajaran dan pembelajaran takwa dikenal pasti melalui lima pendekatan utama, iaitu kaedah penjelasan, pendalilan, penyampaian, bimbingan dan motivasi yang berteraskan al-Quran dan hadis. Dapatan ini membuktikan bahawa pendidikan takwa menurut Imam al-Nawawi bersifat holistik, integratif dan berorientasikan pembentukan insan yang seimbang dari aspek ilmu, amalan, akhlak, dan kerohanian. Kajian ini telah menghasilkan tiga model utama, iaitu Model Kurikulum Takwa Menurut Paradigma Imam al-Nawawi, Model Kaedah Pengamalan Takwa Menurut Paradigma Imam al-Nawawi, dan Model Kaedah Pengajaran dan Pembelajaran Takwa Menurut Paradigma Imam al-Nawawi. Ketiga-tiga model ini berpotensi dijadikan kerangka rujukan dalam pembangunan kurikulum, pedagogi dan program pembinaan sahsiah berasaskan takwa di pelbagai peringkat pendidikan Islam. Kajian lanjutan dicadangkan untuk menguji keberkesanan model-model ini melalui pendekatan kuantitatif, pembangunan modul serta kajian tindakan dalam konteks pendidikan semasa.

This study aims to explore the curriculum of taqwa (God-consciousness) and the methods of teaching the Qur'an and Hadith in Riyad al-Salihin by Imam al-Nawawi, with reference to its commentary, Dalil al-Falihin, by Ibn 'Alan. The study was conducted based on three main objectives: (1) to explore the concept of taqwa as presented in the Qur'anic verses and hadiths compiled by Imam al-Nawawi and elaborated by Ibn 'Alan; (2) to examine the methods of practising the values of taqwa based on the guidance of the Qur'an and Hadith as explained in Riyad al-Salihin and Dalil al-Falihin; and (3) to analyse the teaching methods of taqwa

according to the Qur'anic and Prophetic approaches presented in both works. This research employed a qualitative approach using content analysis of relevant Qur'anic verses, hadiths, and the commentary of Ibn 'Alan concerning the theme of taqwa. The findings reveal that the curriculum of taqwa according to Imam al-Nawawi's paradigm consists of five major components: the definition of taqwa, the foundations of taqwa, the characteristics of taqwa, the prohibitions related to taqwa, and the effects of taqwa. The practice of taqwa is further structured around eight major dimensions, namely faith and intention, spiritual and inner development, morality and dignity, judgment and evaluation, patience in facing trials, righteous deeds and steadfastness, social relationships and responsibilities, and orientation towards the Hereafter. In addition, the study identifies five principal approaches to teaching and learning taqwa: explanatory methods, evidential methods, instructional delivery methods, guidance methods, and motivational methods, all of which are grounded in the Qur'an and Hadith. These findings demonstrate that the educational framework of taqwa according to Imam al-Nawawi is holistic, integrated, and oriented towards the development of balanced individuals in terms of knowledge, practice, morality, and spirituality. This study has produced three major models: the Taqwa Curriculum Model according to Imam al-Nawawi's Paradigm, the Taqwa Practice Model according to Imam al-Nawawi's Paradigm, and the Taqwa Teaching and Learning Model according to Imam al-Nawawi's Paradigm. These models have the potential to serve as conceptual frameworks for curriculum development, pedagogy, and character-building programmes based on taqwa at various levels of Islamic education. Future research is recommended to evaluate the effectiveness of these models through quantitative studies, module development, and action research within contemporary educational contexts.

PERSEPSI MAHASISWA TERHADAP KURIKULUM PENDIDIKAN PENGAJIAN ISLAM DAN HUBUNGANNYA DENGAN PERSONALITI ISLAMIK DI UTM

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Kurikulum Pendidikan Pengajian Islam berperanan penting dalam membentuk kefahaman, penghayatan nilai dan keperibadian mahasiswa sebagai bakal pendidik Muslim. Sehubungan itu, kajian ini bertujuan untuk mengenal pasti persepsi mahasiswa terhadap Kurikulum Pendidikan Pengajian Islam serta hubungannya dengan Personaliti Islamik Mahasiswa Ijazah Sarjana Muda Pendidikan (Pengajian Islam) di Universiti Teknologi Malaysia (UTM). Fokus kajian merangkumi tiga aspek kurikulum, iaitu kandungan kurikulum, pendekatan pengajaran dan pembelajaran serta aktiviti sokongan kurikulum. Personaliti Islamik Mahasiswa pula diteliti berdasarkan empat aspek, iaitu akhlak peribadi, tanggungjawab sosial, jati diri sebagai pendidik Muslim dan kerohanian. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan dengan soal selidik berskala Likert lima mata sebagai instrumen kajian. Seramai 115 orang responden yang terdiri daripada mahasiswa Ijazah Sarjana Muda Pendidikan (Pengajian Islam) di UTM dari Tahun Satu hingga Tahun Empat telah terlibat dalam kajian ini. Data kajian dianalisis menggunakan perisian SPSS versi 31 melalui analisis deskriptif dan korelasi Pearson. Dapatan kajian menunjukkan bahawa persepsi mahasiswa terhadap Kurikulum Pendidikan Pengajian Islam berada pada tahap tinggi dengan nilai min keseluruhan 4.60 dan sisihan piawai 0.43. Tahap Personaliti Islamik Mahasiswa juga berada pada tahap tinggi dengan nilai min keseluruhan 4.58 dan sisihan piawai 0.42. Analisis korelasi Pearson menunjukkan terdapat hubungan positif yang signifikan antara Kurikulum Pendidikan Pengajian Islam dengan Personaliti Islamik Mahasiswa, iaitu r

= .555 dan p < .001. Secara keseluruhannya, dapatan ini menunjukkan bahawa Kurikulum Pendidikan Pengajian Islam mempunyai hubungan yang positif dan signifikan dengan Personaliti Islamik Mahasiswa. Persepsi yang positif terhadap kurikulum turut berkait secara signifikan dengan aspek akhlak peribadi, tanggungjawab sosial, jati diri sebagai pendidik Muslim dan kerohanian mahasiswa.

The Islamic Studies Education Curriculum plays an important role in shaping students' understanding, appreciation of values, and personality as prospective Muslim educators. Accordingly, this study aims to identify students' perceptions of the Islamic Studies Education Curriculum and its relationship with the Islamic Personality of Bachelor of Education (Islamic Studies) students at Universiti Teknologi Malaysia (UTM). The study focuses on three aspects of the curriculum, namely curriculum content, teaching and learning approaches, and curriculum support activities. Students' Islamic Personality is examined based on four aspects, namely personal morality, social responsibility, identity as Muslim educators, and spirituality. This study employs a quantitative survey approach using a five-point Likert scale questionnaire as the research instrument. A total of 115 respondents, consisting of Bachelor of Education (Islamic Studies) students at UTM from Year One to Year Four, participated in this study. The data were analysed using SPSS version 31 through descriptive analysis and Pearson correlation. The findings show that students' perceptions of the Islamic Studies Education Curriculum were at a high level, with an overall mean score of 4.60 and a standard deviation of 0.43. The level of Students' Islamic Personality was also high, with an overall mean score of 4.58 and a standard deviation of 0.42. Pearson correlation analysis showed that there was a significant positive relationship between the Islamic Studies Education Curriculum and Students' Islamic Personality, with r = .555 and p < .001. Overall, the findings indicate that the Islamic Studies Education Curriculum has a significant positive relationship with Students' Islamic Personality. Positive perceptions of the curriculum were also significantly associated with students' personal morality, social responsibility, identity as Muslim educators, and spirituality.

KESAN PENGALAMAN LATIHAN MENGAJAR TERHADAP PEMBENTUKAN PROFESIONALISME DAN SAHSIAH MAHASISWA JURUSAN PENDIDIKAN DI UTM

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Kajian ini dijalankan bagi mengkaji kesan pengalaman latihan mengajar terhadap pembentukan profesionalisme dan sahsiah mahasiswa jurusan Pendidikan di Universiti Teknologi Malaysia (UTM). Kajian ini menggunakan pendekatan kuantitatif melalui kaedah tinjauan dengan borang soal selidik sebagai instrumen kajian. Responden kajian terdiri daripada 140 orang mahasiswa tahun empat jurusan Pendidikan di UTM yang beragama Islam dan telah menjalani latihan mengajar. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui statistik deskriptif dan korelasi Pearson. Dapatan kajian menunjukkan bahawa pengalaman latihan mengajar berada pada tahap tinggi dengan nilai min 4.40, profesionalisme guru pelatih berada pada tahap tinggi dengan nilai min 4.57, manakala pembentukan sahsiah turut berada pada tahap tinggi dengan nilai min 4.53. Analisis korelasi Pearson menunjukkan terdapat hubungan positif yang kuat dan signifikan antara pengalaman latihan mengajar dengan profesionalisme guru pelatih ($r = 0.827$, $p < 0.001$), pengalaman latihan mengajar dengan pembentukan sahsiah ($r = 0.785$, $p < 0.001$), serta profesionalisme guru pelatih dengan pembentukan sahsiah ($r = 0.817$, $p < 0.001$). Secara keseluruhannya, dapatan kajian membuktikan bahawa pengalaman latihan mengajar memainkan peranan penting dalam membentuk profesionalisme dan sahsiah mahasiswa jurusan Pendidikan di UTM. Oleh itu, latihan mengajar perlu terus diperkukuh sebagai medium pembangunan bakal guru yang berilmu, profesional dan mempunyai sahsiah yang baik.

This study was conducted to examine the effects of teaching practicum experience on the development of professionalism and character among Education students at Universiti Teknologi Malaysia (UTM). This study employed a quantitative approach using a survey method, with a questionnaire as the research instrument. The respondents consisted of 140 fourth-year Muslim Education students at UTM who had undergone teaching practicum. The data were analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive statistics and Pearson correlation analysis. The findings showed that teaching practicum experience was at a high level, with a mean score of 4.40. Trainee teachers' professionalism was also at a high level, with a mean score of 4.57, while character development was similarly at a high level, with a mean score of 4.53. Pearson correlation analysis revealed a strong and significant positive relationship between teaching practicum experience and trainee teachers' professionalism ($r = 0.827$, $p < 0.001$), teaching practicum experience and character development ($r = 0.785$, $p < 0.001$), as well as trainee teachers' professionalism and character development ($r = 0.817$, $p < 0.001$). Overall, the findings of this study prove that teaching practicum experience plays an important role in developing the professionalism and character of Education students at UTM. Therefore, teaching practicum should continue to be strengthened as a medium for developing prospective teachers who are knowledgeable, professional and possess good character.

HUBUNGAN PENGGUNAAN TEKNOLOGI DIGITAL DENGAN PENGHAYATAN NILAI ISLAM DALAM KALANGAN BAKAL GURU PENDIDIKAN ISLAM

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Kajian ini dijalankan untuk mengenal pasti tahap penggunaan teknologi digital, tahap penghayatan nilai Islam serta hubungan antara penggunaan teknologi digital dengan penghayatan nilai Islam dalam kalangan bakal guru Pendidikan Islam di Universiti Teknologi Malaysia (UTM). Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kajian tinjauan. Seramai 115 orang pelajar Program Pendidikan Pengajian Islam dipilih sebagai responden kajian melalui kaedah persampelan bertujuan. Instrumen kajian yang digunakan ialah soal selidik yang mengandungi tiga konstruk penggunaan teknologi digital, iaitu komunikasi, pembelajaran dan penggunaan kecerdasan buatan (AI), serta tiga konstruk penghayatan nilai Islam, iaitu akidah, ibadah dan akhlak. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 31 melalui analisis deskriptif dan inferensi. Dapatan kajian menunjukkan bahawa tahap penggunaan teknologi digital berada pada tahap tinggi (M = 4.18, SP = 0.50), manakala tahap penghayatan nilai Islam juga berada pada tahap tinggi (M = 4.26, SP = 0.45). Analisis korelasi Pearson pula menunjukkan terdapat hubungan positif yang kuat dan signifikan antara penggunaan teknologi digital dengan penghayatan nilai Islam ($r = 0.779$, $p < 0.001$). Dapatan ini menunjukkan bahawa peningkatan penggunaan teknologi digital turut disertai dengan peningkatan tahap penghayatan nilai Islam dalam kalangan responden. Kajian ini memberikan implikasi kepada pembangunan profesionalisme bakal guru Pendidikan Islam, pengukuhan literasi digital berteraskan nilai Islam serta penambahbaikan kurikulum pendidikan guru bagi memenuhi keperluan pendidikan dalam era digital. Secara keseluruhannya, kajian ini menyumbang kepada pemahaman yang lebih jelas tentang peranan teknologi digital dalam menyokong penghayatan nilai Islam dalam kalangan bakal guru Pendidikan Islam.

This study was conducted to determine the level of digital technology usage, the level of Islamic values internalisation, and the relationship between digital technology usage and Islamic values internalisation among pre-service Islamic Education teachers at Universiti Teknologi Malaysia (UTM). The study employed a quantitative approach using a survey research design. A total of 115 students from the Islamic Education Programme were selected as respondents through purposive sampling. The research instrument consisted of a questionnaire comprising three dimensions of digital technology usage, namely communication, learning, and artificial intelligence (AI) usage, as well as three dimensions of Islamic values internalisation, namely aqidah (faith), ibadah (worship), and akhlak (morality). Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 31 through descriptive and inferential analyses. The findings revealed that the level of digital technology usage was high ($M = 4.18$, $SD = 0.50$), while the level of Islamic values internalisation was also high ($M = 4.26$, $SD = 0.45$). Pearson correlation analysis indicated a strong and significant positive relationship between digital technology usage and Islamic values internalisation ($r = 0.779$, $p < 0.001$). These findings suggest that higher levels of digital technology usage are associated with higher levels of Islamic values internalisation among the respondents. The study provides important implications for the professional development of pre-service Islamic Education teachers, the strengthening of Islamic-based digital literacy, and the enhancement of teacher education curricula to meet the demands of the digital era. Overall, this study contributes to a better understanding of the role of digital technology in supporting the internalisation of Islamic values among pre-service Islamic Education teachers.

PENGARUH PENGGUNAAN TIKTOK TERHADAP PEMBENTUKAN

PERSONALITI ISLAMIK DALAM KALANGAN MAHASISWA DI UNIVERSITI TEKNOLOGI MALAYSIA (UTM)

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Perkembangan pesat penggunaan media sosial, khususnya TikTok telah menjadikan platform ini antara aplikasi yang paling popular dalam kalangan belia. Selain berfungsi sebagai medium hiburan, TikTok turut dimanfaatkan sebagai platform pembelajaran dan penyebaran dakwah. Sehubungan dengan itu, kajian ini dijalankan untuk mengkaji tahap penggunaan TikTok, mengenal pasti tahap personaliti Islamik serta menganalisis hubungan antara penggunaan TikTok dengan personaliti Islamik dalam kalangan mahasiswa Universiti Teknologi Malaysia (UTM). Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan yang melibatkan seramai 161 orang mahasiswa beragama Islam daripada Fakulti Pendidikan, Sains dan Teknologi, UTM. Data dikumpulkan melalui soal selidik dan dianalisis menggunakan statistik deskriptif serta analisis Korelasi Pearson. Dapatan kajian menunjukkan bahawa tahap penggunaan TikTok berada pada tahap tinggi dengan nilai min sebanyak 4.12, manakala tahap personaliti Islamik turut berada pada tahap tinggi dengan nilai min sebanyak 4.58. Hasil analisis Korelasi Pearson menunjukkan terdapat hubungan positif yang signifikan pada tahap lemah antara penggunaan TikTok dengan personaliti Islamik ($r = 0.281$, $p =<0.001$). Secara keseluruhannya, kajian ini menunjukkan bahawa penggunaan TikTok mempunyai hubungan dengan personaliti Islamik dalam kalangan mahasiswa. Oleh itu, penggunaan TikTok secara berhemah berpotensi menjadi medium yang bermanfaat dalam menyokong pembentukan personaliti Islamik serta penyebaran nilai-nilai Islam dalam kalangan mahasiswa.

The rapid growth of social media, particularly TikTok, has made it one of the most popular applications among young people. In addition to serving as a source of entertainment, TikTok has also been widely utilised as a platform for learning and Islamic da'wah. Accordingly, this study was conducted to examine the level of TikTok usage, identify the level of Islamic personality, and analyse the relationship between TikTok usage and Islamic personality among students at Universiti Teknologi Malaysia (UTM). This study employed a quantitative survey approach involving 161 Muslim students from the Faculty of Educational Sciences and Technology, UTM. Data were collected using a questionnaire and analysed through descriptive statistics and Pearson correlation analysis. The findings revealed that the level of TikTok usage was high, with a mean score of 4.12, while the level of Islamic personality was also high, with a mean score of 4.58. The results of the Pearson correlation analysis indicated a weak but statistically significant positive relationship between TikTok usage and Islamic personality ($r = 0.281$, $p = <0.001$). Overall, the findings indicate that TikTok usage is associated with Islamic personality among students. Therefore, the prudent use of TikTok has the potential to serve as a beneficial medium in supporting the development of Islamic personality and promoting Islamic values among university students.

AMALAN MUHASABAH DIRI SEBAGAI MEKANISME MENANGANI KEMEROSOTAN AKHLAK MAHASISWA UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini dijalankan bagi mengkaji amalan muhasabah diri sebagai mekanisme menangani kemerosotan akhlak dalam kalangan mahasiswa Universiti Teknologi Malaysia (UTM). Objektif kajian ini adalah untuk mengenal pasti tahap amalan muhasabah diri, meneliti faktor-faktor yang menyumbang kepada kemerosotan akhlak, serta menilai hubungan antara amalan muhasabah diri dengan pembentukan akhlak mahasiswa. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan dengan menggunakan soal selidik berskala Likert lima mata. Seramai 130 orang mahasiswa Tahun Empat Fakulti Pendidikan Sains dan Teknologi (FEST), UTM telah terlibat sebagai responden kajian. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui statistik deskriptif seperti kekerapan, peratusan, min dan sisihan piawai serta statistik inferensi iaitu korelasi Pearson. Dapatan kajian menunjukkan bahawa tahap amalan muhasabah diri mahasiswa berada pada tahap tinggi dengan nilai min keseluruhan 4.44. Faktor kemerosotan akhlak juga berada pada tahap tinggi, dengan pengaruh media sosial mencatatkan nilai min tertinggi iaitu 4.53. Selain itu, tahap pembentukan akhlak mahasiswa turut berada pada tahap tinggi dengan nilai min keseluruhan 4.44. Analisis korelasi Pearson menunjukkan terdapat hubungan positif yang kuat dan signifikan antara amalan muhasabah diri dengan pembentukan akhlak mahasiswa, iaitu $r = 0.775$, $p < .001$. Kesimpulannya, amalan muhasabah diri berperanan penting sebagai mekanisme dalaman dalam membantu mahasiswa menilai diri, mengawal tingkah laku dan membentuk akhlak yang lebih baik.

This study was conducted to examine the practice of self-reflection (muhasabah diri) as a mechanism for addressing moral decline among students at Universiti Teknologi Malaysia (UTM). Specifically, the study aims to identify the level of self-reflection practices, examine the factors contributing to moral decline, and determine the relationship between self-reflection practices and students' moral development. A quantitative survey design was employed using a five-point Likert scale questionnaire. A total of 130 final-year students from the Faculty of Educational Sciences and Technology (FEST), Universiti Teknologi Malaysia, participated as respondents. The collected data were analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive statistics, including frequency, percentage, mean, and standard deviation, as well as inferential statistics using Pearson correlation analysis. The findings revealed that the level of self-reflection practice among the respondents was high, with an overall mean score of 4.44. The factors contributing to moral decline were also found to be at a high level, with the influence of social media recording the highest mean score of 4.53. In addition, the level of students' moral development was high, with an overall mean score of 4.44. Pearson correlation analysis indicated a strong and statistically significant positive relationship between self-reflection practices and students' moral development ($r = 0.775$, $p < .001$). In conclusion, the practice of self-reflection plays an important role as an internal mechanism that enables students to evaluate themselves, regulate their behaviour, and develop commendable moral character.

MENILAI TAHAP KEFAHAMAN MAHASISWA UNIVERSITI TEKNOLOGI MALAYSIA (UTM) TERHADAP KONSEP DAN PRINSIP MAQASID SYARIAH

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Maqasid Syariah merupakan asas penting dalam membimbing kehidupan seorang Muslim, namun tahap kefahaman mahasiswa terhadap konsep dan prinsipnya serta kepentingannya dalam kehidupan seharian masih kurang diterokai secara empirikal. Oleh itu, kajian ini bertujuan menilai tahap kefahaman mahasiswa Universiti Teknologi Malaysia (UTM) terhadap konsep dan prinsip Maqasid Syariah serta persepsi mereka terhadap kepentingannya dalam kehidupan seharian dan kehidupan moden. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan melalui soal selidik dalam talian yang melibatkan 180 orang mahasiswa daripada pelbagai fakulti dan tahun pengajian. Data dianalisis menggunakan perisian SPSS versi 30 melalui analisis deskriptif yang merangkumi kekerapan, peratusan, min dan sisihan piawai. Dapatan kajian menunjukkan bahawa mahasiswa mempunyai tahap kefahaman yang tinggi terhadap konsep dan prinsip Maqasid Syariah serta persepsi yang positif terhadap kepentingannya dalam kehidupan harian dan cabaran masyarakat moden. Kajian ini turut menunjukkan bahawa mahasiswa melihat Maqasid Syariah sebagai panduan penting dalam membentuk integriti, sahsiah, tingkah laku dan proses membuat keputusan secara beretika. Oleh itu, dapatan kajian ini memberi implikasi bahawa usaha memperkukuh penghayatan Maqasid Syariah dalam pendidikan tinggi wajar diperkasakan bagi menyokong pembangunan graduan yang holistik, berintegriti dan berdaya saing.

Maqasid Syariah serves as an important foundation in guiding the life of a Muslim. However, students' level of understanding of its concepts and principles, as well as its importance in daily life, remains insufficiently explored empirically. Therefore, this study aims to assess the level of understanding among Universiti Teknologi Malaysia (UTM) students regarding the concepts and principles of Maqasid Syariah, as well as their perceptions of its importance in daily life and modern society. This study employed a quantitative survey approach through an online questionnaire involving 180 students from various faculties and years of study. The data were analysed using SPSS version 30 through descriptive analysis, including frequency, percentage, mean and standard deviation. The findings indicate that students have a high level of understanding of the concepts and principles of Maqasid Syariah, as well as positive perceptions of its importance in daily life and in addressing the challenges of modern society. The study also shows that students view Maqasid Syariah as an important guide in shaping integrity, character, behaviour and ethical decision-making processes. Therefore, the findings imply that efforts to strengthen the appreciation of Maqasid Syariah in higher education should be enhanced to support the development of holistic, ethical and competitive graduates.

TAHAP PENGHAYATAN SOLAT FARDU DAN FAKTOR PELAKSANAANNYA DALAM KALANGAN MAHASISWA UTM

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Solat fardu merupakan ibadah asas dalam Islam yang berperanan penting dalam membentuk sahsiah, disiplin diri dan kesejahteraan rohani seorang Muslim. Kajian ini dijalankan bertujuan untuk mengenal pasti tahap pelaksanaan dan penghayatan solat fardu dalam kalangan mahasiswa Universiti Teknologi Malaysia (UTM), menganalisis faktor-faktor yang mempengaruhi pelaksanaannya serta menilai persepsi mahasiswa terhadap kepentingan penghayatan solat dalam pembentukan akhlak dan disiplin diri. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan dengan instrumen soal selidik yang melibatkan 120 orang mahasiswa Muslim prasiswazah daripada 10 fakulti di UTM. Data dianalisis menggunakan Statistical Package for the Social Sciences (SPSS) melalui analisis statistik deskriptif. Dapatan kajian menunjukkan bahawa tahap pelaksanaan solat fardu berada pada tahap baik manakala tahap penghayatan solat berada pada tahap tinggi. Faktor kesedaran terhadap kewajipan solat, didikan keluarga dan persekitaran kampus yang kondusif dikenal pasti sebagai faktor utama yang mempengaruhi pelaksanaan solat fardu. Selain itu, mahasiswa turut menunjukkan persepsi yang positif terhadap kepentingan penghayatan solat dalam membentuk akhlak, disiplin diri dan kesejahteraan diri. Secara keseluruhannya, kajian ini membuktikan bahawa penghayatan solat bukan sahaja penting sebagai tuntutan ibadah bahkan menjadi asas pembentukan modal insan yang seimbang. Oleh itu, usaha memperkukuh pembangunan kerohanian dan budaya kampus yang menyokong pelaksanaan solat wajar diperkasakan bagi melahirkan mahasiswa yang berakhlak, berdisiplin dan berdaya tahan.

Obligatory prayer is a fundamental act of worship in Islam that plays an important role in shaping the character, self-discipline, and spiritual well-being of a Muslim. This study was conducted to identify the level of performance and internalisation of obligatory prayer among students of Universiti Technology Malaysia (UTM) to analyse the factors influencing its performance, and to assess students' perceptions of the importance of prayer internalisation in the formation of morality and self-discipline. This study employed a quantitative survey approach using a questionnaire as the research instrument, involving 120 Muslim undergraduate students from 10 faculties at UTM. The data were analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive statistical analysis. The findings show that the level of obligatory prayer performance was good, while the level of prayer internalisation was high. Awareness of the obligation to pray, family upbringing, and a conducive campus environment were identified as the main factors influencing the performance of obligatory prayer. In addition, students also showed positive perceptions of the importance of prayer internalisation in shaping morality, self-discipline, and personal well-being. Overall, this study proves that prayer internalisation is not only important as a religious obligation but also serves as a foundation for developing balanced human capital. Therefore, efforts to strengthen spiritual development and a campus culture that supports the performance of prayer should be enhanced to produce students who are morally upright, disciplined, and resilient.

PERSEPSI MAHASISWA FAKULTI SAINS PENDIDIKAN DAN TEKNOLOGI UTM TERHADAP KERJAYA GURU SELEPAS MENJALANI LATIHAN MENGAJAR

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Kerjaya guru merupakan profesion yang penting dalam pembangunan pendidikan kerana guru berperanan sebagai pendidik, pembimbing dan pembentuk sahsiah pelajar. Namun, persepsi mahasiswa terhadap kerjaya guru selepas menjalani Latihan Mengajar masih menjadi persoalan kerana pengalaman sebenar di sekolah boleh mempengaruhi minat, kefahaman dan kesediaan mereka untuk menceburi profesion perguruan. Justeru, kajian ini dijalankan bagi mengenal pasti persepsi mahasiswa terhadap kerjaya guru selepas menjalani Latihan Mengajar. Objektif kajian adalah untuk: (i) mengenal pasti persepsi mahasiswa terhadap kerjaya guru selepas menjalani Latihan Mengajar, (ii) menilai sumbangan kursus Latihan Mengajar terhadap minat dan kefahaman mahasiswa terhadap kerjaya guru dan (iii) menganalisis cadangan dan pendekatan penambahbaikan kursus Latihan Mengajar bagi meningkatkan minat mahasiswa terhadap kerjaya guru. Kajian ini menggunakan pendekatan kuantitatif berbentuk deskriptif melalui edaran borang soal selidik kepada 60 orang mahasiswa tahun akhir aliran sains sosial Fakulti Sains Pendidikan dan Teknologi, Universiti Teknologi Malaysia yang telah menjalani Latihan Mengajar. Responden terdiri daripada mahasiswa program Pendidikan Islam, Bahasa Inggeris dan Sains Sukan yang dipilih menggunakan kaedah persampelan bertujuan. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 31.0 menerusi statistik deskriptif seperti kekerapan, peratusan, min dan sisihan piawai. Dapatan kajian menunjukkan bahawa persepsi mahasiswa terhadap kerjaya guru selepas menjalani Latihan Mengajar berada pada tahap tinggi dengan nilai min purata 4.62 dan sisihan piawai 0.41. Selain itu, sumbangan kursus Latihan Mengajar terhadap minat dan kefahaman mahasiswa terhadap kerjaya guru juga berada pada tahap tinggi dengan nilai min purata 4.59 dan sisihan piawai 0.41. Dapatan turut menunjukkan bahawa cadangan dan pendekatan penambahbaikan kursus Latihan Mengajar berada pada tahap tinggi dengan nilai min purata 4.03 dan sisihan piawai 0.72. Kajian ini mencadangkan agar pelaksanaan Latihan Mengajar diperkukuh melalui latihan persediaan, bimbingan guru pembimbing dan pensyarah pembimbing, sokongan pihak sekolah serta perhatian terhadap kebajikan mahasiswa bagi melahirkan bakal guru yang lebih yakin, kompeten dan bersedia menghadapi realiti profesion perguruan.

Teaching is an important profession in educational development as teachers play a role as educators, guides and shapers of students' character. However, students' perception of the teaching profession after undergoing Teaching Practice remains an issue, as real school experience may influence their interest, understanding and readiness to pursue a career in teaching. Therefore, this study was conducted to identify students' perception of the teaching profession after undergoing Teaching Practice. The objectives of this study are: (i) to identify students' perception of the teaching profession after undergoing Teaching Practice, (ii) to evaluate the contribution of the Teaching Practice course towards students' interest and understanding of the teaching profession, and (iii) to analyse suggestions and improvement approaches for the Teaching Practice course in order to increase students' interest in the teaching profession. This study employed a descriptive quantitative approach through the distribution of questionnaires to 60 final-year students from the social science stream at the Faculty of Educational Sciences and Technology, Universiti Teknologi Malaysia, who had undergone Teaching Practice. The respondents consisted of students from the Islamic Education, English Language and Sports Science programmes, selected using purposive

sampling. The data were analysed using the Statistical Package for the Social Sciences (SPSS) version 31.0 through descriptive statistics such as frequency, percentage, mean and standard deviation. The findings showed that students' perception of the teaching profession after undergoing Teaching Practice was at a high level, with an overall mean score of 4.62 and a standard deviation of 0.41. In addition, the contribution of the Teaching Practice course towards students' interest and understanding of the teaching profession was also at a high level, with an overall mean score of 4.59 and a standard deviation of 0.41. The findings also indicated that suggestions and improvement approaches for the Teaching Practice course were at a high level, with an overall mean score of 4.03 and a standard deviation of 0.72. This study suggests that the implementation of Teaching Practice should be strengthened through preparatory training, guidance from mentor teachers and supervising lecturers, support from schools, and attention to students' welfare in order to produce future teachers who are more confident, competent and prepared to face the realities of the teaching profession.

PERSEPSI MAHASISWA TERHADAP KURSUS PRA-PERKAHWINAN ANJURAN PUSAT ISLAM UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini bertujuan untuk mengenal pasti persepsi mahasiswa terhadap kursus pra-perkahwinan anjuran Pusat Islam Universiti Teknologi Malaysia (UTM), menilai impak kursus tersebut terhadap pembangunan diri mahasiswa serta mencadangkan penambahbaikan kursus berdasarkan keberkesanan pelaksanaannya dalam mencapai objektif yang disasarkan. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan dengan instrumen soal selidik sebagai kaedah pengumpulan data. Populasi kajian terdiri daripada 62 orang mahasiswa yang mengikuti kursus pra-perkahwinan, manakala seramai 40 orang responden telah dipilih sebagai sampel kajian. Data yang diperoleh dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui analisis deskriptif yang melibatkan kekerapan, peratusan dan min. Dapatan kajian menunjukkan bahawa persepsi mahasiswa terhadap kursus pra-perkahwinan anjuran Pusat Islam UTM adalah positif. Kursus ini dilihat mampu meningkatkan pengetahuan, kesedaran dan kefahaman mahasiswa berkaitan persediaan awal sebelum memasuki alam perkahwinan. Selain itu, kursus pra-perkahwinan turut memberi impak terhadap pembangunan diri mahasiswa, khususnya dari aspek tanggungjawab, kematangan emosi, komunikasi dan persediaan membina kehidupan berkeluarga. Walau bagaimanapun, beberapa penambahbaikan masih boleh dilaksanakan bagi meningkatkan keberkesanan kursus, antaranya dari aspek kaedah penyampaian, kandungan kursus dan pendekatan yang lebih interaktif. Secara keseluruhannya, kajian ini menunjukkan bahawa kursus pra-perkahwinan anjuran Pusat Islam UTM merupakan satu program yang relevan, bermanfaat dan wajar diteruskan sebagai usaha membimbing mahasiswa ke arah persediaan perkahwinan yang lebih terancang. Kata kunci: persepsi mahasiswa, kursus pra-perkahwinan, Pusat Islam UTM, pembangunan diri, penambahbaikan kursus.

This study aims to identify students' perceptions of the pre-marriage course organised by the Islamic Centre of Universiti Teknologi Malaysia (UTM), examine the impact of the course on students' self-development, and propose improvements based on the effectiveness of the course in achieving its intended objectives. This study employed a quantitative survey design using a questionnaire as the research instrument. The population of the study consisted of 62 students who participated in the pre-marriage course, while 40 respondents were selected as the research sample. The data were analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive analysis involving frequency, percentage and mean. The findings indicate that students' perceptions of the pre-marriage course organised by the Islamic Centre of UTM were positive. The course was found to enhance students' knowledge, awareness and understanding of early preparation before entering married life. In addition, the pre-marriage course also contributed to students' self-development, particularly in terms of responsibility, emotional maturity, communication and readiness to build a family life. However, several improvements can still be made to enhance the effectiveness of the course, particularly in terms of delivery methods, course content and a more interactive approach. Overall, this study demonstrates that the pre-marriage course organised by the Islamic Centre of UTM is a relevant and beneficial programme that should be continued as an effort to guide students towards better and more systematic preparation for marriage. Keywords: students' perception, pre-marriage course, Islamic Centre of UTM, self-development, course improvement.

PENGARUH PERSEKITARAN KAMPUS ISLAMIK TERHADAP PEMBENTUKAN AKHLAK MAHASISWA

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Kajian ini bertujuan untuk mengkaji pengaruh persekitaran kampus Islamik terhadappembentukan akhlak mahasiswa di universiti. Secara khususnya, kajian ini dijalankan untuk mengenal pasti tahap persekitaran kampus Islamik dalam kalangan mahasiswa, menilai tahap pembentukan akhlak mahasiswa serta mengenal pasti hubungan antara persekitaran kampus Islamik dengan pembentukan akhlak mahasiswa. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan melalui borang soal selidik sebagai instrumen kajian. Seramai 95 orang mahasiswa Pendidikan Pengajian Islam dari Tahun 1 hingga Tahun 4 telah terlibat sebagai responden kajian. Data yang diperoleh dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) dengan melibatkan analisis deskriptif seperti kekerapan, peratusan, min dan sisihan piawai, serta analisis inferensi iaitu Korelasi Pearson. Dapatan kajian menunjukkan bahawa tahap persekitaran kampus Islamik berada pada tahap tinggi dengan nilai min keseluruhan sebanyak 4.40. Selain itu, tahap pembentukan akhlak mahasiswa juga berada pada tahap tinggi dengan nilai min keseluruhan sebanyak 4.81. Dapatan analisis Korelasi Pearson pula menunjukkan bahawa terdapat hubungan positif yang signifikan antara persekitaran kampus Islamik dengan pembentukan akhlak mahasiswa, iaitu r=.536, p=.000. Hal ini menunjukkan bahawa semakin baik persekitaran kampus Islamik, semakin tinggi tahap pembentukan akhlak mahasiswa. Secara keseluruhannya, kajian ini membuktikan bahawa persekitaran kampus Islamik yang merangkumi budaya kampus, aktiviti kerohanian, kemudahan ibadah, pengaruh rakan sebaya, teladan pensyarahsertasokongan pihak universiti berperanan penting dalam menyokong pembentukan akhlak mahasiswa. Justeru, persekitaran kampus Islamik perlu terus diperkukuh bagi melahirkanmahasiswa yang bukan sahaja cemerlang dari aspek akademik, tetapi juga memiliki akhlak mulia, berdisiplin, bertanggungjawab dan berperibadi Muslim.

This study aims to examine the influence of an Islamic campus environment on the moral development of university students. Specifically, this study seeks to identify the level of Islamic campus environment among students, assess the level of students'moral development, and determine the relationship between the Islamic campus environment and students' moral development. This study employed a quantitative survey design using a questionnaire as the research instrument. A total of 95 Islamic Education students from Year 1 to Year 4 were involved as respondents. The data obtained were analysed using the Statistical Package for the Social Sciences (SPSS), involving descriptive analyses such as frequency, percentage, mean and standard deviation, as well as inferential analysis through Pearson correlation. The findings revealed that the level of Islamic campus environment was high, with an overall mean score of 4.40. In addition, the level of students' moral development was also high, with an overall mean score of 4.81. The Pearson correlation analysis indicated a significant positive relationship between the Islamic campus environment and students' moral development, with r=.536 and p =.000. This indicates that the better the Islamic campus environment, the higher the level of students' moral development. Overall, this study demonstrates that an Islamic campus environment, which includes campus culture, spiritual activities, worship facilities, peer influence, lecturers' role modelling and support from the university, plays an important role in supporting students' moral development. Therefore, the Islamic campus environment should be continuously strengthened to produce students who are not only academically excellent, but also possess noble character, discipline, responsibility and a strong Muslim personality.

PENGARUH PENDIDIKAN KELUARGA DALAM MEMBENTUK IDENTITI

ISLAM DALAM KALANGAN ANAK REMAJA

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Kajian ini dijalankan bagi mengkaji hubungan antara pendidikan keluarga dengan identiti Islam anak remaja. Secara khususnya, kajian ini bertujuan untuk mengenal pasti tahap pendidikan keluarga dalam membentuk identiti Islam anak remaja, mengenal pasti tahap identiti Islam dalam kalangan anak remaja serta mengkaji hubungan antara pendidikan keluarga dengan identiti Islam anak remaja. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk deskriptif dan korelasi. Instrumen kajian berbentuk soal selidik telah diedarkan kepada 105 orang pelajar Muslim Tingkatan 1 hingga Tingkatan 3 di SMK Taman Universiti, Skudai, Johor. Data kajian dianalisis menggunakan perisian IBM Statistical Package for the Social Sciences (SPSS) melalui analisis deskriptif dan Korelasi Pearson. Dapatan kajian menunjukkan bahawa tahap pendidikan keluarga berada pada tahap tinggi dengan nilai min keseluruhan 4.5898. Tahap identiti Islam anak remaja juga berada pada tahap tinggi dengan nilai min keseluruhan 4.4571. Selain itu, dapatan Korelasi Pearson menunjukkan terdapat hubungan positif yang signifikan dan sangat kuat antara pendidikan keluarga dengan identiti Islam anak remaja, iaitu $r = 0.878$, $p < .001$. Dapatan ini menunjukkan bahawa semakin tinggi tahap pendidikan keluarga yang diterima oleh anak remaja, semakin tinggi tahap identiti Islam dalam diri mereka. Kesimpulannya, pendidikan keluarga merupakan faktor penting dalam pembentukan identiti Islam anak remaja, khususnya melalui pengajaran nilai akidah, ibadah, akhlak, komunikasi keluarga dan teladan ibu bapa. Kajian ini mencadangkan agar peranan keluarga terus diperkukuh melalui kerjasama ibu bapa, sekolah dan masyarakat bagi melahirkan generasi remaja Muslim yang berakhlak, berprinsip dan berpegang teguh kepada ajaran Islam.

This study was conducted to examine the relationship between family education and the Islamic identity of adolescents. Specifically, the objectives of this study were to identify the level of family education in shaping the Islamic identity of adolescents, to determine the level of Islamic identity among adolescents, and to examine the relationship between family education and adolescents' Islamic identity. This study employed a quantitative approach using a descriptive and correlational research design. A questionnaire was distributed to 105 Muslim students from Form 1 to Form 3 at SMK Taman Universiti, Skudai, Johor. The collected data were analysed using the IBM Statistical Package for the Social Sciences (SPSS) through descriptive statistics and Pearson Correlation analysis. The findings revealed that the overall level of family education was high, with an overall mean score of 4.5898. Similarly, the level of adolescents' Islamic identity was also found to be high, with an overall mean score of 4.4571. Furthermore, the Pearson Correlation analysis indicated a significant and very strong positive relationship between family education and adolescents' Islamic identity ($r = 0.878$, $p < .001$). These findings suggest that the higher the level of family education received by adolescents, the stronger their Islamic identity. In conclusion, family education is a crucial factor in shaping adolescents' Islamic identity, particularly through the teaching of aqidah (Islamic creed), ibadah (acts of worship), akhlaq (moral values), effective family communication, and parental role modelling. Therefore, this study recommends that the role of the family be further strengthened through the collaboration of parents, schools, and the wider community in nurturing a generation of Muslim adolescents who possess strong moral character, uphold Islamic values, and remain steadfast in practising the teachings of Islam.

PENGGUNAAN TIKTOK SEBAGAI PLATFORM AKSES KANDUNGAN ISLAMIK DALAM KALANGAN MAHASISWA MUSLIM FAKULTI SAINS PENDIDIKAN DAN TEKNOLOGI UNIVERSITI TEKNOLOGI MALAYSIA

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Perkembangan teknologi digital dan media sosial telah mengubah cara masyarakat memperoleh maklumat, termasuk dalam aspek pembelajaran dan penyebaran ilmu agama. TikTok yang pada asalnya dikenali sebagai platform hiburan kini turut dimanfaatkan sebagai medium untuk mengakses kandungan Islamik, khususnya dalam kalangan mahasiswa. Sehubungan itu, kajian ini bertujuan untuk mengenal pasti tahap penggunaan TikTok sebagai platform akses kandungan Islamik dalam kalangan mahasiswa Muslim Fakulti Sains Pendidikan dan Teknologi, Universiti Teknologi Malaysia (UTM), mengenal pasti jenis kandungan Islamik yang paling kerap diakses melalui TikTok serta mengenal pasti faktor-faktor yang mempengaruhi kecenderungan mahasiswa menggunakan TikTok untuk mengakses kandungan Islamik. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Seramai 140 orang mahasiswa Muslim Tahun 4 Fakulti Sains Pendidikan dan Teknologi, Universiti Teknologi Malaysia telah dipilih sebagai responden melalui kaedah persampelan bertujuan. Instrumen kajian yang digunakan ialah soal selidik yang mengandungi 32 item, manakala data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 31.0 melalui analisis statistik deskriptif yang melibatkan kekerapan, peratusan dan min. Dapatan kajian menunjukkan bahawa tahap penggunaan TikTok sebagai platform akses kandungan Islamik berada pada tahap yang tinggi. Responden didapati kerap mengakses pelbagai jenis kandungan Islamik seperti tazkirah ringkas, motivasi Islam, ibadah dan amalan harian serta kandungan berkaitan isu-isu semasa umat Islam. Selain itu, kemudahan penggunaan platform, persepsi terhadap keberkesanan kandungan Islamik, keberkesanan penyampaian dan pengaruh sosial dikenal pasti sebagai faktor utama yang mempengaruhi kecenderungan mahasiswa menggunakan TikTok untuk mengakses kandungan Islamik. Secara keseluruhannya, kajian ini membuktikan bahawa TikTok mempunyai potensi sebagai platform pembelajaran agama secara tidak formal dan medium penyebaran kandungan Islamik yang relevan dengan keperluan mahasiswa Muslim. Kajian ini diharapkan dapat menjadi rujukan kepada pendidik, pendakwah, institusi pendidikan dan penyelidik dalam memperkasa penggunaan media sosial sebagai medium penyebaran ilmu Islam secara lebih berkesan.

The rapid development of digital technology and social media has transformed the way people access information, including in the areas of religious learning and the dissemination of Islamic knowledge. TikTok, originally recognised as an entertainment platform, has increasingly been utilised as a medium for accessing Islamic content, particularly among university students. Accordingly, this study aimed to identify the level of TikTok usage as a platform for accessing Islamic content among Muslim students at the Faculty of Educational Sciences and Technology, Universiti Teknologi Malaysia (UTM), to determine the types of Islamic content most frequently accessed through TikTok, and to identify the factors influencing students' tendency to use TikTok to access Islamic content. This study adopted a quantitative approach employing a survey research design. A total of 140 Year 4 Muslim students from the Faculty of Educational Sciences and Technology, Universiti Teknologi Malaysia, were selected as respondents through purposive sampling. The research instrument consisted of a 32-item questionnaire, and the data were analysed using the Statistical Package for the Social Sciences (SPSS) version 31.0 through descriptive statistical analysis involving frequencies, percentages and mean scores. The findings revealed that the level of TikTok

usage as a platform for accessing Islamic content was high. The respondents were found to frequently access various types of Islamic content, including tazkirah, Islamic motivational content, acts of worship and daily religious practices, as well as content related to current issues affecting the Muslim community. In addition, ease of platform use, perceived effectiveness of Islamic content, effectiveness of content delivery, and social influence were identified as the main factors influencing students' tendency to use TikTok to access Islamic content. Overall, the findings demonstrate that TikTok has considerable potential as an informal platform for religious learning and an effective medium for disseminating Islamic content that is relevant to the needs of Muslim university students. It is anticipated that the findings of this study will serve as a valuable reference for educators, Islamic preachers, educational institutions and future researchers in strengthening the use of social media as an effective platform for the dissemination of Islamic knowledge.

PERMASALAHAN PENGAJIAN TAFSIR AL-QURAN DALAM KALANGAN WANITA DI MASJID NEGERI JOHOR

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Kajian ini bertujuan untuk mengkaji permasalahan pengajian tafsir al-Quran dalam kalangan wanita di Masjid Negeri Johor. Pengajian tafsir al-Quran merupakan medium penting dalam meningkatkan kefahaman masyarakat terhadap isi kandungan al-Quran dan penghayatan ajaran Islam dalam kehidupan seharian. Oleh itu, kajian ini bertujuan untuk mengenal pasti bentuk pelaksanaan pengajian tafsir al-Quran, mengenal pasti permasalahan yang dihadapi oleh wanita semasa mengikuti pengajian tersebut serta mengemukakan cadangan penambahbaikan bagi memperkukuhkan pelaksanaannya. Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk kajian kes. Data dikumpulkan melalui temu bual separa berstruktur yang melibatkan tiga orang peserta wanita dan seorang pengajar pengajian tafsir al-Quran yang dipilih secara persampelan bertujuan. Data kajian dianalisis menggunakan kaedah analisis tematik berdasarkan pendekatan yang dikemukakan oleh Braun dan Clarke (2006). Dapatan kajian menunjukkan bahawa pengajian tafsir al-Quran di masjid ini dilaksanakan secara sistematik berdasarkan kitab dan silibus tertentu serta disampaikan melalui pendekatan yang mudah difahami oleh peserta. Walau bagaimanapun, beberapa permasalahan telah dikenal pasti, antaranya adalah kesukaran memahami istilah tafsir, kekurangan bahan bantu pembelajaran, faktor kesihatan, komitmen keluarga, kekangan fasiliti serta keterbatasan penggunaan teknologi digital. Di samping itu, dapatan kajian menunjukkan bahawa penggunaan media sosial membantu peserta mengakses semula kandungan pengajian yang tertinggal. Sehubungan itu, kajian mencadangkan penambahbaikan daripada aspek penyediaan bahan pembelajaran, penggunaan medium digital, penambahbaikan fasiliti serta perluasan pelaksanaan pengajian tafsir al-Quran di institusi masjid. Secara keseluruhannya, kajian ini diharapkan dapat menyumbang kepada usaha memperkukuh pengajian tafsir al-Quran dan meningkatkan kefahaman masyarakat terhadap isi kandungan al-Quran.

This study aims to examine the issues of Tafsir al-Quran studies among women at the State Mosque of Johor. Tafsir al-Quran studies serve as an important medium in enhancing the community's understanding of the contents of the Qur'an and appreciation of Islamic teachings in daily life. Therefore, this study aims to identify the implementation of Tafsir al-Quran studies, identify the issues faced by women while participating in these studies, and propose recommendations for improvement to strengthen their implementation. This study employed a qualitative approach using a case study research design. Data were collected through semi-structured interviews involving three female participants and one Tafsir al-Quran instructor selected through purposive sampling. The data were analysed using thematic analysis based on the approach proposed by Braun and Clarke (2006). The findings indicate that Tafsir al-Quran studies at the mosque are implemented systematically based on a specific textbook and syllabus and are delivered through an approach that is easily understood by the participants. However, several issues were identified, including difficulties in understanding tafsir terminology, the lack of learning support materials, health-related factors, family commitments, limited facilities, and the limited use of digital technology. In addition, the findings indicate that the use of social media helps participants revisit the learning content that they had missed. Accordingly, this study recommends improvements in the provision of learning materials, the use of digital platforms, the enhancement of facilities, and the expansion of Tafsir al-Quran studies in mosque institutions. Overall, this study is expected to contribute to strengthening Tafsir al-Quran studies and enhancing the community's understanding of the contents of the Qur'an.

HUBUNGAN ANTARA AMALAN KEROHANIAN DENGAN DAYA TAHAN DIRI MAHASISWA FAKULTI PENDIDIKAN DAN TEKNOLOGI DI UNIVERSITI TEKNOLOGI MALAYSIA

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Mahasiswa institusi pengajian tinggi kini berhadapan dengan pelbagai tekanan akademik dan cabaran emosi yang menuntut daya tahan diri yang tinggi, manakala amalan kerohanian dilihat sebagai sumber kekuatan dalaman yang berpotensi menyokong ketahanan tersebut. Justeru, kajian ini dijalankan bagi mengkaji hubungan antara amalan kerohanian dengan daya tahan diri dalam kalangan mahasiswa Fakulti Sains Pendidikan dan Teknologi (FEST), Universiti Teknologi Malaysia (UTM). Secara khususnya, kajian ini bertujuan untuk mengenal pasti tahap amalan kerohanian dan daya tahan diri serta mengkaji hubungan antara kedua-duanya dalam kalangan mahasiawa. Kajian ini menggunakan reka bentuk kuantitatif berbentuk tinjauan menggunakan soal selidik. Seramai 140 mahasiswa tahun akhir beragama Islam di FEST, UTM telah dipilih sebagai responden kajian menggunakan kaedah persampelan bertujuan. Soal selidik kajian terdiri daripada tiga bahagian, iaitu demografi responden, amalan kerohanian dan daya tahan diri. Data yang diperoleh dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) V31 melalui analisis deskriptif dan analisis korelasi Pearson. Dapatan kajian menunjukkan bahawa tahap amalan kerohanian dan daya tahan diri mahasiswa berada pada tahap sangat tinggi. Analisis korelasi pula menunjukkan bahawa terdapat hubungan positif yang kuat dan signifikan antara amalan kerohanian dengan daya tahan diri, iaitu tahap amalan kerohanian yang tinggi berkait dengan tahap daya tahan diri yang tinggi dalam kalangan mahasiswa. Hasil kajian ini memberikan sumbangan dalam memahami kepentingan amalan kerohanian sebagai sumber kekuatan dalaman yang membantu mahasiswa menghadapi cabaran kehidupan kampus. Kajian lanjutan dicadangkan dengan melibatkan sampel yang lebih luas serta menggunakan pendekatan kualitatif atau kaedah campuran bagi mendapatkan kefahaman yang lebih mendalam tentang peranan amalan kerohanian dalam pembentukan daya tahan diri mahasiswa.

Students in higher education institutions today face various academic pressures and emotional challenges that demand a high level of resilience, while spiritual practices are seen as a source of inner strength with the potential to support such resilience. Accordingly, this study was conducted to examine the relationship between spiritual practices and resilience among students of the Faculty of Educational Sciences and Technology (FEST), Universiti Teknologi Malaysia (UTM). Specifically, this study aimed to identify the level of spiritual practices and resilience, as well as to examine the relationship between the two among students. This study employed a quantitative survey design using a questionnaire. A total of 140 final-year Muslim students at FEST, UTM were selected as respondents using purposive sampling. The questionnaire comprised three sections, namely respondent demographics, spiritual practices and resilience. The data obtained were analysed using the Statistical Package for the Social Sciences (SPSS) V31 software through descriptive analysis and Pearson correlation analysis. The findings showed that the levels of spiritual practices and resilience among the students were very high. Meanwhile, the correlation analysis showed a strong and significant positive relationship between spiritual practices and resilience, whereby a high level of spiritual practices was associated with a high level of resilience among the students. The findings of this study contribute to understanding the importance of spiritual practices as a source of inner strength that helps students cope with the challenges of campus life. Further research is recommended, involving a wider sample and employing

qualitative or mixed method approaches to gain a deeper understanding of the role of spiritual practices in the development of students' resilience.

KEBAIKAN SUKAN BERKUDA MENURUT ISLAM DAN PENGHAYATANNYA DI PUSAT EKUIN UTM

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Kajian ini bertajuk Kebaikan Sukan Berkuda Menurut Islam dan Penghayatannya di Pusat Ekuin UTM. Kajian ini bertujuan untuk mengenal pasti kebaikan sukan berkuda dalam Islam, menganalisis sejauh mana aktiviti berkuda di Pusat Ekuin UTM dapat membantu penghayatan Sunnah Nabi Muhammad SAW serta mengenal pasti cabaran dalam mempromosikan sukan berkuda sebagai sunnah Nabi di Pusat Ekuin UTM. Kajian ini menggunakan pendekatan kualitatif melalui kaedah temu bual separa berstruktur bersama enam orang responden yang terlibat secara langsung dalam aktiviti berkuda. Data dianalisis secara tematik bagi mengenal pasti tema-tema utama berdasarkan objektif kajian. Dapatan kajian menunjukkan bahawa sukan berkuda memberikan manfaat terhadap aspek fizikal, mental, emosi, keyakinan diri, kepimpinan dan pembentukan sahsiah. Selain itu, aktiviti berkuda turut membantu peserta menghayati sunnah secara praktikal melalui nilai disiplin, amanah, sabar, tanggungjawab, ukhuwah dan ihsan terhadap haiwan. Kajian juga mendapati terdapat beberapa cabaran dalam mempromosikan sukan berkuda sebagai sunnah, antaranya faktor kos, persepsi masyarakat, kekurangan promosi, keterbatasan kepakaran dan keperluan sokongan institusi.Secara keseluruhannya, kajian ini membuktikan bahawa sukan berkuda bukan sekadar aktiviti rekreasi, malah berpotensi menjadi medium pendidikan Islam yang holistik dalam membentuk insan yang seimbang dari aspek jasmani, emosi, rohani dan intelek.

This study is entitled The Benefits of Horse Riding and Its Appreciation at the UTM Equestrian Centre. This study aims to identify the benefits of horse riding in Islam, analyse the extent to which horse riding activities at the UTM Equestrian Centre help participants appreciate the Sunnah of Prophet Muhammad PBUH, and identify the challenges in promoting horse riding as a Sunnah practice at the UTM Equestrian Centre. This study employed a qualitative approach through semi-structured interviews with six respondents who were directly involved in horse riding activities. The data were analysed thematically to identify the main themes based on the research objectives. The findings show that horse riding provides benefits in terms of physical, mental and emotional development, as well as self-confidence, leadership and character formation. In addition, horse riding activities help participants appreciate the Sunnah in a practical way through values such as discipline, trustworthiness, patience, responsibility, ukhuwah and ihsan towards animals. The study also found several challenges in promoting horse riding as a Sunnah practice, including cost, public perception, lack of promotion, limited expertise and the need for institutional support. Overall, this study proves that horse riding is not merely a recreational activity, but also has the potential to become a holistic Islamic educational medium in developing individuals who are balanced physically, emotionally, spiritually and intellectually.

HUBUNGAN PENGGUNAAN KECERDASAN BUATAN AI DALAM TUGASAN AKADEMIK TERHADAP PENGHAYATAN NILAI ISLAM DALAM KALANGAN MAHASISWA

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Perkembangan teknologi kecerdasan buatan AI (Artificial Intelligence) telah membawa perubahan dalam kaedah pembelajaran di institusi pengajian tinggi termasuk dalam kalangan mahasiswa bidang pendidikan islam. Penggunaan aplikasi AI semakin diterima sebagai medium sokongan pembelajaran melalui penyediaan maklumat, penjanaan idea dan bantuan memahami sesuatu konsep. Walaubagaimanapun, penggunaan teknologi ini turut menimbulkan cabaran dalam etika akademik, integriti ilmu dan keupayaan mahasiswa mengaplikasikan nilai Islam dalam proses memperoleh serta menguruskan ilmu. Walaupun kajian berkaitan penggunaan AI dalam pendidikan semakin berkembang, kajian yang meneliti hubungan antara penggunaan AI dengan penghayatan nilai Islam masih kurang diberi perhatian. Oleh itu, kajian ini dijalankan bagi mengenal pasti tahap penggunaan kecerdasan buatan AI dalam tugasan akademik, menilai persepsi penghayatan nilai Islam dalam kalangan mahasiswa Pendidikan Islam dan menganalisis hubungan antara tahap penggunaan teknologi kecerdasan buatan AI dalam tugasan akademik dengan penghayatan nilai Islam dalam kalangan mahasiswa Pendidikan Islam. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kajian tinjauan korelasi. Seramai 115 orang mahasiswa Pendidikan Pengajian Islam dipilih sebagai responden kajian. Instrumen kajian berbentuk soal selidik digunakan bagi mengukur konstruk tahap penggunaan kecerdasan buatan AI dalam tugasan akademik dan penghayatan nilai Islam. Data yang diperoleh dianalisis menggunakan statistik deskriptif yang mel ibatkan nilai min dan sisihan piawai manakala analisis inferensi menggunakan ujian korelasi Pearson bagi menentukan hubungan antara pemboleh ubah kajian. Dapatan kajian menunjukkan bahawa tahap penggunaan kecerdasan buatan AI terhadap tugasan akademik dalam kalangan mahasiswa Pendidikan Pengajian Islam berada pada tahap tinggi dengan nilai min keseluruhan 4.08 manakala persepsi penghayatan nilai Islam juga berada pada tahap tinggi dengan nilai min keseluruhan 4.59. Analisis korelasi Pearson menunjukkan terdapat hubungan positif yang sederhana dan signifikan antara penggunaan kecerdasan buatan AI dengan penghayatan nilai Islam iaitu $r= 0.327$, $p<.001$, $N=115$. Dapatan ini menunjukkan mahasiswa yang menggunakan AI dalam proses pembelajaran turut menunjukkan tahap penghayatan nilai Islam yang lebih baik khususnya dalam aspek tanggungjawab, amanah ilmu dan integriri akademik. Kesimpulannya, penggunaan AI dalam kalangan mahasiswa Pendidikan Pengajian Islam perlu dipandu oleh prinsip dan nilai Islam agar teknologi tersebut dapat dimanfaatkan secara beretika. Kajian ini memberikan implikasi kepada institusi pendidikan tinggi bagi memperkukuhkan literasi AI yang berteraskan nilai amanah, tanggungjawab dan integriti bagi melahirkan mahasiswa yang mampu mengadaptasi teknologi moden tanpa mengabaikan prinsip Islam dalam pengurusan ilmu.

The development of Artificial Intelligence (AI) technology has brought significant changes to learning methods in higher education institutions, including among Islamic Education students. The use of AI applications has increasingly been accepted as a learning support medium through the provision of information, idea generation, and assistance in understanding concepts. However, the use of this technology also raises challenges related to academic ethics, knowledge integrity, and students' ability to apply Islamic values in the process of acquiring and managing knowledge. Although studies on the use of AI in education have continued to grow, research examining the relationship between AI usage and the

internalisation of Islamic values remains limited. Therefore, this study was conducted to identify the level of Artificial Intelligence (AI) usage in academic assignments, assess the perception of Islamic values internalisation among Islamic Education students, and analyse the relationship between the level of Artificial Intelligence (AI) usage in academic assignments and the internalisation of Islamic values among Islamic Education students. This study employed a quantitative approach using a correlational survey research design. A total of 115 Islamic Education students were selected as the respondents. A questionnaire was used as the research instrument to measure the constructs of the level of Artificial Intelligence (AI) usage in academic assignments and the internalisation of Islamic values. The collected data were analysed using descriptive statistics involving mean and standard deviation, while inferential analysis was conducted using the Pearson correlation test to determine the relationship between the study variables. The findings revealed that the level of Artificial Intelligence (AI) usage in academic assignments among Islamic Education students was at a high level, with an overall mean score of 4.08, while the perception of the internalisation of Islamic values was also at a high level, with an overall mean score of 4.59. Pearson correlation analysis indicated a moderate positive and significant relationship between the use of Artificial Intelligence (AI) and the internalisation of Islamic values, $r = 0327$, $p < .001$, $N = 115$. These findings indicate that students who use AI in the learning process also demonstrate a higher level of Islamic values internalisation, particularly in the aspects of responsibility, trustworthiness in knowledge (amanah ilmu), and academic integrity. In conclusion, the use of AI among Islamic Education students should be guided by Islamic principles and values to ensure that the technology is utilised ethically. This study provides implications for higher education institutions to strengthen AI literacy based on the values of trustworthiness, responsibility, and integrity in order to produce students who are capable of adapting to modern technology without neglecting Islamic principles in the management of knowledge.

TAHAP PENGAMALAN KEBERSIHAN DIRI YANG SUCI DALAM KALANGAN MAHASISWI ISLAM KOLEJ 9 UTM

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Kajian ini bertujuan untuk mengenal pasti tahap pengamalan kebersihan diri yang suci dalam kalangan mahasiswi Islam Kolej 9, Universiti Teknologi Malaysia. Secara khususnya, kajian ini dijalankan bagi mengenal pasti tahap pengetahuan mahasiswi tentang kebersihan diri berdasarkan panduan Islam, mengkaji tahap pengamalan kebersihan diri menurut perspektif Islam serta menganalisis hubungan antara pengetahuan dan pengamalan kebersihan diri. Kajian ini menggunakan pendekatan kuantitatif melalui kaedah soal selidik yang melibatkan seramai 242 orang mahasiswi Islam Kolej 9 sebagai responden. Data yang diperoleh dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 31.0 bagi mendapatkan nilai kekerapan, peratusan, min dan Korelasi Pearson. Dapatan kajian menunjukkan bahawa tahap pengetahuan mahasiswi terhadap kebersihan diri berdasarkan panduan Islam berada pada tahap tinggi dengan nilai min keseluruhan sebanyak 4.61. Selain itu, tahap pengamalan kebersihan diri menurut perspektif Islam juga berada pada tahap tinggi dengan nilai min keseluruhan sebanyak 4.55. Dapatan bagi amalan taharah wanita turut menunjukkan tahap yang tinggi dengan nilai min keseluruhan sebanyak 4.65. Analisis Korelasi Pearson pula menunjukkan terdapat hubungan positif yang kuat dan signifikan antara tahap pengetahuan dengan tahap pengamalan kebersihan diri, iaitu $r = 0.601$ dan $p < 0.001$. Dapatan ini membuktikan bahawa semakin tinggi tahap pengetahuan mahasiswi terhadap kebersihan diri berdasarkan panduan Islam, semakin tinggi tahap pengamalan kebersihan diri mereka dalam kehidupan seharian. Secara keseluruhannya, kajian ini menunjukkan bahawa pengetahuan kebersihan diri memainkan peranan penting dalam membentuk amalan kebersihan diri yang suci, khususnya dalam aspek kebersihan tubuh badan, pakaian, tempat tinggal dan taharah wanita menurut perspektif Islam.

This study aims to identify the level of pure personal hygiene practices among Muslim female students at College 9, Universiti Teknologi Malaysia. Specifically, this study seeks to identify the students' level of knowledge regarding personal hygiene based on Islamic guidelines, examine their level of personal hygiene practices from an Islamic perspective, and analyse the relationship between knowledge and personal hygiene practices. This study employed a quantitative approach using a questionnaire method involving 242 Muslim female students from College 9 as respondents. The data obtained were analysed using the Statistical Package for the Social Sciences (SPSS) version 31.0 to determine frequency, percentage, mean, and Pearson correlation. The findings show that the students' level of knowledge regarding personal hygiene based on Islamic guidelines was at a high level, with an overall mean score of 4.61. In addition, the level of personal hygiene practices from an Islamic perspective was also at a high level, with an overall mean score of 4.55.
The findings on women's taharah practices also indicated a high level, with an overall mean score of 4.65. The Pearson correlation analysis revealed a strong and significant positive relationship between the level of knowledge and personal hygiene practices, with $r = 0.601$ and $p < 0.001$. These findings indicate that the higher the students' level of knowledge regarding personal hygiene based on Islamic guidelines, the higher their level of personal hygiene practices in daily life. Overall, this study shows that knowledge of personal hygiene plays an important role in shaping pure personal hygiene practices, particularly in the aspects of body hygiene, clothing, living environment, and women's taharah from an Islamic perspective.

AMALAN SOLAT FARDU DAN KAEDAH KETENTERAMAN JIWA MAHASISWA MUSLIM UTM

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Kajian ini merupakan satu tinjauan untuk meneliti amalan solat fardu dan kaedah ketenteraman jiwa Mahasiswa Muslim UTM. Kajian ini bertujuan untuk mengkaji amalan solat fardu, menilai tahap ketenteraman jiwa, menganalisis kaedah ketenteraman jiwa serta mengenal pasti hubungan antara amalan solat fardu dengan kaedah ketenteraman jiwa dalam kalangan Mahasiswa Muslim Universiti Teknologi Malaysia. Kajian ini menggunakan pendekatan kuantitatif dengan instrumen kajian berbentuk soal selidik mengandungi 35 item yang telah diedarkan kepada 140 orang Mahasiswa Muslim tahun 4 Fakulti Sains Pendidikan dan Teknologi, UTM. Data yang diperoleh dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 29.0 bagi mendapatkan analisis deskriptif yang melibatkan kekerapan, peratusan dan min, serta analisis korelasi Pearson bagi mengenal pasti hubungan antara pemboleh ubah kajian. Dapatan kajian menunjukkan bahawa tahap amalan solat fardu dalam kalangan Mahasiswa Muslim UTM berada pada tahap tinggi dengan nilai min keseluruhan 4.15. Tahap ketenteraman jiwa mahasiswa juga berada pada tahap tinggi dengan nilai min keseluruhan 4.22. Selain itu, kaedah ketenteraman jiwa yang merangkumi amalan zikir, solat malam atau qiamullail serta membaca dan memelihara al-Quran turut berada pada tahap tinggi dengan nilai min keseluruhan 4.12. Hal ini menunjukkan bahawa semakin tinggi amalan solat fardu mahasiswa, semakin tinggi kecenderungan mereka mengamalkan kaedah ketenteraman jiwa.
Kesimpulannya, amalan solat fardu berperanan penting sebagai asas pembentukan ketenteraman jiwa Mahasiswa Muslim UTM.

This study is a survey conducted to examine the practice of obligatory prayers and methods of attaining inner peace among Muslim students at Universiti Teknologi Malaysia (UTM). This study aims to examine the practice of obligatory prayers, assess the level of inner peace, analyse the methods of attaining inner peace, and identify the relationship between the practice of obligatory prayers and methods of attaining inner peace among Muslim students at Universiti Teknologi Malaysia. This study used a quantitative approach with a questionnaire as the research instrument, consisting of 35 items, which was distributed to 140 fourth-year Muslim students from the Faculty of Educational Sciences and Technology, UTM. The data obtained were analysed using the Statistical Package for the Social Sciences (SPSS) version 29.0 to obtain descriptive analysis involving frequency, percentage and mean, as well as Pearson correlation analysis to identify the relationship between the study variables. The findings show that the level of obligatory prayer practice among Muslim students at UTM was at a high level, with an overall mean value of 4.15. The level of inner peace among the students was also at a high level, with an overall mean value of 4.22. In addition, the methods of attaining inner peace, which include dhikr, night prayer or qiamullail, as well as reading and preserving the Quran, were also at a high level, with an overall mean value of 4.12. This shows that the higher the students' practice of obligatory prayers, the higher their tendency to practise methods of attaining inner peace. In conclusion, the practice of obligatory prayers plays an important role as the basis for the formation of inner peace among UTM Muslim students.

SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA TEKNOLOGI DENGAN PENDIDIKAN (KEJURUTERAAN MEKANIKAL) DENGAN KEPUJIAN [SHPJH]

STRATEGI GAYA PENGAJARAN GURU TERHADAP MATAPELAJARAN AUTOCAD DI KOLEJ VOKASIONAL

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Kajian ini membincangkan gaya pengajaran guru yang memberikan impak kepada para pelajar dimana menjadi polemik kritikal dalam konteks mata pelajaran AutoCAD di Kolej Vokasional. Menyedari jurang kajian literatur yang sedia ada, penyelidikan ini dilaksanakan dengan tiga objektif utama dimana iaitu mengenalpasti gaya pengajaran guru berdasarkan Vygotsky, mengenalpasti strategi gaya pengajaran guru berdasarkan Vygotsky, dan mencadangkan strategi gaya pengajaran guru yang bersesuaian berdasarkan Vygotsky. Bagi mencapai matlamat tersebut, kerangka metodologi kuantitatif telah digunapakai melalui instrumen edaran borang soal selidik kepada 69 responden yang terdiri daripada bidang Teknologi Automotif dan Teknologi Kimpalan. Instrumen kajian berupa soal selidik yang telah disahkan dan diuji kebolehpercayaannya melalui nilai Alpha Cronbach yang tinggi iaitu 0.792. Data dianalisis menggunakan statistik deskriptif (min, peratusan) dan tematik bagi soalan terbuka. Hasil kajian menunjukkan penguasaan perisian kompleks seperti AutoCAD dalam kalangan pelajar vokasional menuntut peralihan daripada bimbingan scaffolding konvensional (perhatian reaktif guru terhadap soalan asas) kepada struktur scaffolding berasaskan proses yang dipandu oleh interaksi rakan sebaya. Kajian lanjutan disyorkan untuk beralih kepada pendekatan kaedah campuran serta meluaskan skop persampelan ke institusi TVET lain bagi membina standard kompetensi pengajaran CAD yang menyeluruh.

This study critically examines the profound impact of teachers' instructional styles on students, addressing a pivotal polemic within the context of AutoCAD education in Vocational Colleges. Recognizing gaps in the existing literature, this research was orchestrated based on Vygotsky's sociocultural framework with three primary objectives: to identify contemporary teaching styles, to evaluate current pedagogical strategies, and to propose optimized instructional strategies tailored to the subject matter. To achieve these goals, a quantitative methodological framework was deployed, utilizing a validated questionnaire administered to 69 respondents across the Automotive Technology and Welding Technology programs. The instrument demonstrated high internal consistency, yielding a robust Cronbach's Alpha coefficient of 0.792. Data were subsequently scrutinized using descriptive statistics (mean and percentages) alongside thematic analysis for open-ended insights. The empirical findings reveal that mastering complex software like AutoCAD demands a paradigm shift from conventional scaffolding—characterized by reactive teacher intervention on basic queries—towards process-based, structured scaffolding driven by peer-to-peer interaction. Ultimately, these insights offer a substantive framework for future research, which is recommended to transition toward a mixed-method approach and expand the sampling scope across other TVET institutions to cultivate a comprehensive competency standard for CAD pedagogy.

TAHAP KESEDARAN PELAJAR DALAM BIDANG TEKNOLOGI KIMPALAN TERHADAP KEMAHIRAN HIJAU KEMAHIRAN HIJAU DI KOLEJ VOKASIONAL JOHOR

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Kemahiran hijau penting dalam pendidikan Teknikal dan Vokasional kerana kemahiran ini membantu melahirkan tenaga kerja yang cekap serta bertanggungjawab terhadap alam sekitar. Namun begitu, aktiviti kimpalan boleh menghasilkan wasap berbahaya, menggunakan tenaga yang tinggi dan menghasilkan sisa logam yang perlu diurus dengan betul. Oleh itu, tahap kesedaran pelajar terhadap kemahiran hijau perlu diberi perhatian. Kajian ini bertujuan mengenal pasti tahap kesedaran pelajar Teknologi Kimpalan terhadap kemahiran hijau berdasarkan aspek pengetahuan, sikap dan amalan. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Soal selidik digunakan sebagai instrumen utama untuk mengumpulkan data daripada pelajar Teknologi Kimpalan di Kolej Vokasional Johor. Data yang diperoleh dianalisis secara deskriptif bagi menentukan tahap bagi setiap aspek yang dikaji. Hasil kajian menunjukkan bahawa tahap kesedaran pelajar terhadap kemahiran hijau berada pada tahap yang tinggi. Aspek sikap menunjukkan pencapaian yang paling baik. Aspek pengetahuan dan amalan juga berada pada tahap yang tinggi. Pelajar mempunyai kesedaran yang baik tentang penggunaan peralatan perlindungan diri, bahaya wasap kimpalan dan kepentingan mematuhi prosedur keselamatan bengkel. Walau bagaimanapun, pemahaman tentang teknologi hijau masih perlu diperkukuh. Keprihatinan terhadap pencemaran dan amalan pengasingan sisa logam juga perlu diberi lebih perhatian. Kesimpulannya, pelajar telah mempunyai asas kesedaran kemahiran hijau yang baik. Pihak institusi dan pensyarah disarankan untuk memperbanyak aktiviti amali, mengadakan taklimat secara berkala dan menyediakan kemudahan pengurusan sisa yang lebih teratur. Elemen kemahiran hijau juga perlu diterapkan secara berterusan dalam proses pengajaran dan pembelajaran. Pengukuhan ini penting supaya pelajar bukan sahaja memahami konsep kemahiran hijau tetapi mampu mengamalkannya secara konsisten semasa aktiviti amali. Pensyarah juga memainkan peranan penting dalam membimbing pelajar melalui contoh dan pemantauan yang berterusan. Persekitaran bengkel yang tersusun dapat membantu pelajar membina tabiat kerja yang lebih selamat dan mesra alam. Usaha ini diharapkan dapat melahirkan graduan yang lebih bersedia untuk memenuhi keperluan industri hijau.

Green skills are important in Technical and Vocational Education and Training because they help produce skilled workers who are responsible towards the environment. Welding activities can produce harmful fumes and metal waste. They also require high energy consumption. Therefore, students need to have good awareness of green skills when carrying out welding activities. This study aimed to identify the level of green skills awareness among Welding Technology students based on knowledge, attitude and practice. A quantitative approach with a survey design was used in this study. A questionnaire was used as the main instrument to collect data from Welding Technology students at Vocational Colleges in Johor. The data were analysed using descriptive analysis to determine the level of each aspect studied. The findings showed that the students had a high level of awareness of green skills. Attitude was the most prominent aspect, while knowledge and practice were also at a high level. The students showed good awareness of the use of personal protective equipment, the dangers of welding fumes and the importance of following workshop safety procedures. However, their understanding of green technology still needs to be strengthened. More attention should also be given to environmental pollution and the practice of separating metal waste. In conclusion, the students already have a good foundation in green skills awareness.

Vocational Colleges and lecturers are encouraged to provide more structured practical activities and regular briefings. Waste management facilities should also be improved. Green skills should be continuously integrated into the teaching and learning of Welding Technology. This improvement is important so that students not only understand the concept of green skills but are also able to apply it consistently during practical activities. Lecturers also play an important role in guiding students through good examples and continuous monitoring. A well-organised workshop environment can help students develop safer and more environmentally friendly working habits. These efforts are expected to produce graduates who are better prepared to meet the needs of the green industry.

GAYA PEMBELAJARAN BERDASARKAN MODEL VARK DALAM SUBJEK LUKISAN KEJURUTERAAN DAN KEBERKESANANNYA

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Kajian ini dijalankan untuk mengenal pasti gaya pembelajaran pelajar berdasarkan Model VARK dalam subjek Lukisan Kejuruteraan serta melihat keberkesanannya terhadap proses pembelajaran pelajar Pendidikan TVET di Universiti Teknologi Malaysia (UTM). Subjek Lukisan Kejuruteraan memerlukan pelajar memahami lukisan teknikal dengan jelas, termasuk dari segi bentuk, arahan, simbol dan latihan amali. Oleh itu, gaya pembelajaran yang sesuai amat penting bagi membantu pelajar menguasai subjek ini dengan lebih baik. Kajian ini menggunakan pendekatan kuantitatif melalui borang soal selidik yang diedarkan kepada 101 orang responden. Data yang diperoleh dianalisis menggunakan statistik deskriptif seperti kekerapan, peratusan, min dan sisihan piawai. Hasil kajian menunjukkan bahawa profil gaya pembelajaran VARK pelajar berada pada tahap sederhana. Tahap keberkesanan gaya pembelajaran dalam subjek Lukisan Kejuruteraan juga berada pada tahap sederhana. Selain itu, cadangan pendekatan pembelajaran berasaskan Model VARK turut menunjukkan tahap sederhana. Dapatan ini menunjukkan bahawa pelajar tidak hanya bergantung kepada satu gaya pembelajaran sahaja, sebaliknya memerlukan gabungan kaedah visual, auditori, membaca/menulis dan kinestetik. Secara keseluruhannya, pendekatan pembelajaran berasaskan Model VARK sesuai digunakan dalam subjek Lukisan Kejuruteraan, namun perlu diperkukuhkan supaya proses pengajaran dan pembelajaran menjadi lebih berkesan serta sesuai dengan keperluan pelajar.

This study was conducted to identify students' learning styles based on the VARK model in the Engineering Drawing subject and to examine its effectiveness on the learning process of TVET students at Universiti Teknologi Malaysia (UTM). The Engineering Drawing subject requires students to clearly comprehend technical drawings, including shapes, instructions, symbols, and practical exercises. Therefore, appropriate learning styles are crucial in helping students master this subject more effectively. This study employed a quantitative approach through questionnaires distributed to 101 respondents. The data obtained were analyzed using descriptive statistics such as frequency, percentage, mean, and standard deviation. The findings indicate that the students' VARK learning style profile is at a moderate level. The effectiveness level of learning styles in the Engineering Drawing subject is also at a moderate level. Additionally, the proposed learning approach based on the VARK model also showed a moderate level. These findings indicate that students do not rely on a single learning style; instead, they require a combination of visual, auditory, read/write, and kinesthetic methods. Overall, the VARK model-based learning approach is suitable for use in the Engineering Drawing subject, but it needs to be strengthened to ensure that the teaching and learning process becomes more effective and better suited to students' needs.

KEMAHIRAN INSANIAH DALAM KALANGAN PELAJAR TAHUN AKHIR DIPLOMA KOLEJ VOKASIONAL NEGERI SABAH DALAM PERSEKITARAN INDUSTRI 5.0

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Kajian ini dijalankan untuk mengenal pasti tahap penguasaan kemahiran insaniah dalam kalangan pelajar tahun akhir Diploma Vokasional Malaysia (DVM) di Kolej Vokasional Negeri Sabah sebagai persediaan menghadapi cabaran Revolusi Industri 5.0. Kajian ini memberikan tumpuan kepada tiga domain utama berdasarkan Hasil Pembelajaran Program (Program Learning Outcomes, PLO) di bawah seliaan Bahagian Pendidikan dan Latihan Teknikal Vokasional (BPLTV), iaitu Kemahiran Komunikasi (PLO 4), Kemahiran Sosial dan Kerja Berpasukan (PLO 5), serta Etika dan Profesionalisme (PLO 8). Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan deskriptif yang melibatkan 102 orang pelajar tahun akhir daripada lapan buah Kolej Vokasional di Negeri Sabah, yang dipilih melalui kaedah persampelan rawak mudah. Data dikumpulkan menggunakan borang soal selidik berstruktur berasaskan skala Likert lima mata dan dianalisis secara statistik deskriptif melibatkan kekerapan, peratusan, min dan sisihan piawai menggunakan perisian SPSS. Dapatan kajian menunjukkan bahawa penguasaan kemahiran insaniah pelajar berada pada tahap tinggi dan memuaskan. Konstruk Etika dan Profesionalisme (PLO 8) mencatatkan skor min tertinggi (M = 4.3990, SP = 0.3611), diikuti oleh Kemahiran Sosial dan Kerja Berpasukan (PLO 5) (M = 4.2422, SP = 0.4513), manakala Kemahiran Komunikasi (PLO 4) merekodkan skor min terendah (M = 4.2029, SP = 0.4944). Walaupun terdapat perbezaan skor antara konstruk, keseluruhan dapatan menunjukkan bahawa pelajar mempunyai tahap penguasaan kemahiran insaniah yang baik sebagai persediaan memenuhi keperluan pasaran kerja. Implikasi kajian ini diharapkan dapat menjadi rujukan kepada BPLTV, pihak pengurusan Kolej Vokasional dan sektor industri dalam memperkukuh pembangunan kemahiran insaniah serta menambah baik kurikulum ke arah melahirkan graduan TVET yang lebih kompeten dan berdaya saing. Kata kunci: Kemahiran insaniah, Diploma Vokasional Malaysia, Kolej Vokasional, Revolusi Industri 5.0, TVET, Hasil Pembelajaran Program (PLO).

This study was conducted to identify the level of soft skills mastery among final-year Diploma in Malaysian Vocational (DVM) students at Vocational Colleges in Sabah as preparation for the challenges of the Industrial Revolution 5.0. The study focused on three key domains based on the Program Learning Outcomes (PLOs) under the Technical and Vocational Education and Training Division (BPLTV), namely Communication Skills (PLO 4), Social Skills and Teamwork (PLO 5), and Ethics and Professionalism (PLO 8). A quantitative approach employing descriptive survey design was adopted. A total of 102 final-year students from eight Vocational Colleges in Sabah were selected using a simple random sampling technique. Data was collected using a structured questionnaire based on a five-point Likert scale and analysed using descriptive statistics, including frequency, percentage, mean, and standard deviation through the Statistical Package for the Social Sciences (SPSS). The findings revealed that the overall level of students' soft skills mastery was high and satisfactory. Among the three domains, Ethics and Professionalism (PLO 8) recorded the highest mean score (M = 4.3990, SD = 0.3611), followed by Social Skills and Teamwork (PLO 5) (M = 4.2422, SD = 0.4513), while Communication Skills (PLO 4) recorded the lowest mean score (M = 4.2029, SD = 0.4944). Despite the differences in mean scores, the findings indicate that the students possess positive, balanced, and satisfactory affective readiness to meet current labour market demands. The findings are expected to provide valuable references for the Technical and Vocational Education and Training Division (BPLTV), Vocational College management, and

industry stakeholders in strengthening soft skills development and enhancing the TVET curriculum to produce graduates who are more competent, competitive, and better prepared for the future workforce. Keywords: Soft skills, Technical and Vocational Education and Training (TVET), Diploma in Malaysian Vocational (DVM), Vocational Colleges, Industrial Revolution 5.0, Program Learning Outcomes (PLOs).

KESEDIAAN PELAJAR DVM KIMPALAN KOLEJ VOKASIONAL MENGHADAPI PEKERJAAN 3D SEBELUM LATIHAN INDUSTRI (OJT)

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Kajian ini dijalankan untuk menilai tahap kesediaan pelajar Diploma Vokasional Malaysia (DVM) program Teknologi Kimpalan di Kolej Vokasional sebelum menjalani fasa Latihan Industri atau On-the-Job Training (OJT). Kajian ini memberi tumpuan kepada kesediaan pelajar dalam menghadapi realiti pekerjaan industri yang dikategorikan sebagai 3D iaitu kotor (dirty), berbahaya (dangerous) dan sukar (difficult), yang merupakan cabaran utama dalam bidang kimpalan. Secara khusus, objektif kajian ini adalah untuk mengenal pasti tahap kesediaan pelajar dari tiga aspek utama iaitu pengetahuan asas terhadap pekerjaan 3D, kesediaan kemahiran insaniah, serta kesediaan kemahiran teknikal dalam bidang kimpalan. Ketiga-tiga aspek ini penting dalam menentukan sejauh mana pelajar bersedia untuk menyesuaikan diri dengan persekitaran kerja sebenar di industri selepas tamat pengajian. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kajian tinjauan. Seramai 76 orang responden yang terdiri daripada pelajar tahun akhir DVM Kimpalan telah terlibat dalam kajian ini. Instrumen utama yang digunakan ialah soal selidik yang dibangunkan bagi mendapatkan maklumat berkaitan pengetahuan, kemahiran dan persepsi pelajar terhadap pekerjaan 3D serta persediaan mereka menghadapi Latihan Industri (OJT). Instrumen ini merangkumi aspek teknikal seperti proses kimpalan SMAW dan GMAW serta pematuhan kepada Welding Procedure Specification (WPS), di samping aspek kemahiran insaniah dan kesedaran keselamatan kerja. Data yang diperoleh dianalisis menggunakan statistik deskriptif bagi memberikan gambaran keseluruhan tentang tahap kesediaan pelajar.

Hasil analisis ini diharapkan dapat membantu menjelaskan profil kesediaan pelajar dalam aspek teknikal dan bukan teknikal sebelum mereka melangkah ke alam pekerjaan sebenar. Dapatan kajian juga boleh dijadikan rujukan oleh pihak Kolej Vokasional dalam menambah baik kandungan kurikulum serta memperkukuhkan pelaksanaan program persediaan OJT agar lebih relevan dengan keperluan industri semasa. Selain itu, kajian ini turut memberi nilai tambah kepada usaha memperkukuhkan hubungan antara institusi pendidikan dan industri dalam melahirkan graduan TVET yang lebih kompeten dan bersedia menghadapi cabaran pekerjaan 3D. Pendedahan awal kepada realiti industri dilihat penting dalam membentuk graduan yang bukan sahaja mahir dari segi teknikal, tetapi juga mempunyai ketahanan mental, disiplin serta kebolehpasaran yang tinggi. Kesimpulannya, tahap kesediaan yang baik terhadap elemen pekerjaan 3D merupakan faktor penting dalam memastikan pelajar dapat menyesuaikan diri dengan persekitaran kerja industri kimpalan. Hal ini secara tidak langsung menyokong aspirasi pembangunan TVET negara dalam melahirkan tenaga kerja mahir yang berdaya saing, profesional dan memenuhi keperluan industri masa hadapan.

This study was conducted to evaluate the readiness level of Diploma Vokasional Malaysia (DVM) Welding Technology students at Kolej Vokasional before undergoing Industrial Training or On-the-Job Training (OJT). The main purpose is to identify students'

preparedness in facing the realities of industrial work, which is categorized as 3D, namely dirty, dangerous, and difficult, particularly in the welding field. Specifically, this study examines students' readiness in three main aspects: basic knowledge of 3D jobs, soft skills, and technical skills in welding. These aspects are important in determining students' ability to adapt to real industrial environments after completing their studies. A quantitative approach using a survey design was employed. A total of 76 final-year DVM Welding Technology students were involved as respondents. A questionnaire was used as the main instrument to gather data on students' knowledge, skills, and perceptions of 3D jobs and their readiness for OJT, including welding processes such as SMAW and GMAW as well as Welding Procedure Specification (WPS). The data were analyzed using descriptive statistics to provide an overall view of students' readiness. The findings are expected to help institutions understand students' preparedness in both technical and non-technical aspects and improve OJT preparation programs in line with industry needs. In conclusion, readiness toward 3D job elements is essential to ensure students can adapt effectively to the industrial welding environment and become competent, disciplined, and industry-ready graduates.

KOMPETENSI GURU VOKASIONAL DALAM MELAKSANAKAN GAMIFIKASI SEBAGAI STRATEGI SOKONGAN KOGNITIF DI KOLEJ VOKASIONAL

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Kajian ini dijalankan untuk menilai tahap kompetensi guru vokasional dalam pelaksanaan gamifikasi sebagai strategi sokongan kognitif dalam pengajaran dan pembelajaran di institusi pendidikan vokasional. Isu utama kajian ini ialah pelaksanaan gamifikasi dalam PdP masih berada pada tahap sederhana dan belum dimanfaatkan secara optimum bagi meningkatkan keberkesanan pembelajaran pelajar dalam bidang teknikal. Objektif kajian ini adalah untuk mengenal pasti tahap kompetensi guru vokasional dari aspek pengetahuan, kemahiran dan sikap terhadap pelaksanaan gamifikasi serta menganalisis perbezaan berdasarkan pengalaman mengajar antara guru novis dan guru veteran. Kajian ini turut menilai elemen gamifikasi sebagai strategi sokongan kognitif dalam PdP. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan. Instrumen kajian ialah soal selidik yang diedarkan kepada 75 orang guru vokasional melalui persampelan rawak mudah. Data dianalisis menggunakan statistik deskriptif iaitu min dan sisihan piawai serta statistik inferensi Ujian Mann-Whitney U bagi mengenal pasti perbezaan berdasarkan pengalaman mengajar. Dapatan kajian menunjukkan tahap kompetensi guru vokasional dari aspek pengetahuan, kemahiran dan sikap berada pada tahap sederhana. Analisis inferensi juga mendapati terdapat perbezaan signifikan dalam aspek pengetahuan berdasarkan pengalaman mengajar, namun tidak bagi aspek kemahiran dan sikap antara guru novis dan guru veteran. Ini menunjukkan pengalaman mengajar lebih mempengaruhi pengetahuan berbanding kemahiran dan sikap dalam pelaksanaan gamifikasi. Secara keseluruhannya, kajian ini merumuskan bahawa pelaksanaan gamifikasi dalam pendidikan vokasional masih berada pada tahap perkembangan dan memerlukan penambahbaikan sistematik. Oleh itu, dicadangkan agar pihak berkepentingan seperti Kementerian Pendidikan Malaysia, institusi latihan perguruan dan kolej vokasional melaksanakan latihan profesional berstruktur, berterusan serta berasaskan amalan bilik darjah bagi meningkatkan kompetensi guru. Penekanan juga perlu diberikan kepada pengukuhan integrasi pengetahuan pedagogi, kemahiran reka bentuk instruksional digital serta sikap positif terhadap inovasi pendidikan bagi memastikan keberkesanan gamifikasi sebagai strategi sokongan kognitif dalam pendidikan vokasional.

This study was conducted to evaluate the level of competency among vocational teachers in implementing gamification as a cognitive support strategy in teaching and learning within vocational education institutions. The main issue of this study is that the implementation of gamification in teaching and learning is still at a moderate level and has not been fully optimised to enhance students' learning effectiveness in technical fields. The objectives of this study were to identify the level of vocational teachers' competency in terms of knowledge, skills, and attitude towards gamification implementation, and to analyse differences based on teaching experience between novice and veteran teachers. This study also examined gamification elements as a cognitive support strategy in teaching and learning. This study employed a quantitative survey design. A questionnaire was distributed to 75 vocational teachers using simple random sampling. Data were analysed using descriptive statistics (mean and standard deviation) and inferential statistics using the Mann-Whitney U test. The findings showed that the level of competency in knowledge, skills, and attitude was at a moderate level. A significant difference was found in knowledge based on teaching experience, while no significant differences were found for skills and attitude. This indicates that teaching experience influences knowledge more than skills and attitude in gamification implementation. Overall, the study concludes that gamification implementation in vocational education is still developing and requires systematic improvement. Therefore, structured and continuous professional training should be provided by relevant stakeholders to strengthen teachers' competency in integrating gamification effectively, alongside reinforcing pedagogical knowledge, instructional design skills, and positive attitudes toward educational innovation.

TAHAP KESEDIAN PELAJAR MEKANIKAL KOLEJ VOKASIONAL TERHADAP PENGGUNAAN KECERDASAN BUATAN (AI) DALAM PEMBELAJARAN

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Integrasi Kecerdasan Buatan dalam Pendidikan dan Latihan Teknikal dan Vokasional kini menjadi keperluan mendesak impak Revolusi Industri Keempat. Walau bagaimanapun, wujud isu kritikal membabitkan tahap literasi teknologi yang masih rendah dalam kalangan pelajar. Meskipun dikategorikan sebagai generasi pribumi digital, gajet digital lebih cenderung dieksploitasi untuk tujuan hiburan dan sosial berbanding akademik. Isu ini ditambah pula dengan wujudnya keresahan teknologi akibat persepsi salah bahawa sistem pintar akan menggantikan peranan kemahiran tangan yang menjadi teras identiti bidang vokasional, serta jurang akses digital akibat perbezaan latar belakang sosioekonomi pelajar. Menyedari kekangan tersebut, kajian ini dijalankan bertujuan untuk menilai tahap kesiapsiagaan pelajar Sijil Vokasional Malaysia aliran mekanikal, khususnya dalam bidang Teknologi Automotif dan Teknologi Kimpalan di Kolej Vokasional negeri Johor, terhadap penggunaan kecerdasan buatan dalam pembelajaran. Penilaian ini difokuskan kepada beberapa dimensi utama berasaskan Model Penerimaan Teknologi, iaitu tahap pengetahuan atau kognitif, tahap kemahiran atau psikomotor, sikap pelajar atau afektif, serta tahap kesediaan infrastruktur sokongan. Bagi mencapai tujuan tersebut, kajian kuantitatif dengan reka bentuk tinjauan telah dilaksanakan. Teknik pensampelan bertujuan digunakan untuk memilih sekumpulan responden daripada institusi berkaitan. Instrumen kajian menggunakan borang soal selidik Skala Pilihan Lima Mata yang dibahagikan kepada beberapa konstruk utama bagi mengumpul respons subjek dalam tempoh yang efisien. Data mentah yang diperoleh kemudian disaring dan dianalisis secara deskriptif menggunakan perisian analisis statistik untuk meneliti nilai kekerapan, peratusan, skor purata, dan sisihan piawai. Analisis kebolehpercayaan instrumen menunjukkan nilai indeks kebolehpercayaan bagi setiap konstruk berada pada tahap yang memuaskan hingga tinggi, sekali gus membuktikan kestabilan borang soal selidik untuk kajian lapangan. Hasil analisis data membuktikan secara konsisten bahawa kesemua pemboleh ubah mencatatkan purata skor yang tinggi secara keseluruhan. Tahap kesediaan infrastruktur merekodkan skor purata tertinggi, diikuti rapat oleh tahap pengetahuan, tahap kemahiran praktikal, dan tahap sikap atau penerimaan pelajar. Secara keseluruhannya, pelajar menunjukkan keupayaan kognitif dan psikomotor yang matang dalam memanfaatkan teknologi digital untuk tugasan amali, namun sekelompok kecil pelajar kekal berwaspada terhadap impak automasi pintar ke atas pasaran kerja masa hadapan. Berdasarkan dapatan ini, beberapa strategi intervensi dan rekomendasi praktikal dikemukakan, antaranya mencadangkan pihak kementerian menyemak semula Kurikulum Standard Kolej Vokasional dengan memasukkan submodul rasmi aplikasi kecerdasan buatan dalam kejuruteraan mekanikal bagi menstrukturkan proses pembelajaran kendiri pelajar. Pihak pengurusan kolej juga disaran menubuhkan kumpulan pemikir strategik bersama pihak industri serta mengoptimumkan penyenggaraan fasiliti makmal dan rangkaian internet yang sedia ada. Akhir sekali, latihan literasi digital dan etika kecerdasan buatan perlu dilaksanakan secara berterusan bagi mengekang isu salah laku akademik seperti plagiarisme.

The integration of Artificial Intelligence in Technical and Vocational Education and Training has become an urgent necessity due to the onset of the Fourth Industrial Revolution. However, critical issues persist regarding the low level of artificial intelligence literacy among students. Despite being classified as digital natives, digital devices are primarily exploited for entertainment and social purposes rather than academic integration. This issue is further compounded by technological anxiety stemming from the misconception that artificial

intelligence will entirely replace the hands-on practical skills central to the vocational identity, alongside digital access disparities caused by students' diverse socioeconomic backgrounds. Recognizing these constraints, this study aims to evaluate the readiness level of mechanical stream Malaysia Vocational Certificate students, specifically in Automotive Technology and Welding Technology across Johor Vocational Colleges, towards utilizing artificial intelligence tools in learning. The evaluation maps out several primary dimensions adapted from the Technology Acceptance Model: knowledge, skills, attitudes, and the readiness of institutional support infrastructure. To achieve these objectives, a quantitative approach utilizing a survey research design was implemented. A purposive sampling technique was utilized to select a targeted group of respondents from the related institutions. The research instrument comprised a Five-Point Likert scale questionnaire divided into several core constructs to gather responses within an efficient timeframe. The collected raw data were screened and descriptively analyzed using statistical analysis software to compute frequencies, percentages, mean scores, and standard deviations. Instrument reliability testing yielded satisfactory high Cronbach's Alpha indices across all constructs, confirming the stability of the questionnaire for fieldwork. The empirical data consistently demonstrated that all measured variables recorded a high overall average score. Infrastructure readiness registered the highest average score, followed closely by knowledge, practical skills, and student attitudes or acceptance. Overall, students exhibited mature cognitive and psychomotor capacities by leveraging digital technologies for workshop assignments; however, a small faction remains cautious regarding the implications of smart automation on future job security. Based on these insights, several practical intervention strategies and recommendations are proposed, including a recommendation for the ministry to restructure the Vocational College Standard Curriculum by embedding an official sub-module on artificial intelligence applications in mechanical engineering to guide self-directed learning. Institutional management is also urged to establish strategic think-tanks with industry partners and optimize the maintenance of existing lab facilities and network connectivity. Lastly, continuous digital literacy and artificial intelligence ethics training must be deployed to eliminate academic misconduct such as plagiarism.

TAHAP KESEDARAN TERHADAP PENYELENGGARAAN PERALATAN BENGKEL DALAM KALANGAN BAKAL GURU PENDIDIKAN TEKNIKAL DI UNIVERSITI TEKNOLOGI MALAYSIA

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Penyelenggaraan peralatan bengkel merupakan aspek penting dalam Pendidikan Teknikal kerana berkait rapat dengan keselamatan pengguna, kelancaran pembelajaran amali dan pengurusan aset institusi. Kajian ini dijalankan untuk mengenal pasti tahap kesedaran terhadap penyelenggaraan peralatan bengkel dalam kalangan bakal guru Pendidikan Teknikal bidang Mekanikal, Elektrik, Awam dan Reka Bentuk dan Teknologi di Universiti Teknologi Malaysia berdasarkan aspek pengetahuan, sikap dan amalan. Kajian menggunakan pendekatan kuantitatif berbentuk tinjauan melalui soal selidik berstruktur berskala Likert lima mata. Sebelum kajian sebenar, kajian rintis melibatkan 15 responden telah dijalankan. Nilai Cronbach's Alpha bagi konstruk pengetahuan, sikap dan amalan masing-masing ialah .924, .933 dan .951, menunjukkan ketekalan dalaman yang sangat tinggi. Populasi kajian sebenar terdiri daripada 86 orang bakal guru Pendidikan Teknikal tahun akhir, manakala 71 soal selidik lengkap diterima dan dianalisis menggunakan statistik deskriptif. Dapatan menunjukkan tahap pengetahuan, sikap dan amalan berada pada tahap tinggi. Aspek sikap mencatatkan skor min tertinggi, diikuti amalan dan pengetahuan. Secara keseluruhannya, bakal guru Pendidikan Teknikal mempunyai tahap kesedaran yang baik terhadap penyelenggaraan peralatan bengkel. Namun, aspek pelaporan kerosakan, dokumentasi penyelenggaraan, pemilihan peralatan yang sesuai dan pematuhan arahan penggunaan perlu terus diperkukuh. Nilai kebolehpercayaan data sebenar yang lebih rendah berbanding kajian rintis turut diambil kira dan dapatan ditafsir secara berhati-hati.

Workshop equipment maintenance is an important aspect of Technical Education because it is closely related to user safety, the smooth implementation of practical learning and institutional asset management. This study was conducted to identify the level of awareness of workshop equipment maintenance among prospective Technical Education teachers in Mechanical, Electrical, Civil, and Design and Technology programmes at Universiti Teknologi Malaysia based on knowledge, attitude and practice. A quantitative survey design was employed using a structured questionnaire with a five-point Likert scale. Before the actual study, a pilot study involving 15 respondents was conducted. Cronbach's Alpha values for knowledge, attitude and practice were .924, .933 and .951 respectively, indicating very high internal consistency. The actual study population consisted of 86 final-year prospective Technical Education teachers, while 71 completed questionnaires were received and analysed using descriptive statistics. The findings showed that the levels of knowledge, attitude and practice were high. Attitude recorded the highest mean score, followed by practice and knowledge. Overall, the respondents demonstrated a good level of awareness of workshop equipment maintenance. Nevertheless, damage reporting, maintenance documentation, selection of suitable equipment and compliance with operating instructions should be further strengthened. The lower reliability values obtained from the actual data compared with the pilot study were also considered, and the findings were interpreted cautiously.

PENYEDIAAN JURUTERA MASA HADAPAN YANG SEDIA MENDEPANI CABARAN MELALUI PEMBELAJARAN PENGALAMAN

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Kajian ini dijalankan untuk mengenal pasti profil gaya dan fleksibiliti pembelajaran berdasarkan Model Kolb 4.0 dalam kalangan pelajar kejuruteraan di Universiti Teknologi Malaysia (UTM). Kajian ini memberi tumpuan kepada sembilan gaya pembelajaran, iaitu Initiating, Experiencing, Imagining, Reflecting, Analyzing, Thinking, Deciding, Acting dan Balancing, serta aspek fleksibiliti pembelajaran yang menggambarkan keupayaan pelajar menyesuaikan pendekatan pembelajaran mengikut situasi. Kajian menggunakan pendekatan kuantitatif berbentuk tinjauan dengan borang soal selidik sebagai instrumen utama. Seramai 120 orang pelajar daripada beberapa program kejuruteraan dan tahun pengajian telah terlibat sebagai responden. Data dianalisis menggunakan statistik deskriptif dan analisis kebolehpercayaan bagi menghuraikan profil responden serta kecenderungan pembelajaran yang dikenal pasti. Dapatan menunjukkan bahawa responden mempunyai kecenderungan terhadap pelbagai gaya pembelajaran dengan skor min berada pada tahap sederhana tinggi hingga tinggi. Keadaan ini menunjukkan bahawa corak pembelajaran pelajar kejuruteraan tidak tertumpu kepada satu pendekatan sahaja, sebaliknya melibatkan pelbagai bentuk pengalaman, refleksi, pemikiran dan tindakan. Analisis kebolehpercayaan pula menunjukkan konstruk utama mempunyai tahap konsistensi dalaman yang memuaskan. Walau bagaimanapun, setiap gaya pembelajaran hanya diwakili oleh dua item dan taburan responden antara tahun serta program pengajian adalah tidak seimbang. Oleh itu, dapatan kajian perlu ditafsir sebagai gambaran awal terhadap kumpulan responden yang terlibat dan tidak digeneralisasikan secara menyeluruh kepada semua pelajar kejuruteraan di UTM. Secara keseluruhannya, kajian ini memberikan gambaran tentang kepelbagaian profil dan fleksibiliti pembelajaran pelajar serta dapat menjadi asas kepada pemahaman yang lebih baik terhadap cara pelajar kejuruteraan menyesuaikan pembelajaran mereka dalam persekitaran akademik yang berbeza.

This study was conducted to identify the learning style profiles and learning flexibility based on the Kolb 4.0 Model among engineering students at Universiti Teknologi Malaysia (UTM). The study focused on nine learning styles, namely Initiating, Experiencing, Imagining, Reflecting, Analyzing, Thinking, Deciding, Acting, and Balancing, as well as learning flexibility, which reflects students' ability to adapt their learning approaches according to different situations. A quantitative survey design was employed, with a structured questionnaire used as the main research instrument. A total of 120 engineering students from different programmes and years of study participated as respondents. The data were analysed using descriptive statistics and reliability analysis to describe the respondents' profiles and identify their learning tendencies. The findings showed that the respondents demonstrated tendencies towards various learning styles, with mean scores ranging from moderately high to high levels. This indicates that engineering students do not rely on a single learning approach, but instead engage in different forms of experience, reflection, thinking, and action. Reliability analysis also showed that the main constructs achieved satisfactory levels of internal consistency. However, each learning style was represented by only two items, and the distribution of respondents across years of study and engineering programmes was unequal. Therefore, the findings should be interpreted as an initial description of the respondents involved and should not be broadly generalised to all engineering students at UTM. Overall, this study provides an overview of students' diverse learning profiles and learning flexibility, which may serve as a useful basis for understanding how engineering

students adapt their learning approaches within different academic environments.

FAKTOR PENDORONG MELANJUTKAN PELAJARAN DALAM BIDANG PENDIDIKAN DI UNIVERSITI AWAM

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Pemilihan bidang pengajian merupakan satu keputusan penting yang mempengaruhi hala tuju kerjaya seseorang pelajar, khususnya dalam bidang pendidikan yang berperanan melahirkan bakal pendidik berkualiti untuk memenuhi keperluan sistem pendidikan negara. Walau bagaimanapun, terdapat pelajar yang memilih bidang pendidikan tanpa dipengaruhi oleh minat dan personaliti yang sesuai, sekali gus boleh menjejaskan motivasi, kepuasan serta komitmen terhadap profesion perguruan. Oleh itu, kajian ini bertujuan mengenal pasti faktor yang mendorong pelajar melanjutkan pelajaran dalam bidang pendidikan di Universiti Teknologi Malaysia (UTM) berdasarkan enam komponen Teori Holland (RIASEC) serta menentukan faktor yang paling dominan mempengaruhi pemilihan bidang tersebut. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan yang melibatkan seramai 81 orang pelajar prasiswazah Tahun 1 Program Pendidikan Teknik dan Vokasional (TVET). Data dikumpulkan menggunakan soal selidik dan dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 26.0 melalui statistik deskriptif iaitu kekerapan, peratusan dan min. Dapatan kajian menunjukkan bahawa semua enam komponen Teori Holland berada pada tahap tinggi sebagai faktor yang mempengaruhi pemilihan bidang pendidikan, dengan aspek Social mencatatkan nilai min tertinggi (min = 4.64), diikuti Realistic (min = 4.44), Conventional (min = 4.43), Investigative (min = 4.32), Artistic (min = 4.30) dan Enterprising (min = 4.23). Kesimpulannya, faktor sosial seperti keinginan membantu dan membimbing orang lain, berinteraksi dengan pelajar serta menyumbang kepada pembangunan insan merupakan faktor paling dominan yang mendorong pelajar memilih bidang pendidikan. Dapatan kajian ini diharapkan dapat menjadi rujukan kepada institusi pengajian tinggi dan pihak berkepentingan dalam merancang strategi pengambilan pelajar serta memperkukuh pembangunan program pendidikan yang selaras dengan minat dan personaliti bakal pendidik.

Choosing a field of study is an important decision that influences a student's career path, particularly in the field of education, which plays a vital role in producing competent future educators to meet the needs of the national education system. However, some students choose education programmes without considering whether their interests and personalities align with the profession, which may affect their motivation, academic performance, and commitment to the teaching profession. Therefore, this study aims to identify the factors that motivate students to pursue studies in the field of education at Universiti Teknologi Malaysia (UTM) based on the six components of Holland's Theory (RIASEC) and to determine the most dominant factor influencing their choice. This study employed a quantitative approach using a survey research design involving 81 first-year undergraduate students from the Technical and Vocational Education and Training (TVET) programme. Data were collected using a questionnaire and analysed using the Statistical Package for the Social Sciences (SPSS) version 26.0 through descriptive statistics, namely frequency, percentage, and mean. The findings revealed that all six components of Holland's Theory recorded high mean scores as factors influencing students' choice of the education field. The Social component was identified as the most dominant factor with a mean score of 4.64, followed by Realistic (mean = 4.44), Conventional (mean = 4.43), Investigative (mean = 4.32), Artistic (mean = 4.30),

and Enterprising (mean = 4.23). In conclusion, social-related factors, particularly the desire to help and guide others, interact with students, and contribute to human capital development, are the primary motivations for students to pursue studies in the field of education. The findings of this study are expected to serve as a useful reference for higher education institutions and relevant stakeholders in developing more effective student recruitment strategies and educational programmes that align with students' interests and personalities.

PERSEPSI PELAJAR TAHUN AKHIR PENDIDIKAN TVET DI UTM TERHADAP KEPENTINGAN GAYA KEPIMPINAN DALAM PENGURUSAN BILIK DARJAH

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Kajian ini dijalankan adalah untuk mengkaji persepsi pelajar tahun akhir Pendidikan TVET di Universiti Teknologi Malaysia (UTM) terhadap kepentingan gaya kepimpinan dalam pengurusan bilik darjah. Objektif kajian ini adalah untuk mengenal pasti persepsi terhadap kepentingan gaya kepimpinan dalam memastikan pengurusan bilik darjah yang berkesan, mengkaji peranan gaya kepimpinan dalam mengawal tingkah laku serta disiplin pelajar, dan mengenal pasti peranannya dalam meningkatkan minat serta motivasi pelajar.
Gabungan Teori Kepimpinan Klasik dan Teori Kepimpinan Moden digunakan sebagai landasan teori bagi mengukur lima gaya kepimpinan utama iaitu Autokratik, Demokratik, Laissez-Faire, Transaksional, dan Transformasional. Seramai 86 orang responden telah dipilih menggunakan teknik persampelan bancian. Data yang diperoleh telah dianalisis secara statistik deskriptif bagi mendapatkan nilai skor min, peratusan, kekerapan, dan sisihan piawai. Hasil kajian mendapati bahawa responden bersetuju pendekatan kepimpinan situasional adalah paling penting dalam pengurusan kelas (skor min 3.23), mengutamakan kombinasi gaya Autokratik dan Transaksional bagi pengawalan disiplin, serta memilih gaya Transformasional (skor min 3.16) bagi meningkatkan motivasi pelajar manakala gaya Laissez-Faire ditolak sepenuhnya. Kesimpulannya, bakal guru TVET bersedia mengamalkan kepimpinan dinamik selari dengan Teori Kontingensi, sekali gus memberi implikasi terhadap keperluan penambahbaikan kurikulum latihan perguruan pada masa akan datang.

This study was conducted to examine the perceptions of final-year TVET Education students at Universiti Teknologi Malaysia (UTM) regarding the importance of leadership styles in classroom management. The objectives of this study were to identify perceptions of the importance of leadership styles in ensuring effective classroom management, examine the role of leadership styles in controlling student behavior and discipline, and determine their role in enhancing student interest and motivation. A combination of Classical Leadership Theory and Modern Leadership Theory served as the theoretical framework to measure five main leadership styles: Autocratic, Democratic, Laissez-Faire, Transactional, and Transformational. A total of 86 respondents were selected using a census sampling technique. The collected data were analyzed using descriptive statistics to obtain mean scores, percentages, frequencies, and standard deviations. The findings revealed that respondents agreed the situational leadership approach is the most important in classroom management (mean score of 3.23), favored a combination of Autocratic and Transactional styles for discipline control, and selected the Transformational style (mean score of 3.16) to boost student motivation, whereas the Laissez-Faire style was fully rejected. In conclusion, prospective TVET teachers are prepared to practice dynamic leadership in line with Contingency Theory, thereby implying the need for improvements in future teacher training curricula.

CABARAN DALAM MELAKSANAKAN PROGRAM TVET DI SEKOLAH MENENGAH LUAR BANDAR

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Pendidikan dan Latihan Teknikal dan Vokasional (TVET) memainkan peranan strategik dalam pembangunan modal insan negara bagi memenuhi keperluan ekonomi berteraskan inovasi dan teknologi termaju. Walau bagaimanapun, pelaksanaan program TVET di institusi sekolah menengah luar bandar sering kali berhadapan dengan pelbagai rintangan bersistem yang merencatkan keberkesanannya. Kajian ini dijalankan untuk mengenal pasti cabaran utama pelaksanaan program TVET, menilai kesan cabaran tersebut terhadap keberkesanan pengajaran dan pembelajaran (PdPc), serta mengenal pasti faktor-faktor penyumbang kepada kelemahan pelaksanaan program tersebut di sekolah menengah luar bandar sekitar daerah Kulai, Johor. Menggunakan reka bentuk kajian kuantitatif berbentuk tinjauan rentas-seksyen, data dikumpulkan daripada 80 orang responden yang terdiri daripada pelajar Tingkatan Empat dan Tingkatan Lima melalui instrumen soal selidik. Hasil analisis deskriptif menunjukkan bahawa responden menghadapi cabaran material seperti peralatan bengkel yang usang item dengan min tertinggi ialah mesin dan peralatan amali berada dalam keadaan baik dan selamat (M = 4.21, SP = 0.62), manakala item terendah ialah kemudahan teknologi seperti simulasi, automasi atau robotik (M = 3.10, SP = 1.19) serta cabaran sosiologikal seperti stigma masyarakat dan keutamaan ibu bapa terhadap aliran akademik konvensional item "Saya percaya lulusan TVET mampu memperoleh pendapatan yang lumayan" memperoleh min tertinggi (M = 4.46, SP = 0.63), manakala item "Masih terdapat stigma bahawa kerjaya TVET hanya melibatkan pekerjaan 3D" mencatatkan min terendah (M = 3.12, SP = 1.13).. Cabaran ini secara langsung menjejaskan proses PdPc, memaksa peralihan daripada latihan amali kepada teori makmal, serta mencetuskan kebimbangan pelajar terhadap kebolehpasaran diri. Faktor utama kelemahan pelaksanaan dikenal pasti berpunca daripada kekurangan peruntukan kewangan khusus, budaya sekolah yang mengutamakan gred akademik, serta ketiadaan jaringan kerjasama strategik dengan pihak industri. Kajian ini merumuskan bahawa intervensi yang lebih inklusif, kerjasama pintar antara sekolah dan industri, serta pemanfaatan teknologi digital adalah kritikal bagi memperkasa ekosistem TVET di luar bandar.

Technical and Vocational Education and Training (TVET) plays a strategic role in developing the nation's human capital to meet the demands of an economy driven by innovation and advanced technology. However, the implementation of TVET programmes in rural secondary schools often faces various systemic challenges that hinder their effectiveness. This study was conducted to identify the main challenges in implementing TVET programmes, assess the impact of these challenges on the effectiveness of teaching and learning (T&L), and identify the factors contributing to the weaknesses in programme implementation in rural secondary schools in the Kulai district of Johor. Employing a quantitative cross-sectional survey research design, data were collected from 80 respondents comprising Form Four and Form Five students through a questionnaire instrument. The results of the descriptive analysis indicated that respondents faced material challenges, particularly outdated workshop equipment. The highest mean score was recorded for the item "Machines and practical equipment are in good and safe condition" (M = 4.21, SD = 0.62), while the lowest mean score was recorded for "Technological facilities such as simulation, automation, or robotics are available" (M = 3.10, SD = 1.19). Sociological challenges, such as societal stigma and parents' preference for conventional academic streams, were also identified. The item "I believe that TVET graduates are capable of earning a lucrative income" recorded the highest mean score (M = 4.46, SD = 0.63), whereas the item "There is still a stigma that TVET careers only involve 3D jobs" recorded the lowest mean score (M = 3.12, SD = 1.13). These challenges directly affect the teaching and learning process by forcing a shift from practical training to theoretical laboratory-based instruction, while also generating concerns among

students regarding their employability. The main factors contributing to weaknesses in implementation were identified as insufficient dedicated financial allocations, a school culture that prioritises academic grades, and the absence of strategic collaboration networks with industry stakeholders. This study concludes that more inclusive interventions, smart partnerships between schools and industries, and the utilisation of digital technologies are critical to strengthening the TVET ecosystem in rural areas.

KESESUAIAN 3D METAVERSE DALAM PEMBELAJARAN IMERSIF BAGI BIDANG TEKNOLOGI MEKANIKAL DAN PEMBUATAN DI KOLEJ VOKASIONAL

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Perkembangan teknologi digital dalam era Revolusi Industri 4.0 menuntut anjakan paradigma dalam landskap pendidikan teknik dan vokasional (TVET) melalui pengintegrasian platform pembelajaran digital yang interaktif. Walau bagaimanapun, wujud jurang kompetensi digital pengajar dan kekangan pelaksanaan amali fizikal berbahaya yang memerlukan penilaian empirikal terhadap kesediaan pendidik sebelum pelaburan infrastruktur besar-besaran dilaksanakan. Objektif utama kajian ini adalah untuk mengenal pasti tahap kesediaan pensyarah Teknologi Mekanikal dan Pembuatan di Kolej Vokasional negeri Johor terhadap aplikasi teknologi 3D Metaverse berdasarkan konstruk pengetahuan, kemahiran, sikap dan infrastruktur. Kajian ini menggunakan reka bentuk kuantitatif deskriptif menerusi kaedah tinjauan dengan instrumen soal selidik skala Likert yang diedarkan kepada pensyarah bidang berkaitan di seluruh Kolej Vokasional negeri Johor. Dapatan kajian menunjukkan tahap kesediaan am pensyarah berada pada tahap sederhana dengan skor min keseluruhan 3.37, di mana konstruk sikap mencatatkan skor tertinggi (3.53) manakala konstruk infrastruktur mencatatkan skor terendah (3.14) akibat isu komputer usang dan capaian Internet yang lemah. Kesimpulannya, modal insan di peringkat akar umbi sudah mempunyai kesediaan mental yang positif, namun potensi ini terhalang oleh ekosistem fizikal institusi yang belum bersedia sepenuhnya. Bagi penambahbaikan, pihak Kementerian Pendidikan Malaysia disyorkan untuk mewujudkan Dana Khas Penataran Digital TVET bagi menaik taraf perkakasan komputer serta rangkaian internet, di samping membangunkan modul pedagogi imersif rasmi dan merombak program latihan profesionalisme pensyarah secara bersemuka.

The rapid advancement of digital technology in the era of the Fourth Industrial Revolution demands a paradigm shift in the landscape of Technical and Vocational Education and Training (TVET) through the integration of interactive digital learning platforms. However, existing gaps in instructors' digital competencies and constraints in executing hazardous physical practical tasks necessitate an empirical evaluation of educators' readiness before large-scale infrastructure investments are implemented. The primary objective of this study is to identify the level of readiness among Mechanical and Manufacturing Technology lecturers in Johor Vocational Colleges toward the application of 3D Metaverse technology based on the constructs of knowledge, skills, attitude, and infrastructure. This study employed a descriptive quantitative design using a survey method, utilizing a Likert-scale questionnaire distributed to lecturers in the related fields across Vocational Colleges in Johor. The findings indicated that the general readiness level of the lecturers stands at a moderate level with an overall mean score of 3.37, where the attitude construct recorded the highest score (3.53) while the infrastructure construct recorded the lowest score (3.14) due to obsolete computers and weak Internet connectivity. In conclusion, human capital at the grassroots level possesses a positive mental readiness, yet this potential is hindered by an institutional physical ecosystem that is not fully prepared. For future improvement, it is recommended that the Ministry of Education Malaysia establish a Special TVET Digital Upgrading Fund to upgrade computer hardware and internet networks, alongside developing an official immersive pedagogical module and revamping face-to-face professional development training programs for lecturers.

KEPERLUAN SISTEM PERSIJILAN KEMAHIRAN MALAYSIA (SPKM) SEBAGAI STANDARD KOMPETENSI GURU TEKNIKAL BERDASARKAN KERANGKA SGM 2.0

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Kajian ini bertujuan untuk meneliti keperluan pengiktirafan melalui Sistem Persijilan Kemahiran Malaysia (SPKM) sebagai standard kompetensi guru teknikal berdasarkan kerangka Standard Guru Malaysia (SGM 2.0). Sistem SPKM dilihat sebagai instrumen penting yang berpotensi besar untuk memperkukuh elemen profesionalisme guru melalui empat domain utama iaitu Domain Orientasi Ilmu, Domain Instruksional, Domain Pelibatan Komuniti, dan Domain Kualiti Peribadi. Kajian ini menggunakan reka bentuk kuantitatif dengan pendekatan tinjauan melalui soal selidik terhadap guru teknikal Kolej Vokasional di Johor. Objektif utama kajian ini adalah untuk menilai tahap keperluan pengiktirafan SPKM bagi setiap domain SGM 2.0 serta mengenal pasti adakah terdapat perbezaan yang signifikan dalam tahap keperluan tersebut mengikut status pemilikan sijil kemahiran responden. Dapatan kajian menunjukkan bahawa guru teknikal mempunyai persepsi yang sangat positif dengan merekodkan tahap keperluan yang tinggi bagi kesemua domain yang dikaji. Hasil analisis inferensi melalui Ujian-t Sampel Bebas mendedahkan bahawa tidak terdapat perbezaan yang signifikan dalam tahap keperluan pengiktirafan kompetensi antara kelompok guru yang memiliki sijil dengan kelompok yang tidak memiliki sijil di bawah SPKM. Kajian ini mencadangkan agar pengiktirafan kompetensi melalui SPKM menstrukturkan dasar latihan berkala dan pemantapan laluan kerjaya guru teknikal demi memartabatkan mutu ekosistem pendidikan TVET negara di masa hadapan.

This study aims to examine the requirement of recognition through the Malaysian Skills Certification System (SPKM) as a competency standard for technical teachers based on the Malaysian Teacher Standard framework (SGM 2.0). The SPKM system is seen as a vital instrument with great potential to strengthen teacher professionalism across four main domains which is Knowledge Orientation, Instructional, Community Involvement, and Personal Quality. A quantitative research design using a survey method via questionnaires was employed, targeting technical teachers at Vocational Colleges at Johor. The primary objectives of this study are to assess the requirement level of SPKM recognition for each SGM 2.0 domain and to determine if there is a significant difference in this perceived requirement based on the respondents' skills certification ownership status. Findings revealed that technical teachers held highly positive perceptions, recording a high level of requirement across all studied domains. Inferential analysis using the Independent Samples t-Test demonstrated that there was no significant difference in the competency recognition requirement level between teachers who possessed skills certification and those who did not under SPKM. This study recommends structuring competency recognition through SPKM as a base for continuous training policies and career development path for technical teachers to uphold the quality of the national TVET education ecosystem in the future.

MODUL INTERAKTIF MENGGUNAKAN AUGMENTED REALITY (AR) BAGI MATAPELAJARAN LUKISAN KEJURUTERAAN DI KOLEJ VOKASIONAL

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Kekangan utama yang dihadapi pelajar vokasional dalam subjek Lukisan Kejuruteraan ialah kesukaran untuk menguasai kemahiran visualisasi spatial, yang membolehkan mereka menterjemahkan objek tiga dimensi (3D) daripada media dua dimensi (2D) yang statik. Kajian ini dijalankan dengan tujuan untuk membangunkan serta mengukur keberkesanan modul interaktif yang menggunakan teknologi Augmented Reality (AR) dalam mata pelajaran Lukisan Kejuruteraan di Kolej Vokasional Kota Tinggi, Johor. Modul ini dibina menggunakan Model Reka Bentuk Instruksional ADDIE, dan platform Assemblr Studio digunakan untuk membina aset interaktif 3D, manakala Assemblr Edu digunakan sebagai sistem pengurusan kelas secara digital. Kajian kuantitatif yang berbentuk eksperimen kuasi dengan satu kumpulan melibatkan 26 orang pelajar dari Semester 3 Program Pemesinan Industri yang dipilih menggunakan teknik sampelan yang bertujuan. Instrumen kajian terdiri daripada satu set soalan daripada Ujian Pra dan Ujian Pasca serta borang soal selidik Likert lima mata yang digunakan untuk mengukur tiga konstruk utama iaitu kesesuaian elemen modul, tahap kebolehgunaan teknikal, dan kesan penggunaan modul tersebut ke atas pelajar. Analisis data menggunakan perisian SPSS melalui kaedah statistik deskriptif seperti frekuensi, peratusan, dan skor purata, serta kaedah inferensial iaitu ujian-t berkepentingan. Implikasi kajian ini menunjukkan bahawa penggunaan teknologi imersif AR secara interaktif boleh menjadi alat bantu pembelajaran yang berkesan dalam meningkatkan prestasi akademik dan motivasi pelajar. Dengan kata lain, Modul Interaktif AR ini berjaya memenuhi standard kualiti media pengajaran dalam Latihan Teknikal dan Vokasional (TVET) dan mempunyai potensi yang sangat besar untuk diperluaskan dalam sistem pendidikan kejuruteraan masa kini.

The primary constraint faced by vocational students in the Engineering Drawing subject is the difficulty in mastering spatial visualization skills, which enable them to translate three-dimensional (3D) objects from static two-dimensional (2D) media. This study was conducted with the aim of developing and measuring the effectiveness of an interactive module utilizing Augmented Reality (AR) technology in the Engineering Drawing subject at Kota Tinggi Vocational College, Johor. The module was developed using the ADDIE Instructional Design Model, where the Assemblr Studio platform was utilized to build 3D interactive assets, while Assemblr Edu served as the digital classroom management system. This quantitative study adopted a one-group quasi-experimental design involving 26 Semester 3 students from the Industrial Machining Program, who were selected using a purposive sampling technique. The research instruments consisted of a set of questions for the Pre-Test and Post-Test, alongside a five-point Likert scale questionnaire used to measure three main constructs: the suitability of the module elements, the level of technical usability, and the impact of utilizing the module on the students. Data analysis was executed using SPSS software via descriptive statistics, such as frequency, percentage, and mean score, as well as inferential statistics, specifically the paired samples t-test. The implications of this study indicate that the interactive use of immersive AR technology can serve as an effective learning aid in enhancing students' academic performance and motivation. In other words, this Interactive AR Module has successfully met the quality standards of instructional media in Technical and Vocational Education and Training (TVET) and possesses vast potential to be scaled up within the contemporary engineering education system.

PEMBANGUNAN BAHAN BANTU MENGAJAR SECARA GAMIFIKASI DALAM KALANGAN PELAJAR PROGRAM PEMESINAN INDUSTRI DI KOLEJ VOKASIONAL

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Kajian ini dijalankan untuk membangunkan dan menilai keberkesanan Bahan Bantu Mengajar (BBM) interaktif berasaskan aplikasi permainan Machining Quest menggunakan platform Genially bagi kursus Teknologi Pemesinan Industri. Fokus utama kajian adalah untuk menilai tahap motivasi pelajar berdasarkan Model ARCS Keller (2010) serta menguji tahap kebolehgunaan teknikal aplikasi tersebut. Kajian kuantitatif ini melibatkan sampel bertujuan yang terdiri daripada 28 orang pelajar Tahun 1 Sijil Vokasional Malaysia (SVM) di sebuah Kolej Vokasional. Instrumen kajian menggunakan borang soal selidik skala Likert 5 mata yang disahkan oleh empat pakar bidang dengan purata persetujuan 94.17%. Analisis kebolehpercayaan rintis mencatatkan indeks alfa Cronbach akhir bagi Konstruk Motivasi (M) sebanyak 0.751 (12 item) dan Konstruk Teknikal (T) sebanyak 0.667 (9 item setelah pemurnian). Data dianalisis menggunakan statistik deskriptif melalui perisian IBM SPSS. Hasil dapatan menunjukkan tahap motivasi pelajar berada pada tahap sangat tinggi dengan purata min keseluruhan 4.705 (SP = 0.455), di mana konstruk keyakinan (confidence) mencatatkan skor tertinggi menerusi aspek susunan topik berperingkat (scaffolding). Bagi aspek kebolehgunaan teknikal, aplikasi ini merekodkan purata min keseluruhan yang cemerlang iaitu 4.698 (SP = 0.457), sekali gus membuktikan antara mukanya mesra pengguna dan menyokong pembelajaran kendiri. Secara tuntasnya, aplikasi Machining Quest terbukti merangsang motivasi intrinsik dan mengurangkan beban kognitif pelajar terhadap subjek teori pemesinan yang abstrak. Implikasi kajian mencadangkan inovasi ini diangkat sebagai bahan rujukan standard di institusi TVET serta dikembangkan dalam bentuk aplikasi luar talian pada masa hadapan.

This study was conducted to develop and evaluate the effectiveness of an interactive Instructional Media (IM) based on the Machining Quest game application utilizing the Genially platform for the Industrial Machining Technology course. The primary focus of the study was to assess students' motivation levels based on Keller's (2010) ARCS Motivation Model and to test the application's technical usability. This quantitative study involved a purposive sample consisting of 28 Year 1 Malaysian Vocational Certificate (SVM) students at a Vocational College. The research instrument comprised a 5-point Likert scale questionnaire validated by four domain experts, yielding an average expert agreement percentage of 94.17%. The pilot reliability analysis recorded a final Cronbach's Alpha index of 0.751 for the Motivation Construct (12 items) and 0.667 for the Technical Construct (9 items after item purification). Data were analyzed using descriptive statistics via IBM SPSS software. The findings indicated that the students' motivation was at a very high level, with an overall mean average of 4.705 (SD = 0.455), where the confidence construct recorded the highest score through structured, step-by step topic sequencing (scaffolding). Regarding the technical usability aspect, the application registered an excellent overall mean average of 4.698 (SD = 0.457), thereby demonstrating that the application interface is user-friendly and fully supports self-directed learning. In conclusion, the Machining Quest application has proven to stimulate intrinsic motivation and reduce the extraneous cognitive load of students toward abstract machining theory subjects. The implications of the study suggest that this innovation should be adopted as a standard reference material in TVET institutions and further developed into a standalone offline mobile application in the future.

PEMBINAAN MODUL KECERDASAN EMOSI BERASASKAN MODEL COGNITIVE BEHAVIORAL THERAPY (CBT) OLEH DR. AARON T. BECK

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Kajian ini dilakukan bertujuan untuk membina Modul Kecerdasan Emosi berasaskan Cognitive Behavioral Therapy atau CBT oleh Dr. Aaron T. Beck dan menilai potensi modul tersebut dalam meningkatkan kecerdasan emosi pelajar program mekanikal di Kolej Vokasional. Keperluan terhadap pembangunan bahan bimbingan ini timbul ekoran kekurangan instrumen psikologi yang disesuaikan khas mengikut latar belakang dan tekanan unik pelajar dalam bidang ini. Bagi mencapai matlamat tersebut, kajian kualitatif ini mengaplikasikan lima fasa Model ADDIE sebagai kerangka kerja utama yang merangkumi fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Data kajian diperoleh melalui analisis keperluan, kesahan instrumen, kesahan kandungan modul serta soal selidik terbuka melibatkan tiga orang panel pakar dalam bidang pembangunan modul, kaunselor berdaftar dan guru TVET. Penglibatan bidang kepakaran ini penting untuk memastikan modul dinilai secara menyeluruh agar praktikal untuk ekosistem pendidikan TVET. Data yang dikumpul kemudiannya dianalisis secara sistematik menggunakan Kaedah Analisis Tematik bagi memperincikan proses pembangunan dan pandangan pakar. Hasil Kajian menunjukkan bahawa Modul Kecerdasan Emosi ini berjaya dibina secara teratur dengan pengintegrasian prinsip CBT dalam setiap unit pembelajaran setelah disahkan sepenuhnya oleh panel pakar. Hasil analisis tematik membuktikan bahawa panel pakar bersetuju kandungan modul adalah sesuai, tersusun dan relevan. Di samping itu, mereka mencapai kesepakatan tinggi bahawa modul yang dibangunkan mempunyai potensi besar untuk berfungsi sebagai bahan bantu yang efektif dalam mempertingkatkan kecerdasan emosi kumpulan sasar. Secara keseluruhannya, kajian ini berjaya menghasilkan modul intervensi spesifik yang terancang dan dinilai jauh lebih efektif dalam mendepani realiti pelajar berbanding modul motivasi umum.

This study was conducted to develop an Emotional Intelligence Module based on the Cognitive Behavioral Therapy (CBT) principles formulated by Dr. Aaron T. Beck, while evaluating its potential to enhance the emotional intelligence of mechanical program students at Kolej Vokasional. The necessity for this intervention arose from a distinct shortage of psychological instruments tailored specifically to the unique backgrounds and environmental pressures faced by students in this technical field. To achieve this objective, this qualitative study utilized the five phases of the ADDIE model as its primary development framework, consisting of analysis, design, development, implementation and evaluation. Data were gathered through a needs analysis, instrument validation, module content validation and open-ended questionnaires involving a panel of three experts representing module development, registered counselor and TVET educator. Engaging these diverse areas of expertise was critical to ensuring a well-rounded evaluation. Thereby, guaranteeing that the module remains highly practical for the TVET ecosystem. The collected data were systematically examined using Thematic Analysis to detail the developmental process d capture expert perspectives. The findings revealed that the Emotional Intelligence Module was successfully constructed through a structured approach, seamlessly integrating CBT principles into every learning unit following full expert validation. Furthermore, the thematic analysis demonstrated that the expert panel agreed to the module content is appropriate, well organized and highly relevant. The experts also achieved a high level of consensus that the developed module holds significant potential to serve as an effective aid in improving the emotional intelligence of the target group. Overall, this study successfully produced a well-planned, specific intervention module that is evaluated to be far more effective in addressing

the actual realities of these students compared to generic motivational modules.

PERSEPSI GURU TVET DALAM MENGINTEGRASIKAN KECERDASAN BUATAN (AI) UNTUK PENGAJARAN DAN PEMBELAJARAN

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Kajian ini dijalankan untuk mengenal pasti persepsi guru Pendidikan dan Latihan Teknikal dan Vokasional (TVET) terhadap penggunaan Kecerdasan Buatan (AI) dalam proses pengajaran dan pembelajaran (PdP). Secara khusus, kajian ini menilai tahap kesedaran, pengetahuan, dan kesediaan guru TVET, serta menguji perbezaan persepsi tersebut berdasarkan tempoh pengalaman mengajar mereka. Kajian kuantitatif berbentuk tinjauan ini melibatkan seramai 59 orang guru TVET sebagai responden kajian. Data dianalisis menggunakan perisian statistik melalui analisis deskriptif (nilai min dan sisihan piawai) dan statistik inferensi (Ujian ANOVA sehala). Hasil kajian menunjukkan bahawa tahap kesedaran, kesediaan, dan pengetahuan guru TVET berada pada tahap yang tinggi. Tahap kesedaran mencatatkan nilai min keseluruhan tertinggi (min = 4.54), diikuti oleh tahap kesediaan (min = 4.49) dan tahap pengetahuan (min = 4.28). Seterusnya, hasil Ujian ANOVA Sehala membuktikan bahawa tidak terdapat perbezaan persepsi yang signifikan terhadap penggunaan AI berdasarkan kumpulan pengalaman mengajar guru. Kesimpulannya, guru TVET mempunyai keterbukaan dan penerimaan yang sangat positif terhadap teknologi AI tanpa mengira faktor tempoh mengajar. Implikasi kajian mencadangkan agar pihak institusi dan kementerian memberikan lebih banyak latihan kemahiran secara hands-on bagi membantu guru mengaplikasikan teknologi AI secara praktikal dalam tugas harian mereka.

This study was conducted to identify the perception of Technical and Vocational Education and Training (TVET) teachers towards the use of Artificial Intelligence (AI) in the teaching and learning (T&L) process. Specifically, this study assessed the levels of awareness, knowledge, and readiness of TVET teachers, and tested the differences in these perceptions based on their teaching experience duration. This quantitative survey-based study involved a total of 59 TVET teachers as respondents. Data were analyzed using statistical software through descriptive analysis (mean values and standard deviations) and inferential statistics (One-Way ANOVA). The results indicated that the levels of awareness, readiness, and knowledge of TVET teachers were high. The level of awareness recorded the highest overall mean score (mean = 4.54), followed by readiness (mean = 4.49) and knowledge (mean = 4.28). Furthermore, the One-Way ANOVA results proved that there was no significant difference in perception towards the use of AI based on the teachers' teaching experience groups. In conclusion, TVET teachers demonstrate openness and a highly positive acceptance towards AI technology, regardless of their length of service. The implications of the study suggest that institutions and the ministry should provide more hands-on skills training to assist teachers in practically applying AI technology in their daily duties.

SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA PENDIDIKAN (PENGAJARAN BAHASA INGGERIS SEBAGAI BAHASA KEDUA) DENGAN KEPUJIAN [SHPLH]

INVESTIGATING UTM ENGLISH AS A SECOND LANGUAGE STUDENTS' DEPENDENCE ON AI WRITING TOOLS IN COMPLETING ACADEMIC ASSIGNMENTS

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Kemunculan alat penulisan kecerdasan buatan (AI) dalam landskap pendidikan telah mengubah cara pelajar melaksanakan tugasan penulisan akademik mereka dengan ketara. Oleh itu, kajian ini dilaksanakan bertujuan untuk menyiasat kebergantungan terhadap alat penulisan AI dalam kalangan pelajar Bahasa Inggeris sebagai bahasa kedua (ESL) prasiswazah di Universiti Teknologi Malaysia. Secara khususnya, kajian ini memberi tumpuan kepada tahap kebergantungan pelajar terhadap alat penulisan AI, faktor-faktor yang menyumbang kepada kebergantungan tersebut, serta kesan yang dirasakan daripada amalan tersebut terhadap kemahiran penulisan dan kemahiran pemikiran kritis pelajar. Kajian ini menggunakan kaedah campuran yang melibatkan pengedaran soal selidik kepada 81 orang pelajar ESL serta temu bual separa berstruktur bersama tiga orang peserta yang dipilih daripada tahap penguasaan bahasa yang berbeza. Dapatan kajian ini menunjukkan bahawa pelajar mempunyai tahap kebergantungan yang sederhana terhadap alat penulisan AI, dengan aplikasi ChatGPT, QuillBot dan Grammarly dikenal pasti sebagai aplikasi yang paling kerap digunakan oleh responden. Selain itu, dapatan kajian turut mendedahkan bahawa faktor utama yang menyumbang kepada kebergantungan pelajar ialah sokongan yang diberikan oleh alat tersebut sepanjang proses penulisan, di samping kecekapan dan kemudahan dalam menggunakannya. Selain itu, pelajar berpendapat bahawa kebergantungan yang berlebihan terhadap alat penulisan AI boleh mengurangkan usaha kendiri, melemahkan pemikiran kritis dan bebas, serta menimbulkan kebimbangan psikologi berkaitan risiko plagiarisme dan keyakinan terhadap kebolehan penulisan kendiri. Kajian ini menyimpulkan bahawa walaupun terdapat peningkatan trend penggunaan alat penulisan AI dalam akademik, pelajar secara umumnya masih mengekalkan tahap autonomi tertentu dalam menyiapkan tugasan mereka. Kajian ini menekankan kepentingan menggalakkan penggunaan alat penulisan AI secara bertanggungjawab dan beretika dalam kalangan pelajar bagi memaksimumkan manfaat teknologi tersebut tanpa menjejaskan pembangunan kemahiran akademik yang penting. Kajian ini boleh dijadikan sebagai rujukan untuk penyelidikan pada masa hadapan berkaitan kebergantungan pelajar terhadap alat penulisan AI serta implikasinya terhadap kemahiran penulisan dan pemikiran kritis dalam konteks pendidikan.

The emergence of artificial intelligence (AI) writing tools into the education landscape has significantly transformed the way students approach academic writing tasks. Thus, this study aims to investigate the dependence on AI writing tools among the undergraduate English as a second language (ESL) students at Universiti Teknologi Malaysia. Specifically, this study focuses on examining the extent of students' dependence on AI writing tools, the factors contributing to such dependence and the perceived effects of this practice on students' writing ability and critical thinking skills. The mixed-method research design was employed in this study, involving the distribution of a questionnaire to 81 ESL students and semi-structured interview sessions with three selected participants from different language proficiency levels. The findings of this study revealed that students demonstrated a moderate level of dependence on AI writing tools with ChatGPT, QuillBot and Grammarly being the most frequently utilised applications among the respondents. Apart from that, it was also reported that the main factors contributing to students' dependence were the support provided by the tools throughout the writing process, as well as the efficiency and ease of use of the tools. In addition, students perceived that excessive dependence on AI writing tools could reduce one's

independent effort, weaken critical and independent thinking and raise psychological concerns related to plagiarism and confidence in personal writing ability. The study concluded that despite the growing trend of utilising AI writing tools in academic practices among students, they generally maintained a certain degree of autonomy in completing their tasks. Therefore, this study highlights the importance of promoting responsible and ethical use of AI tools among students to maximise the benefits of such technology without compromising the development of essential academic skills. This study can serve as a useful reference for future research examining the use, dependence and educational implications of AI writing tools among ESL learners and other student populations.

PRE-SERVICE TEACHERS' PERCEIVED KNOWLEDGE OF CEFR-ALIGNED SPEAKING DESCRIPTORS: AN EVALUATION OF READINESS FOR CLASSROOM BASED ASSESSMENT (CBA)

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Kajian ini meneroka bagaimana sembilan guru pelatih Bahasa Inggeris tahun akhir di Universiti Teknologi Malaysia menangani cabaran dalam melaksanakan pentaksiran kemahiran bertutur berasaskan CEFR di dalam kerangka Pentaksiran Bilik Darjah (PBD) Malaysia. Melalui kajian kes kualitatif, kami telah menjalankan temu bual separa berstruktur untuk memahami pengetahuan, kesediaan, dan cabaran seharian yang dihadapi oleh bakal pendidik ini sepanjang tempoh praktikum mereka. Walaupun peserta menunjukkan pemahaman teori yang baik mengenai prinsip pentaksiran, mereka sering merasakan terdapat jurang antara latihan di universiti dengan realiti sebenar di dalam bilik darjah yang padat dan mempunyai murid dengan pelbagai tahap keupayaan. Dapatan kajian kami menunjukkan perbezaan yang ketara antara bahasa deskriptor DSKP yang abstrak dengan situasi sebenar di dalam bilik darjah, terutamanya apabila guru perlu menyelaraskan sasaran tinggi dengan murid yang kurang mengeluarkan hasil lisan. Daripada bergantung sepenuhnya kepada rubrik rasmi, guru-guru ini telah membangunkan strategi pemerhatian berterusan secara tidak rasmi untuk memastikan pemarkahan kekal adil dan konsisten. Secara keseluruhannya, kajian ini mencadangkan bahawa program pendidikan guru sekarang mungkin terlalu menekankan teori berbanding kemahiran praktikal yang diperlukan untuk PBD yang berkesan. Oleh itu, kami mencadangkan integrasi latihan penilai yang lebih sahih, seperti analisis prestasi murid sebenar dan sesi moderasi kolaboratif, untuk memastikan bakal guru kami sedia menghadapi kerumitan dalam amalan profesional mereka.

This study explores how nine final-year pre-service English teachers at Universiti Teknologi Malaysia navigate the challenges of implementing CEFR-aligned speaking assessments within the Malaysian Classroom-Based Assessment (CBA) framework. Through a qualitative case study, we conducted semi-structured interviews to understand these future educators' perceived knowledge, readiness, and the everyday hurdles they faced during their practicum. While our participants displayed a solid theoretical grasp of assessment principles, they often felt a disconnect between their university training and the nuanced realities of crowded, mixed-ability classrooms. Our findings highlight a significant gap between the abstract language of the DSKP descriptors and the messy reality of the classroom, particularly when teachers had to reconcile high-proficiency targets with low-output learners. Instead of relying strictly on formal rubrics, these teachers developed their own informal, continuous observation strategies to ensure grading remained fair and consistent. Ultimately, the study suggests that our current teacher education programs may overemphasize theory at the expense of the practical diagnostic skills needed for effective CBA. We therefore advocate for the integration of more authentic rater-training such as the analysis of real-world student performances and collaborative moderation to better prepare our teachers for the complexities of their professional practice.

THE PERCEPTIONS ON THE EFFECTIVENESS OF GAME-BASED LEARNING IN REMEDIAL ESL CLASSROOMS IN MALAYSIAN SECONDARY SCHOOLS

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Penguasaan bahasa Inggeris kekal sebagai satu keperluan kritikal bagi pelajar sekolah menengah di Malaysia. Walau bagaimanapun, sebilangan besar pelajar remedial masih berdepan kesukaran dalam menguasai kemahiran asas seperti kosa kata, tatabahasa serta kefahaman membaca meskipun telah mengikuti pembelajaran formal selama bertahun-tahun. Pendekatan remedial tradisional yang lazim digunakan, seperti lembaran kerja dan latihan berulang, didapati kurang berkesan dalam meningkatkan motivasi serta penglibatan pelajar, sekali gus menyumbang kepada tahap kecekapan yang rendah. Sehubungan itu, Pembelajaran Berasaskan Permainan (Game-Based Learning, GBL) muncul sebagai satu alternatif yang berpotensi kerana sifat interaktifnya serta pemberian maklum balas segera yang menepati keperluan pelajar generasi digital. Kajian ini meneliti keberkesanan GBL dalam konteks remedial Bahasa Inggeris sebagai Bahasa Kedua (ESL) di sekolah menengah Malaysia. Reka bentuk kajian menggunakan pendekatan kaedah campuran, dengan pengumpulan data melalui soal selidik yang diedarkan kepada guru ESL serta temu bual separa berstruktur bersama pelajar remedial.

English language proficiency remains a critical requirement for Malaysian secondary school students. However, still a large number of remedial learners continue to struggle with skills such as vocabulary, grammar as well as reading comprehension despite years of formal learning in school. Traditional remedial approaches often rely on worksheets and repetitive drills, which proved insufficient in motivating and keeping these learners engaged during learning which results in a poor proficiency level. Game-Based Learning (GBL) has emerged as a promising alternative which offers interactivity and immediate feedback that align with the needs of digital-native students. This study investigates the effectiveness of GBL in remedial English as a Second Language (ESL) contexts within Malaysian secondary schools. Implementing a mixed-method design, data were collected through questionnaires administered to ESL teachers and semi-structured interviews with remedial students.

EXPLORING PRE-SERVICE TEACHERS' PERCEPTIONS OF STUDENTS WITH READING DIFFICULTIES IN MALAYSIAN SECONDARY ESL CLASSROOMS

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Walaupun penanda aras penguasaan bahasa Inggeris di Malaysia telah ditingkatkan, pelajar ESL (Bahasa Inggeris sebagai Bahasa Kedua) di sekolah menengah masih berhadapan dengan rintangan membaca, yang mana kerap kali diburukkan oleh kekurangan kompetensi diagnostik yang tepat dalam kalangan pendidik. Kajian ini bertujuan untuk meneroka persepsi guru pelatih terhadap rintangan membaca melalui kerangka Simple View of Reading (SVR) dan menggariskan pendekatan pedagogi yang dianggap berkesan. Di samping itu, kajian ini meneliti bagaimana persediaan akademik dan pengalaman praktikum membentuk penaakulan diagnostik guru pelatih. Menggunakan metodologi fenomenologi kualitatif, data dikumpul melalui temu bual separa berstruktur berorientasikan vignet bersama empat (4) orang guru pelatih Pengajaran Bahasa Inggeris sebagai Bahasa Kedua (TESL) pasca-praktikum, dan dianalisis menggunakan Analisis Tematik (TA). Dapatan kajian mendedahkan kelemahan mendalam dalam kecekapan diagnostik, yang dicirikan oleh pergantungan kepada klasifikasi umum dan penggabungan antara defisit penyahkodan dan pemahaman linguistik. Kekaburan ini mencetuskan ketidakselarasan instruksional, dengan peserta mengetepikan pemulihan kognitif dan lebih cenderung kepada intervensi afektif dan perancahan (scaffolding) kelangsungan. Selain itu, apabila berhadapan dengan defisit pelajar yang kompleks, peserta mengabaikan teori formal dan beralih kepada adaptasi berasaskan pengalaman dan cuba-jaya. Kajian ini merumuskan bahawa pengetahuan teori SVR tidak menjamin aplikasi diagnostik yang praktikal. Oleh itu, program pendidikan guru mesti secara terancang mengintegrasikan modul kecekapan diagnostik yang disasarkan untuk memastikan para pendidik mampu memulihkan kepincangan membaca berstruktur dengan terperinci.

Despite elevated English proficiency benchmarks in Malaysia, secondary ESL learners persistently struggle with reading difficulties, often exacerbated by educators' lack of precise diagnostic literacy. This study aims to explore pre-service teachers' perceptions of reading difficulties through the lens of the Simple View of Reading (SVR) and identify the teaching strategies they deem effective. Additionally, the research examines how the pre-service teachers' academic training and practical practicum experiences shape their diagnostic cognition. Employing a qualitative phenomenological design, data were gathered through semi-structured, vignette-based interviews with four pre-service Teaching English as a Second Language (TESL) teachers post-practicum and analysed using Thematic Analysis (TA). Findings revealed a profound vulnerability in diagnostic literacy, characterised by reliance on generalised labels and conflation of decoding and linguistic comprehension deficits. This ambiguity precipitated instructional misalignment, with participants bypassing cognitive remediation for affective interventions and survival scaffolding. Additionally, when confronted with complex learner deficits, participants abandoned formal theories for experiential, trial-and-error adaptations. The study concludes that theoretical SVR knowledge does not guarantee practical diagnostic application. Therefore, teacher education programmes must explicitly integrate targeted diagnostic literacy modules to ensure educators can accurately remediate structural reading failures.

LANGUAGE ANXIETY, SPEAKING PERFORMANCE, AND ESL LEARNERS' PERCEPTIONS OF THE CHALLENGES CREATED BY LANGUAGE ANXIETY DURING ENGLISH-SPEAKING ACTIVITIES AT UNIVERSITI TEKNOLOGI MALAYSIA

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Kebimbangan bahasa atau Language Anxiety, merupakan salah satu faktor yang boleh mempengaruhi pengalaman bertutur dan keyakinan pelajar ESL semasa berkomunikasi dalam bahasa Inggeris. Oleh itu, kajian ini bertujuan untuk mengenal pasti tahap kebimbangan bahasa, menilai prestasi pertuturan pelajar ESL, dan meneroka persepsi pelajar terhadap cabaran yang diwujudkan oleh kebimbangan bahasa semasa aktiviti pertuturan dalam bahasa Inggeris di Universiti Teknologi Malaysia (UTM). Kajian ini menggunakan reka bentuk kaedah campuran penjelasan berurutan (explanatory sequential mixed-methods design) yang melibatkan 47 orang pelajar UTM yang menjawab soal selidik kebimbangan bahasa yang diadaptasi serta menjalani penilaian pertuturan secara spontan, diikuti oleh 10 orang peserta yang terlibat dalam perbincangan kumpulan berfokus (FGD). Data kuantitatif dianalisis menggunakan statistik deskriptif dalam IBM SPSS Statistics, manakala data kualitatif dianalisis menggunakan analisis tematik. Dapatan kajian menunjukkan bahawa peserta mengalami tahap kebimbangan bahasa yang sederhana dan menunjukkan prestasi pertuturan pada tahap sederhana. Ketakutan terhadap penilaian negatif dikenal pasti sebagai punca utama kebimbangan bahasa, manakala kelancaran dan koheren merupakan aspek pertuturan yang paling mencabar. Perbincangan kumpulan berfokus turut mendedahkan bahawa kebimbangan bahasa mewujudkan beberapa cabaran kepada pelajar, termasuk kesukaran mendapatkan semula kosa kata, mengekalkan kelancaran pertuturan, menyusun idea, ketakutan melakukan kesilapan, ketakutan terhadap penilaian negatif, serta keyakinan diri yang rendah semasa aktiviti pertuturan dalam bahasa Inggeris. Diharapkan kajian ini dapat menyumbang kepada pemahaman yang lebih mendalam tentang kebimbangan bahasa serta menyokong pembangunan persekitaran pembelajaran bahasa Inggeris yang lebih kondusif bagi pelajar ESL.

Language anxiety is one of the factors that may influence ESL learners' speaking experiences and confidence when communicating in English. Therefore, this study aimed to examine the level of language anxiety, assess the speaking performance of ESL learners, and explore learners' perceptions of the challenges created by language anxiety during English-speaking activities at Universiti Teknologi Malaysia (UTM). An explanatory sequential mixed-methods design was employed, involving 47 UTM students who completed an adapted language anxiety questionnaire and an impromptu speaking assessment, followed by 10 participants who participated in focus group discussions (FGDs). Quantitative data were analysed using descriptive statistics in IBM SPSS Statistics, while qualitative data were analysed using thematic analysis. The findings revealed that the participants experienced a moderate level of language anxiety and demonstrated a moderate level of speaking performance. Fear of negative evaluation was identified as the main source of language anxiety, while fluency and coherence were the most challenging aspects of speaking performance. The focus group discussions further revealed that language anxiety created several challenges for learners, including difficulties in retrieving vocabulary, maintaining fluency, organising ideas, fear of making mistakes, fear of negative evaluation, and reduced confidence during English-speaking activities. It is hoped that this study will contribute to a better understanding of language anxiety and support the development of more supportive English language learning environments for ESL learners.

FACTORS INFLUENCING ESL LEARNERS' LACK OF WILLINGNESS TO COMMUNICATE (WTC) IN AN URBAN SECONDARY SCHOOL

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Kesediaan untuk Berkomunikasi (Willingness to Communicate, WTC) diiktiraf secara meluas sebagai faktor kritikal dalam Pemerolehan Bahasa Kedua (Second Language Acquisition, SLA), kerana kesediaan pelajar untuk terlibat dalam interaksi bermakna dapat memudahkan perkembangan bahasa dan kompetensi komunikatif. Walau bagaimanapun, ramai pelajar Bahasa Inggeris sebagai Bahasa Kedua (English as a Second Language, ESL) menunjukkan Kekurangan Kesediaan untuk Berkomunikasi (Lack of Willingness to Communicate, LWTC), yang boleh menjejaskan kemajuan pembelajaran bahasa mereka. Kajian ini meneliti faktor-faktor yang menyumbang kepada LWTC dalam kalangan pelajar ESL, dengan penekanan khusus terhadap kebimbangan bertutur (speaking anxiety) dan implikasinya terhadap SLA dalam konteks sekolah menengah bandar. Berpandukan Model WTC oleh MacIntyre et al., kajian ini menggunakan reka bentuk penyelidikan kualitatif dengan melibatkan temu bual separa berstruktur bersama sepuluh pelajar menengah rendah yang dipilih melalui persampelan bertujuan. Data temu bual dianalisis menggunakan analisis tematik. Dapatan kajian menunjukkan bahawa kebimbangan bertutur, ketakutan terhadap penilaian negatif, persepsi rendah terhadap kompetensi komunikatif, pengaruh rakan sebaya, dan dinamika bilik darjah merupakan faktor utama yang menyumbang kepada LWTC. Kajian ini juga mendapati bahawa penglibatan yang berkurangan dalam aktiviti komunikatif telah mengehadkan peluang pelajar untuk berlatih bahasa, sekali gus mengekang SLA. Sebaliknya, maklum balas guru yang menyokong, aktiviti pembelajaran kolaboratif, dan persekitaran bilik darjah yang rendah kebimbangan dilihat dapat meningkatkan WTC. Dapatan ini menekankan kepentingan menangani halangan afektif dan kontekstual terhadap komunikasi bagi menggalakkan penglibatan komunikatif pelajar serta memudahkan pemerolehan bahasa kedua yang lebih berkesan.

Willingness to Communicate (WTC) is widely recognized as a critical factor in Second Language Acquisition (SLA), as learners' readiness to engage in meaningful interaction facilitates language development and communicative competence. Nevertheless, many English as a Second Language (ESL) learners demonstrate a Lack of Willingness to Communicate (LWTC), which may hinder their language learning progress. This study investigates the factors contributing to ESL learners' LWTC, with particular emphasis on speaking anxiety and its implications for SLA in an urban secondary school context. Guided by MacIntyre et al.'s WTC Model, the study employed a qualitative research design involving semi-structured interviews with ten lower secondary school students selected through purposive sampling. The interview data were analysed using thematic analysis. The findings revealed that speaking anxiety, fear of negative evaluation, low perceived communicative competence, peer influence, and classroom dynamics were the primary factors contributing to LWTC. The study further found that reduced participation in communicative activities limited learners' opportunities for language practice, thereby constraining SLA. Conversely, supportive teacher feedback, collaborative learning activities, and low-anxiety classroom environments were perceived to enhance WTC. The findings underscore the importance of addressing affective and contextual barriers to communication in order to promote learners' communicative engagement and facilitate more effective second language acquisition.

THE PERCEPTION OF PRE-SERVICE ENGLISH LANGUAGE TEACHER TRAINEES ON CULTURAL REPRESENTATIONS AND IT'S ROLE IN LANGUAGE LEARNING IN THE PULSE 2 ENGLISH TEXTBOOK

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Pelaksanaan Common European Framework of Reference (CEFR) dalam sistem pendidikan Malaysia telah memperkenalkan buku teks global yang diimport, terutamanya Pulse 2, ke dalam bilik darjah ESL (Bahasa Inggeris sebagai Bahasa Kedua). Walaupun bertujuan untuk meningkatkan tahap penguasaan bahasa Inggeris ke tahap piawaian antarabangsa, dasar atas ke bawah ini telah mencetuskan cabaran pedagogi yang kompleks berkaitan dengan perwakilan budaya. Berlandaskan kerangka Intercultural Communicative Competence (ICC) Byram (1997), kajian kualitatif ini menyiasat persepsi guru pelatih praperkhidmatan Pengajaran Bahasa Inggeris (ELT) terhadap kandungan budaya di dalam Pulse 2 dan peranan mereka seterusnya dalam memudah cara pembelajaran bahasa. Data telah dikumpul melalui temu bual separa berstruktur secara mendalam bersama guru pelatih tahun akhir Sarjana Muda Pendidikan (TESL) yang baru menamatkan praktikum pengajaran mereka. Analisis tematik ke atas data mendedahkan konsensus yang sebulat suara dalam kalangan pelatih mengenai kecenderungan bias Budaya Sasaran (berpusatkan UK) yang ketara dalam buku teks tersebut. Dapatan kajian menunjukkan bahawa jarak budaya ini bertindak sebagai pedang bermata dua: walaupun ia merangsang rasa ingin tahu dalam kalangan pelajar berkecekapan tinggi, ia mewujudkan jurang penguasaan yang ketara yang dicirikan oleh bebanan kognitif dan keterasingan tingkah laku dalam kalangan pelajar berkecekapan sederhana dan rendah. Akibatnya, guru praperkhidmatan mendapati bahawa buku teks tersebut tidak boleh digunakan sebagai sumber rujukan tunggal. Untuk merapatkan jurang ini, para pelatih dikehendaki menukar identiti profesional mereka daripada sekadar penyampai kandungan kepada "pengantara budaya" (cultural mediators) yang aktif. Dengan mengaplikasikan intervensi pedagogi, seperti menggantikan konsep asing dengan elemen tempatan Malaysia yang setara, para pelatih secara aktif menangani ketidakserasian budaya tersebut. Kajian ini merumuskan bahawa keberkesanan pedagogi buku teks CEFR sejajar global dalam konteks tempatan tidak terletak secara intrinsik pada bahan itu sendiri, tetapi sangat bergantung kepada agensi guru. Dapatan ini memberikan implikasi yang signifikan terhadap reka bentuk dan dasar kurikulum ELT, di mana ia menekankan keperluan kritikal bagi program latihan guru untuk memberi tumpuan kepada aspek penyesuaian bahan dan pengantaraan antarabudaya demi menyelaraskan piawaian bahasa Inggeris global dengan realiti sosiobudaya tempatan secara jayanya.

The implementation of the Common European Framework of Reference (CEFR) in the Malaysian education system introduced imported global textbooks, notably Pulse 2, into the ESL classroom. While aimed at elevating English proficiency to international standards, this top-down policy has introduced complex pedagogical challenges regarding cultural representation. Anchored in Byram's (1997) Intercultural Communicative Competence (ICC) framework, this qualitative study investigates the perceptions of pre-service English Language Teaching (ELT) trainees on the cultural content within Pulse 2 and their subsequent role in facilitating language learning. Data was collected through in-depth, semi-structured interviews with final-year Bachelor of Education (TESL) trainees who had recently completed their teaching practicums. Thematic analysis of the data revealed a unanimous consensus among trainees regarding the textbook's heavy Target Culture (UK-centric) bias. The findings demonstrate that this cultural distance acts as a double-edged sword: while it stimulates curiosity among high-proficiency learners, it creates a significant proficiency gap

characterized by cognitive overload and behavioral alienation among average and lower-proficiency students. Consequently, pre-service teachers found that the textbook could not be used as a standalone resource. To bridge this gap, trainees were required to shift their professional identities from mere content deliverers to active "cultural mediators." By employing pedagogical interventions, such as replacing foreign concepts with local Malaysian equivalents, the trainees actively navigated the cultural disconnect. The study concludes that the pedagogical effectiveness of globally aligned CEFR textbooks in local contexts is not intrinsic to the material itself, but is highly contingent upon teacher agency. These findings offer significant implications for ELT curriculum design and policy, emphasizing the critical need for teacher training programs to focus on material adaptation and intercultural mediation to successfully reconcile global English standards with local socio-cultural realities.

EXPLORING STUDENT'S MOTIVATION IN READING LITERATURE TEXTS IN ESL HIGH SCHOOL CLASSROOMS

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Dalam bilik darjah Bahasa Inggeris sebagai Bahasa Kedua (ESL), membaca teks boleh menjadi agak mencabar, dan motivasi pelajar adalah penting untuk penglibatan mereka serta perkembangan kemahiran membaca. Kajian ini meneliti dengan mendalam dari aspek motivasi pelajar sekolah menengah dalam membaca teks sastera, dengan menekankan faktor-faktor yang sama ada memotivasikan atau menurunkan semangat mereka. Corak motivasi, minat dan cabaran yang dirasakan oleh pelajar dalam membaca sastera dikenal pasti melalui pendekatan kaedah campuran yang merangkumi soal selidik dan temu bual. Hasil kajian menunjukkan bahawa penglibatan pelajar dalam membaca dipengaruhi secara signifikan oleh beberapa faktor, termasuk motivasi intrinsik seperti minat peribadi dan keseronokkan atau kecintaan terhadap cerita, serta motivasi ekstrinsik seperti ganjaran, sokongan guru, aktiviti bilik darjah, dan banyak lagi. Kekurangan kaitan dengan teks, corak bahasa yang kompleks, dan kesukaran dengan perbendaharaan kata adalah faktor-faktor yang biasanya menurunkan motivasi. Kajian ini menekankan hubungan antara prestasi membaca dan motivasi, dengan menunjukkan bahawa menggalakkan minat dan keyakinan diri pelajar boleh meningkatkan kemahiran membaca sastera mereka. Hasil kajian ini dapat dijadikan panduan untuk strategi meningkatkan dan menyokong pelajar dalam kelas sastera ESL.

In English as a Second Language (ESL) classrooms, reading texts can be quite different, and student's motivation is significant to their engagement as well as motivation and the development of their reading abilities. The motivation of high school students to read literary texts is examined thoroughly in this study, with an emphasis on the elements that either motivate or demotivate them. Students' motivational tendencies, interests, and perceived challenges with reading literature were found using the mixed method approach that included both questionnaires and interviews. The results show that students' reading engagement is greatly influenced by several factors such as intrinsic drive, which are student's personal interest and enjoyment or love of stories, and also extrinsic motivation, such as prizes, recognition, teacher's support, classroom activities and much more. Lack of connection to the text, complicated linguistic patterns, and vocabulary difficulties are common demotivating causes. The study emphasizes the connection between reading performance and motivation, implying that encouraging students' enthusiasm and self-assurance can enhance their literary reading abilities. Strategies for boosting and supporting student motivation in ESL literature classes can be guided by these ideas.

STUDENTS' PERCEPTIONS ON LEARNING ENGLISH THROUGH LITERATURE CAMP

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Di Malaysia, kurikulum yang dijajarkan dengan CEFR menekankan penguasaan Bahasa Inggeris merentasi pelbagai kemahiran bahasa, namun pengajaran sastera secara tradisional di dalam bilik darjah sering menghadapi cabaran disebabkan oleh matlamat yang berorientasikan peperiksaan dan persepsi murid bahawa elemen sastera adalah sukar. Walaupun kem Bahasa Inggeris secara umum sudah biasa dianjurkan, terdapat jurang kajian yang jelas mengenai bagaimana pengalaman murid semasa menyertai kem sastera yang berjalan dalam jangka masa pendek. Tujuan kajian ini adalah untuk menyelidik pendedahan awal murid sekolah menengah Tingkatan 2 terhadap sastera Inggeris, persepsi mereka terhadap kem sastera selama satu hari, dan cabaran utama yang mereka hadapi sepanjang kem tersebut. Reka bentuk kaedah campuran telah digunakan, dan data dikumpul secara serentak daripada sampel bertujuan yang terdiri daripada murid Tingkatan 2 dengan tahap penguasaan pertengahan. Data kuantitatif dikumpul melalui tinjauan pra dan pasca, manakala hasil data kualitatif diperolehi daripada temu bual kumpulan berfokus, pemerhatian berstruktur, dan maklum balas daripada fasilitator untuk mencapai triangulasi. Dapatan kajian menunjukkan bahawa pendedahan awal yang tinggi terhadap elemen sastera tidak secara automatik menghasilkan pemahaman yang tinggi, memandangkan murid masih memerlukan sokongan instruksional. Walaupun keputusan tinjauan pasca meunjukkan corak positif dalam keseronokan dan penglibatan, terutamanya semasa aktiviti aktif dan kolaboratif seperti Sing a Poem dan Jazz Chants, data kualitatif mengetengahkan beberapa halangan terhadap kejayaan ini. Selain itu, tahap keyakinan semasa aktiviti berasaskan persembahan kekal rendah disebabkan oleh kebimbangan persembahan awam dan sifat introvert. Kajian ini memberi implikasi bahawa walaupun kem sastera menawarkan alternatif yang berharga kepada pengajaran bilik darjah tradisional, ia bukanlah penyelesaian mutlak kepada kebimbangan murid. Adalah dicadangkan bahawa penganjur mesti menyediakan perancah (scaffolding) kosa kata secara eksplisit, merangka aktiviti yang menarik, dan menggalakkan murid introvert dengan teliti. Dapatan ini menyumbang kepada model pembelajaran pengalaman dengan menekankan keperluan mengutamakan keselamatan emosi dalam intervensi pendidikan jangka pendek.

In Malaysia, the CEFR-aligned curriculum emphasizes English proficiency across multiple skills, yet traditional literature classrooms often face challenges due to exam-driven goals and students perceiving literary elements as difficult. While general English camps are commonly organized, there is a distinct research gap regarding how students experience short-term, literature-focused camps. The purpose of this study is to investigate Form 2 secondary school students' prior exposure to English literature, their perceptions on a one-day literature camp, and the main challenges they faced during the camp. A mixed-methods design was utilized, and data was simultaneously collected from a purposive sample of Form 2 intermediate-proficiency students. Quantitative data was gathered through pre- and post-surveys, while qualitative insights were obtained from focus group interviews, structured observations, and feedback from facilitators to achieve triangulation. The findings showed that high prior exposure to literary elements did not automatically result in high comprehension, as students still required support. While post-survey results indicated a positive trend in enjoyment and engagement especially during active and collaborative tasks like Sing a Poem and Jazz Chants, the qualitative data highlighted several barriers to this success. For example, students' confidence levels during performance-based activities had

remained low due to public performance anxiety and introvert traits. The study implied that while literature camps offer a valuable alternative to traditional classroom lessons, they are not a definite solution for student anxiety. It is suggested that organizers must explicitly scaffold vocabulary, design attractive activities, and encourage introverted students. These findings contribute to experiential learning models by highlighting the necessity of prioritizing emotional safety in short-term educational interventions.

A STUDY ON THE DIFFICULTIES IN LEARNING ENGLISH GRAMMAR ENCOUNTERED BY UTM FINAL YEAR TESL STUDENTS AND THEIR PERCEPTION TOWARDS STRATEGIES TO OVERCOME THEM

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Walaupun pelajar TESL telah menerima pendidikan formal dalam Bahasa Inggeris selama bertahun-tahun, ramai daripada mereka masih menghadapi kesukaran dalam mempelajari tatabahasa Bahasa Inggeris, yang boleh mempengaruhi prestasi akademik serta persediaan mereka sebagai bakal guru Bahasa Inggeris. Oleh itu, kajian ini bertujuan untuk mengkaji kesukaran dalam pembelajaran tatabahasa Bahasa Inggeris yang dihadapi oleh pelajar tahun akhir TESL di Universiti Teknologi Malaysia (UTM) serta meneliti persepsi mereka terhadap strategi untuk mengatasi kesukaran tersebut. Secara khususnya, kajian ini bertujuan mengenal pasti faktor-faktor yang menyumbang kepada kesukaran pembelajaran tatabahasa, halangan yang dihadapi oleh pelajar, serta persepsi mereka terhadap strategi yang berkesan untuk meningkatkan pembelajaran tatabahasa. Kajian ini menggunakan reka bentuk kaedah campuran konvergen (convergent mixed-methods design), di mana data kuantitatif dan kualitatif dikumpulkan secara serentak, dianalisis secara berasingan, dan diintegrasikan semasa pentafsiran dapatan kajian. Data kuantitatif diperoleh melalui soal selidik yang diedarkan kepada 22 orang pelajar tahun akhir TESL di Universiti Teknologi Malaysia (UTM). Soal selidik tersebut mengandungi soalan tertutup dan soalan terbuka. Data kuantitatif dianalisis menggunakan statistik deskriptif yang melibatkan kekerapan, peratusan, min, dan sisihan piawai, manakala data daripada soalan terbuka serta temu bual separa berstruktur yang melibatkan lima orang peserta dianalisis menggunakan analisis tema. Pengintegrasian kedua-dua sumber data menunjukkan dapatan yang konsisten. Kajian mendapati bahawa pelajar menghadapi kesukaran mempelajari tatabahasa akibat kerumitan peraturan tatabahasa, kesukaran dalam komponen tatabahasa tertentu, gangguan bahasa pertama, peluang latihan yang terhad, kekangan masa, dan kurang keyakinan diri. Selain itu, pelajar menggunakan pelbagai strategi seperti pembelajaran kendiri, aktiviti membaca dan menulis, serta mendapatkan maklum balas daripada pensyarah dan rakan sebaya untuk meningkatkan penguasaan tatabahasa mereka. Peserta juga menekankan kepentingan bimbingan pensyarah dan sokongan institusi, seperti bengkel tatabahasa serta peluang pembelajaran tambahan, dalam membantu meningkatkan penguasaan tatabahasa. Secara keseluruhannya, pengintegrasian dapatan kuantitatif dan kualitatif memberikan pemahaman yang lebih menyeluruh tentang kesukaran pembelajaran tatabahasa serta menekankan kepentingan latihan yang berterusan, pendekatan pengajaran yang berkesan, dan sokongan institusi dalam meningkatkan penguasaan tatabahasa dalam kalangan pelajar TESL.

Despite years of formal English instruction, many TESL students continue to experience difficulties in learning English grammar, which may affect their academic performance and future roles as English language teachers. Therefore, this study aimed to investigate the

difficulties in learning English grammar encountered by UTM final-year TESL students and examine their perceptions towards strategies to overcome these difficulties. Specifically, the study explored the factors contributing to grammar learning difficulties, the barriers faced by students, and their perceptions of effective strategies for improving grammar learning.
This study employed a convergent mixed-methods design, in which quantitative and qualitative data were collected concurrently, analysed separately, and integrated during the interpretation of the findings. The quantitative data were collected through a questionnaire administered to 22 final-year TESL students at Universiti Teknologi Malaysia (UTM). The questionnaire consisted of closed-ended and open-ended questions. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to analyse the quantitative data, while responses from the open-ended questions and semi-structured interviews conducted with five selected participants were analysed using thematic analysis. The integration of both data sources revealed consistent findings. The study found that students experienced grammar learning difficulties due to the complexity xof grammar rules, challenges in specific grammar components, first-language interference, limited opportunities for practice, time constraints, and confidence issues. At the same time, participants reported using self-directed learning, reading and writing activities, and feedback from lecturers and peers as strategies to improve their grammar proficiency. They also emphasised the importance of lecturer guidance and institutional support, such as grammar workshops and additional learning opportunities. Overall, the integration of quantitative and qualitative findings provides a comprehensive understanding of grammar learning difficulties and highlights the need for continuous practice, effective teaching approaches, and institutional support to enhance grammar proficiency among TESL students.

A STUDY ON UTM TESL STUDENTS' MOTIVATIONS THROUGHOUT TEACHING PRACTICUM

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Motivasi pelajar TESL di Universiti Teknologi Malaysia (UTM) semasa menjalani praktikum pengajaran dikaji dalam kajian ini, berpandukan Teori Determinasi Kendiri (SDT) oleh Deci dan Ryan, yang membezakan antara motivasi intrinsik dan ekstrinsik. Memandangkan hal ini memberi guru pra-perkhidmatan pengalaman bilik darjah dunia sebenar yang mungkin memberi kesan kepada motivasi dan pertumbuhan profesional mereka, latihan mengajar atau lebih dikenali sebagai praktikum merupakan segmen penting dalam pendidikan pengajaran. Kajian ini menggunakan kaedah campuran, iaitu mendapatkan data kuantitatif daripada 30 responden soal selidik dan data kualitatif melalui temu bual bersama 6 peserta. Analisis deskriptif digunakan untuk mengukur tahap motivasi pelajar sebelum dan semasa praktikum, manakala analisis tematik, berdasarkan kerangka Braun dan Clarke (2006), digunakan untuk menyiasat faktor asas yang mempengaruhi pengalaman motivasi pelajar. Dapatan kajian menunjukkan bahawa guru pra-perkhidmatan memulakan praktikum dengan motivasi yang agak tinggi tetapi disertai kebimbangan tentang kesediaan mengajar, dan motivasi ini bertambah kukuh sepanjang praktikum, dipengaruhi oleh empat faktor utama: pengalaman pengajaran yang positif, cabaransemasa praktikum, sokongan mentor, dan kepuasan peribadi. Kajian ini menawarkan pengetahuan menyeluruh tentang motivasi pelajar TESL dengan menggabungkan sudut pandangan kualitatif dan kuantitatif.

The motivation of Teaching English as a Second Language students at Universiti Teknologi Malaysia was looked at in this study. This study was guided by Deci and Ryans Self-Determination Theory. This theory talks about the types of motivation: motivation that comes from inside, motivation that comes from outside and not being motivated at all. The teaching practicum is an important part of teacher education. It gives teachers real experiences in the classroom. These experiences help shape their motivation and who they're as teachers. This study used a mixed-methods design. It collected numbers from 30 questionnaires and interviews with 6 people. Descriptive analysis is used to measure students' motivation levels before and during the practicum, while thematic analysis, based on Braun and Clarke's (2006) framework, is used to investigate the underlying factors that influence students' motivation experiences. The study found out that the students started the practicum with high motivation. They were a little anxious about being ready for the classroom. As the practicum went on their motivation got even stronger. The study also found out what influenced the students' motivation. There were four things: good teaching experiences, challenges during the practicum help from mentors and feeling fulfilled. Teaching English as a Second Language students at Universiti Teknologi Malaysia had these experiences during the practicum. The teaching practicum was very important for Teaching English as a Second Language students. It helped them become teachers and understand their motivation. Teaching English as a Second Language is a job but with the right motivation Teaching English, as a Second Language students can do well.

EXPLORING SECONDARY ESL TEACHERS' USE OF DIFFERENTIATED INSTRUCTIONAL STRATEGIES FOR PRONUNCIATION INSTRUCTION: PRACTICES AND CHALLENGES IN MALAYSIAN CLASSROOMS

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Pengajaran sebutan merupakan suatu komponen yang penting namun seringkali diketepikan dalam pendidikan Bahasa Inggeris sebagai Bahasa Kedua (ESL) dalam konteks sekolah menengah di Malaysia yang berorientasikan peperiksaan. Walau bagaimanapun, penyelidikan sistematik yang memfokuskan kepada intervensi berasaskan bilik darjah di peringkat sekolah menengah masih terhad. Kajian ini bertujuan untuk meneroka amalan dan cabaran guru ESL sekolah menengah berkaitan strategi pembelajaran terbeza bagi pengajaran sebutan. Pendekatan deskriptif kualitatif digunakan untuk mengkaji bagaimana guru memberi sokongan (scaffolding) serta faktor-faktor yang mempengaruhi pilihan pedagogi mereka. Sembilan orang guru ESL sekolah menengah telah dipilih melalui pensampelan bertujuan, manakala data dikumpul melalui temu bual separa berstruktur dan dianalisa menggunakan analisis tematik enam fasa Braun dan Clarke.
Dapatan kajian menunjukkan bahawa guru menggunakan pelbagai strategi terbeza, terutamanya tugasan berperingkat dan sokongan seperti bacaan berirama, untuk menggerakkan pelajar daripada sebutan yang asas kepada ciri yang lebih kompleks seperti ritma dan intonasi. Walau bagaimanapun, data menunjukkan bahawa pelaksanaan strategi ini berdepan cabaran besar, termasuk kekangan masa yang meruncing, saiz kelas yang besar dan tekanan silibus daripada peperiksaan SPM. Berdasarkan keputusan ini, dapat disimpulkan bahawa walaupun guru menggunakan strategi perbezaan secara intuitif, pelaksanaan yang sistematik memerlukan sokongan institusi yang lebih kukuh dan pembangunan profesional yang disasarkan dalam pedagogi sebutan.

Pronunciation instruction is a critical yet frequently neglected component of English as a Second Language (ESL) education within the exam-oriented setting of Malaysian secondary schools. Despite its importance, limited systematic research has focused on classroom-based interventions at the secondary level. This study focused on secondary ESL teachers' practices and challenges in differentiated learning strategies for pronunciation. It drew on a qualitative descriptive approach to explore how teachers implement scaffolding and the factors that influence their pedagogical choices. The participants included nine secondary ESL teachers selected by purposive sampling. Data were collected through semi-structured interviews and analysed via Braun and Clarke's six-phase thematic analysis. The findings revealed that teachers employ various differentiated strategies, mainly tiered tasks and scaffolding such as choral reading, to move learners from basic "survival pronunciation" toward more complex features like rhythm and intonation. However, the data suggested that the execution of these strategies was associated with significant challenges, including acute time constraints, large class sizes and syllabus pressure from the SPM examination. The results suggest that although teachers use differentiation in an intuitive way, more systematic implementation would need more institutional support and specific professional development in pronunciation pedagogy.

THE ACADEMIC AND PSYCHOLOGICAL EXPERIENCES OF SPECIAL EDUCATION NEEDS (SEN) GIRLS IN BOYS' SCHOOL

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Pendidikan inklusif bertujuan untuk memastikan semua pelajar, termasuk pelajar berkeperluan pendidikan khas (MBPK), mempunyai akses kepada peluang pendidikan yang sama. namun, kajian tentang pengalaman pelajar perempuan dengan keperluan pendidikan khas di sekolah menengah lelaki masih agak terbatas. Oleh itu, kajian ini ingin meneroka bagaimana pengalaman mereka di dalam bilik darjah bersama guru dan pentadbir sekolah mempengaruhi aspek pembelajaran akademik dan kesejahteraan psikologi pelajar perempuan berkeperluan pendidikan khas di sebuah sekolah lelaki, serta menilai sejauh mana penempatan mereka dapat membantu dalam aspek tersebut. Kajian ini menggunakan reka bentuk kajian kes kualitatif yang berlandaskan teori kognitif sosial. Data dikumpulkan melalui temubual separa berstruktur yang melibatkan sepuluh peserta iaitu enam pelajar perempuan berkeperluan pendidikan khas dengan masalah penglihatan, seorang guru pendidikan khas, dua guru arus perdana yang berpengalaman dalam mengajar kelas inklusif, dan seorang Penolong Kanan Pendidikan Khas di sebuah sekolah menengah lelaki di Johor.
Untuk analisis data, kami menggunakan analisis tematic daripada Braun dan Clarke (2006). Hasil kajian menunjukkan bahawa amalan pengajaran yang mendukung, pengajaran yang berbeza, sokongan pendidikan khas, dan hubungan positif dengan rakan sebaya telah memberikan sumbangan kepada peningkatan dalam pembelajaran akademik serta kesejahteraan psikologi pelajar. Hasil kajian turut mendapati bahawa para pelajar masih menghadapi beberapa cabaran, seperti kadar pengajaran yang cepat, sukar untuk mengakses bahan pembelajaran, enggan untuk meminta bantuan akademik, dan jumlah pelajar perempuan yang terhad. kajian ini juga mendapati bahawa meletakkan pelajar perempuan yang memerlukan pendidikan khas di sekolah lelaki adalah berkesan jika ada guru yang peka, kepimpinan sekolah yang inklusif, dan sistem sokongan pendidikan yang menyeluruh. diharapkan hasil kajian ini dapat membantu dalam memperbaiki pelaksanaan pendidikan inklusif di Malaysia.

The purpose of inclusive education is to ensure equal opportunities for all students, even those with Special Education Needs (SEN). However, there is a lack of studies focusing on the experiences of SEN girls enrolled in boys' secondary schools. Hence, the current study examines the effects of classroom experience involving the interaction with teachers and school administration on academic learning and psychological well-being of SEN girl students in a boys' school and evaluates the efficiency of their placement concerning such aspects. This research utilized the qualitative design of case study based on Social Cognitive Theory. In order to collect the data, semi-structured interviews with ten participants were conducted. There were six SEN girl students who had visual impairment, one Special Education teacher, two mainstream teachers who had experience in teaching in inclusive classrooms, and one Senior Assistant of Special Education enrolled in boys' secondary school in Johor. Braun and Clarke's (2006) thematic analysis was used in order to analyse the data. The findings revealed that there were certain problems faced by the participants with regard to the speed of mainstream teaching, availability of study materials, hesitation to ask for help from other students, and the low number of girls around. It was also shown in the research that the placement of girl students with SEN in boys' schools was relatively effective with the help of responsive teaching staff and school management, along with relevant educational assistance. Thus, the results of the paper prove the Social Cognitive Theory as they indicate that students learn and feel comfortable due to the interplay of personal, behavioural, and environmental components.

INVESTIGATING TODOROV'S NARRATIVE STRUCTURES AND SOCIAL MEDIA USERS' RESPONSES IN MOTIVATIONAL INSTAGRAM CAROUSELS

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Kajian ini menyiasat tentang penggunaan struktur naratif Todorov dalam hantaran karusel Instagram oleh lima pempengaruh makro motivasi dan menilai penglibatan penonton menggunakan Engagement Valence Model (EVM). Kajian ini bertujuan untuk mengenalpasti bagaimana peringkat naratif digunakan dalam hantaran karusel, jenis kandungan motivasi yang muncul daripada peratusan dominan peringkat naratif dalam setiap hantaran, serta bagaimana penonton memberi tindak balas terhadap hantaran motivasi tersebut. Seterusnya, peringkat naratif diberikan kod berdasarkan struktur naratif Todorov, manakala persepsi pengguna Instagram terhadap hantaran tersebut dianalisis bagi merekod valens penglibatan yang wujud dalam komen tersebut. Dapatan kajian juga menunjukkan bahawa kebanyakan hantaran karusel mengandungi kelima-lima peringkap naratif, dengan new equilibrium sebagai peringkat naratif paling dominan. Cerita berkaitan kisah kejayaan, strategi, dan norma baru merupakan jenis kandungan motivasi yang paling digemari dan paling banyak digunakan dalam hantaran karusel motivasi. Penglibatan penonton menunjukkan bahawa valens positif sering berkait dengan kisah kejayaan, manakala valens negatif lebih tertumpu kepada kisah yang berkaitan dengan konflik. Secara keseluruhannya, amatlah diharapkan bahawa kajian ini dapat memberi implikasi teori dan praktikal tentang bagaimana struktur naratif Todorov boleh diaplikasikan dalam konteks penceritaan digital, serta bagaimana EVM boleh dijadikan sebagai rangka kerja untuk menganalisis valens penglibatan melalui komen di media sosial.

This study investigates the use of Todorov's narrative structure in Instagram carousel posts by five motivational macro-influencers and examines audience engagement valence through the Engagement Valence Model (EVM). It aims to pursue how narrative stages are utilised in carousel posts, the types of motivational content that emerge from the dominant percentage of the narrative stage present in a published carousel post, and how audiences respond to those types of motivational content. Narrative stages were coded according to Todorov's narrative structure, while users' perceptions towards the narratives were analysed through Instagram comments to capture the engagement valence present. The findings revealed that most carousel posts incorporated all five narrative stages, with new equilibrium being the most dominant stage often present in each analysed post. Narratives related to success stories, strategy, and new norms are the most liked and widely used types of motivational content in motivational-based carousel posts. Audience engagement showed that positive valence often corresponds with success stories, while negative valence often centred around stories related to conflict. Lastly, hopefully this study will provide useful theoretical and practical implications on how Todorov's narrative structure can be implemented in the context of digital storytelling, as well as how EVM can serve as a framework to analyse engagement valence through social media comments.

GAMIFIED LEARNING AND ESL LEARNERS' MOTIVATION: AN EXPLORATION ON TEACHER-TRAINEE IMPLEMENTATION

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Pembelajaran bergamifikasi semakin mendapat perhatian sebagai pendekatan pengajaran yang berupaya meningkatkan motivasi dan penglibatan dalam kalangan pelajar Bahasa Inggeris sebagai Bahasa Kedua (ESL). Walaupun kajian terdahulu kebanyakannya fokus kepada hasil pembelajaran pelajar, penyelidikan yang meneliti perspektif guru pelatih terhadap pelaksanaan pembelajaran bergamifikasi dalam bilik darjah ESL masih terhad. Oleh itu, kajian ini meneroka pemahaman guru pelatih terhadap pembelajaran bergamifikasi, sikap mereka terhadap pelaksanaannya serta cabaran yang dihadapi semasa menjalani latihan mengajar. Berpandukan Teori Penentuan Kendiri (Self-Determination Theory, SDT) dan Teori Jangkaan-Nilai (Expectancy-Value Theory, EVT), kajian ini menggunakan reka bentuk kaedah campuran berurutan penjelasan (explanatory sequential mixed-methods). Data kuantitatif dikumpulkan melalui soal selidik yang diberikan kepada 22 orang guru pelatih TESL tahun akhir di Universiti Teknologi Malaysia yang telah menamatkan latihan mengajar. Seterusnya, temu bual separa berstruktur dijalankan dengan lima orang peserta yang dipilih secara sukarela bagi menjelaskan dengan lebih mendalam dapatan kuantitatif. Data kuantitatif dianalisis menggunakan statistik deskriptif melalui perisian SPSS, manakala data kualitatif dianalisis secara tematik. Dapatan kajian menunjukkan bahawa guru pelatih mempunyai tahap pemahaman yang tinggi terhadap pembelajaran bergamifikasi serta menunjukkan sikap yang sangat positif terhadap pelaksanaannya. Mereka mengakui potensinya dalam meningkatkan motivasi, penglibatan, autonomi, kompetensi dan interaksi bilik darjah dalam kalangan pelajar. Walaubagaimanapun, masa persediaan yang panjang dan beban kerja dikenal pasti sebagai halangan utama kepada pelaksanaan yang konsisten, manakala kebimbangan berkaitan literasi digital dan kesan kebaharuan (novelty effect) didapati kurang signifikan. Dapatan kualitatif pula menunjukkan bahawa guru pelatih menangani cabaran tersebut dengan mengadaptasi aktiviti bergamifikasi bukan digital yang ringkas, mengubah suai bahan pengajaran sedia ada serta memilih elemen permainan yang selaras dengan objektif pembelajaran dalam konteks bilik darjah. Mereka juga menyatakan hasrat yang tinggi untuk terus mengintegrasikan pembelajaran bergamifikasi dalam aktiviti pengajaran pada masa hadapan. Kesimpulannya, kajian ini menekankan kepentingan memperkukuh program pendidikan guru melalui penyediaan latihan dan pendedahan praktikal yang lebih menyeluruh dalam mereka bentuk pengalaman pembelajaran bergamifikasi yang lestari dan bermakna dari sudut pedagogi bagi menyokong motivasi pelajar ESL dengan lebih berkesan.

Gamified learning has gained increasing attention as an instructional approach for enhancing motivation and engagement among English as a Second Language (ESL) learners. While previous studies have largely focused on learners' outcomes, limited research has examined teacher-trainees' perspectives on implementing gamified learning in ESL classrooms. This study explored teacher-trainees' understanding of gamified learning, their attitudes towards its implementation, and the challenges encountered during teaching practicum. Guided by Self-Determination Theory (SDT) and Expectancy-Value Theory (EVT), the study employed an explanatory sequential mixed-methods design. Quantitative data were collected through a self-developed questionnaire administered to 22 final-year TESL teacher-trainees at Universiti Teknologi Malaysia who had completed their teaching practicum. Subsequently, semi-structured interviews were conducted with five voluntarily selected participants to further explain the quantitative findings. Quantitative data were analysed using descriptive statistics in SPSS, while qualitative data were analysed

thematically. The findings revealed that teacher-trainees demonstrated a high level of understanding of gamified learning and expressed highly positive attitudes towards its implementation, recognising its potential to enhance learners' motivation, engagement, autonomy, competence, and classroom interaction. Nevertheless, preparation time and workload emerged as the main barriers to consistent implementation, whereas concerns regarding digital literacy and the novelty effect were comparatively less significant. Qualitative findings further showed that teacher-trainees addressed these challenges by adapting simple non-digital gamified activities, modifying existing teaching materials, and selecting game elements that aligned with learning objectives and classroom contexts. They also expressed strong intentions to continue integrating gamified learning into their future teaching practices. Overall, the study highlights the importance of strengthening teacher education programmes by providing greater practical exposure and training in designing sustainable and pedagogically meaningful gamified learning experiences that effectively support ESL learners' motivation.

EXPLORING PRE-SERVICE TEACHERS' PERCEPTIONS DURING TEACHING PRACTICE IN MALAYSIAN SECONDARY SCHOOL

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Latihan mengajar merupakan komponen penting dalam pendidikan guru dalam membantu guru pelatih melalui situasi bilik darjah yang sebenar serta meningkatkan kemahiran mengajar secara profesional. Kajian ini bertujuan untuk mengkaji emosi, cabaran dan cadangan yang mungkin boleh menambah baik kemahiran mengajar mereka. Kaedah kualitatif telah digunakan melalui temu bual separa berstruktur yang melibatkan 10 orang pelajar tahun akhir jurusan Bahasa Inggeris sebagai Bahasa Kedua (TESL) dari Universiti Teknologi Malaysia (UTM). Data yang dikumpul kemudiannya dianalisis menggunakan kaedah Analisis Tematik. Hasil kajian menunjukkan bahawa guru pelatih TESL mengalami emosi positif dan negatif, cabaran sewaktu menjalani latihan mengajar dan mempunyai cadangan-cadangan untuk menambah baik pengalaman latihan mengajar. Kajian ini menekankan kepentingan pembelajaran berasaskan pengalaman dan sokongan berterusan dalam melahirkan pendidik yang kompeten serta berkeyakinan tinggi.

Teaching Practice is a significant component in teacher education which helps pre-service teachers experience real classroom settings and improve professional teaching skills. This study intended to investigate preservice teachers' emotions, challenges and possible recommendations for enhancing their teaching practice. A qualitative technique was employed, conducting semi-structured interviews with 10 final year Teaching English as Second Language (TESL) students from Universiti Teknologi Malaysia (UTM), which were subsequently evaluated by Thematic Analysis. The results indicated the presence of both positive emotions and negative emotions, significant challenges faced by TESL pre-service teachers and possible suggestions from them to make teaching practice better. The research underscores the need for experiential learning and ongoing assistance in cultivating proficient and self-assured educators.

A MULTIMODAL ANALYSIS OF MICRO-STORYTELLING IN ENGLISH-TEACHING TIKTOK VIDEOS

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Kajian ini meneliti bagaimana pencipta kandungan TikTok pengajaran bahasa Inggeris menggunakan strategi mikro-penceritaan dan sumber multimodal untuk menyokong penglibatan serta pemahaman pelajar dalam konteks pembelajaran digital tidak formal. Berpandukan Model Sosiolinguistik Struktur Naratif Labov dan Teori Semiotik Sosial Multimodaliti, kajian ini menggunakan reka bentuk penyelidikan kualitatif interpretif. Sampel bertujuan yang terdiri daripada video TikTok pengajaran bahasa Inggeris terpilih telah dianalisis bagi mengenal pasti pola naratif yang berulang dan penggunaan sumber linguistik, visual, auditori, berasaskan tubuh, serta elemen produksi. Dapatan menunjukkan bahawa pencipta kandungan kerap menggunakan pembukaan berbentuk tarikan perhatian, komplikasi yang dekat dengan pengalaman penonton, penilaian yang ringkas, dan penyelesaian yang jelas untuk menyusun kandungan pengajaran. Elemen naratif ini diperkukuh melalui ciri multimodal yang diselaraskan seperti teks pada skrin, gerak isyarat, ekspresi wajah, kesan bunyi, dan penekanan visual. Kajian ini juga menunjukkan bahawa gabungan mikro-penceritaan dan reka bentuk multimodal berpotensi menyokong penglibatan tingkah laku, emosi, dan kognitif dengan meningkatkan perhatian, kebolehhubungkaitan, kejelasan, dan kebolehcapaian input bahasa. Secara keseluruhannya, kajian ini menonjolkan peranan penjujukan naratif dan pengorkestraan multimodal dalam membentuk kandungan pengajaran bahasa Inggeris berbentuk video pendek di TikTok serta menyumbang kepada pemahaman yang lebih mendalam tentang amalan pembelajaran bahasa digital tidak formal.

This study examines how English-teaching TikTok creators employ micro-storytelling strategies and multimodal resources to support learner engagement and comprehension in informal digital learning contexts. Guided by Labov's Sociolinguistic Model of Narrative Structure and Social Semiotic Theory of Multimodality, the study adopts a qualitative interpretive research design. A purposive sample of selected English-teaching TikTok videos was analysed to identify recurring narrative patterns and the use of linguistic, visual, auditory, embodied, and production-related resources. The findings show that creators frequently use hook-oriented openings, relatable complications, concise evaluations, and clear resolutions to structure instructional content. These narrative elements are reinforced through coordinated multimodal features such as text overlays, gestures, facial expressions, sound effects, and visual emphasis. The study also indicates that the combination of micro-storytelling and multimodal design may support behavioural, emotional, and cognitive engagement by increasing attention, relatability, clarity, and accessibility of language input. Overall, the study highlights the role of narrative sequencing and multimodal orchestration in shaping short-form English-teaching content on TikTok and contributes to a deeper understanding of informal digital language learning practices.

EVALUATING THE ROLE OF ARTIFICIAL INTELLIGENCE IN ENHANCING ESL LEARNERS' READING AND WRITING SKILLS

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Kemahiran membaca dan menulis merupakan kemahiran bahasa yang penting bagi membolehkan pelajar memahami maklumat, menyampaikan idea secara berkesan, serta mencapai kejayaan akademik. Walau bagaimanapun, ramai pelajar Bahasa Inggeris sebagai Bahasa Kedua (English as a Second Language, ESL) menghadapi kesukaran dalam memahami teks dan menghasilkan penulisan yang tersusun dengan baik. Dalam beberapa tahun kebelakangan ini, Kecerdasan Buatan (Artificial Intelligence, AI) telah muncul sebagai alat pendidikan yang bernilai dalam menyokong pembelajaran bahasa Inggeris dengan membantu pelajar melaksanakan pelbagai tugasan membaca dan menulis. Walaupun penggunaannya semakin meluas, penyelidikan yang mengkaji secara perbandingan peranan AI dalam mengintegrasikan kemahiran membaca dan menulis dalam kalangan pelajar ESL di institusi pengajian tinggi di Malaysia masih terhad. Oleh itu, kajian ini menyiasat bagaimana alat-alat AI tersebut membantu meningkatkan kemahiran membaca dan menulis pelajar ESL di Universiti Teknologi Malaysia (UTM). Menggunakan reka bentuk kajian kuantitatif, data tinjauan daripada 82 orang pelajar prasiswazah menunjukkan bahawa alat AI generatif digunakan terutamanya untuk tugasan literasi aras tinggi seperti penjanaan idea dan peringkasan teks yang kompleks. Alat ini bertindak sebagai jambatan kognitif antara kemahiran reseptif (membaca) dan kemahiran produktif (menulis) dengan mengurangkan masalah “writer's block” serta memudahkan proses penghasilan penulisan. Para pelajar turut melaporkan persepsi yang positif terhadap penggunaan AI, termasuk peningkatan keyakinan diri, autonomi dalam pembelajaran, dan pengurangan kebimbangan semasa menulis. Namun begitu, mereka juga menyuarakan kebimbangan terhadap kebergantungan yang berlebihan kepada AI, risiko plagiarisme, serta maklum balas yang bersifat umum dan kurang diperibadikan. Kajian ini merumuskan bahawa AI berfungsi sebagai “writing buddy” dan sokongan kognitif yang berkesan dalam memperkukuh literasi akademik. Walau bagaimanapun, penggunaan AI perlu disertai dengan kesedaran etika dan penjajaran pedagogi yang sesuai bagi memastikan AI kekal sebagai alat sokongan pembelajaran dan bukannya pengganti kepada pemikiran serta usaha kendiri pelajar.

Reading and writing are essential language skills that enable learners to understand information, express ideas effectively, and achieve academic success. However, many English as a Second Language (ESL) learners face challenges in comprehending texts and producing well-organised written work. In recent years, Artificial Intelligence (AI) has emerged as a valuable educational tool that supports English language learning by assisting students with various reading and writing tasks. Despite its increasing use, limited research has explored the comparative role of AI in integrating reading and writing among ESL learners in Malaysia higher education. Therefore, this study investigates how these tools enhance the reading and writing skills of ESL learners at Universiti Teknologi Malaysia (UTM). Using a quantitative design, survey data from 82 undergraduates revealed that generative AI tools are predominantly applied to higher-literacy task such as idea generation and summarizing complex texts, acting as a cognitive bridge between receptive (reading) and productive (writing) skills by reducing writer’s block and facilitating composition. Learners reported positive perceptions of AI, citing increased confidence, autonomy, and reduced writing anxiety, but also expressed concerns about over-reliance, plagiarism risks, and generic feedback. The study concludes that AI serves as a valuable “writing buddy” and cognitive scaffold for academic literacy yet emphasizes the need for ethical awareness and pedagogical

alignment to ensure it remains a supplementary tool rather than a substitute for independent thought.

AN EVALUATION OF GRAMMAR EXERCISES IN THE PULSE 2 TEXTBOOK: PRACTICE TYPOLOGIES, PEDAGOGICAL BENEFITS, AND IMPLEMENTATION CHALLENGES

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Sebagai respons kepada peralihan Malaysia ke arah Common European Framework of Reference for Languages (CEFR), kajian ini menilai keberkesanan pedagogi latihan tatabahasa dalam buku teks wajib, Pulse 2. Penyelidikan ini menangani kebimbangan yang semakin meningkat bahawa bahan import mungkin mengutamakan ketepatan formal berbanding komunikasi autentik, yang berpotensi membawa kepada pembentukan "pengetahuan kaku" (inert knowledge). Dengan menggunakan reka bentuk kaedah campuran berturutan, kajian ini terlebih dahulu melaksanakan analisis dokumen kualitatif terhadap 124 latihan tatabahasa dalam Pulse 2 berdasarkan tipologi latihan Paulston (1972). Kedua, temu bual separa berstruktur telah dijalankan dengan sepuluh guru pelatih TESL untuk meneroka pengalaman pengajaran mereka melalui lensa teori Grammaring Larsen-Freeman (2003). Dapatan kajian mendedahkan ketidakseimbangan struktur yang ketara: latihan mekanikal (45.16%) dan bermakna (48.39%) mendominasi kurikulum, manakala tugasan komunikatif sangat kurang diwakili pada kadar hanya 6.45%. Walaupun guru pelatih menyatakan bahawa latih tubi berstruktur menyediakan asas pengajaran yang selamat dan membantu dalam pengurusan bilik darjah, mereka melaporkan bahawa tugasan ini sering kali mencetuskan kurangnya penglibatan murid, penyalinan pasif, dan tekaan meluru. Tambahan pula, kepadatan leksikal yang tinggi dalam tugasan kontekstual sering mewujudkan halangan pemahaman, dan kekurangan latihan komunikatif memaksa guru meluangkan masa yang lama untuk merangka bahan tambahan sendiri bagi memenuhi standard kurikulum kebangsaan. Kajian ini menyimpulkan bahawa Pulse 2 menunjukkan kekurangan struktur yang sistemik dalam aplikasi komunikatif, sekali gus mengalihkan beban pengajaran daripada bahan kepada guru, yang mesti menyesuaikan buku teks secara proaktif untuk memudahkan kelancaran komunikasi yang sebenar.

In response to Malaysia's transition to the Common European Framework of Reference for Languages (CEFR), this study evaluates the pedagogical efficacy of grammar exercises in the mandated Pulse 2 textbook. The research addresses the growing concern that imported materials may prioritize formal accuracy over authentic communication, potentially leading to the development of inert knowledge. Employing a sequential mixed-methods design, the study first performed a qualitative document analysis of 124 grammar exercises in Pulse 2 based on Paulston's (1972) practice typologies. Secondly, semi-structured interviews were conducted with ten TESL teacher trainees to explore their lived instructional experiences through the lens of Larsen-Freeman's (2003) Grammaring theory. Findings revealed a significant structural imbalance: mechanical (45.16%) and meaningful (48.39%) practices dominated the curriculum, while communicative tasks were critically underrepresented at only 6.45%. While trainees noted that the structured drills provide a secure instructional baseline and aid in classroom management, they reported that these tasks frequently trigger student disengagement, passive copying, and blind guessing. Furthermore, the high lexical density of contextual tasks often creates comprehension barriers, and the scarcity of communicative exercises forces teachers to spend significant time engineering original supplemental materials to meet national curriculum standards. The study concludes that Pulse 2 exhibits a systemic structural deficit in communicative application, shifting the instructional burden from the material to the teacher, who must proactively adapt the textbook to facilitate genuine communicative fluency.

A COMPARATIVE STUDY OF GENDER REPRESENTATION IN KBSM AND KSSM FORM 4 ENGLISH TEXTBOOKS

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Representasi jantina dalam bahan pembelajaran memainkan peranan penting dalam membentuk persepsi pelajar terhadap peranan sosial dan kesaksamaan. Walaupun sistem pendidikan di Malaysia semakin menekankan aspek kesaksamaan jantina, masih wujud kebimbangan terhadap sejauh mana buku teks Bahasa Inggeris menggambarkan representasi jantina yang seimbang. Kajian ini meneliti representasi jantina dalam buku teks Bahasa Inggeris Tingkatan Empat di bawah Kurikulum Bersepadu Sekolah Menengah (KBSM) dan Kurikulum Standard Sekolah Menengah (KSSM). Secara khusus, kajian ini bertujuan untuk mengenal pasti corak representasi jantina dalam elemen teks dan visual serta membandingkan penggambaran watak lelaki dan perempuan antara kedua-dua kerangka kurikulum tersebut. Reka bentuk kajian kaedah campuran digunakan dengan menggabungkan analisis kandungan kuantitatif dan analisis visual kualitatif. Data teks dianalisis menggunakan Analisis Kandungan Krippendorff, manakala data visual ditafsirkan berdasarkan kerangka Visual Grammar oleh Kress dan van Leeuwen. Dapatan kajian menunjukkan peningkatan ketara dalam representasi visual jantina dalam buku teks KSSM, yang memperlihatkan watak lelaki dan perempuan dalam peranan yang lebih seimbang, kolaboratif dan saksama berbanding KBSM. Namun begitu, analisis teks menunjukkan bahawa pilihan leksikal dan rujukan berunsur lelaki masih lebih dominan dalam kedua-dua buku teks, menandakan bahawa unsur ketidakseimbangan jantina masih wujud walaupun berlaku penambahbaikan dari segi visual. Dapatan ini menunjukkan wujudnya jurang antara representasi visual dan teks, serta menegaskan bahawa penambahbaikan visual sahaja tidak mencukupi untuk mencapai kesaksamaan jantina yang menyeluruh. Kajian ini menyumbang kepada pemahaman tentang representasi jantina dalam bahan pembelajaran Bahasa Inggeris di Malaysia serta memberikan cadangan bagi pembangunan bahan pendidikan yang lebih inklusif dari segi jantina.

Gender representation in educational materials plays a significant role in shaping students' perceptions of social roles and equality. Although the Malaysian education system has increasingly emphasized gender inclusivity, concerns remain regarding the extent to which English language textbooks reflect balanced gender representation. This study examined gender representation in Malaysian Form 4 English textbooks developed under the Kurikulum Bersepadu Sekolah Menengah (KBSM) and Kurikulum Standard Sekolah Menengah (KSSM). Specifically, it aimed to identify patterns of gender representation in textual and visual elements and compare the portrayal of male and female characters across the two curriculum frameworks. A mixed-methods research design was employed, integrating quantitative content analysis and qualitative visual analysis. Textual data were analysed using Krippendorff's Content Analysis, while visual data were interpreted through Kress and van Leeuwen's Visual Grammar framework. The findings reveal a notable improvement in the visual representation of gender in the KSSM textbook, where male and female characters are portrayed in more balanced, collaborative, and equitable roles than in the KBSM textbook. However, the textual analysis indicates that male-oriented lexical choices and references continue to predominate in both textbooks, suggesting that gender bias persists despite visual improvements. These findings highlight a disparity between visual and textual representations of gender and suggest that revisions to textbook content should address not only visual design but also linguistic choices to achieve more comprehensive gender inclusivity. The study contributes to the understanding of gender representation in Malaysian English language learning materials and provides evidence to support the development of more gender-

equitable educational resources.

EXPLORING ADJECTIVES IN MALAYSIA TOURISM WEBSITE FOR ESL CLASSROOMS

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Kata adjektif merupakan unsur bahasa yang penting dalam teks promosi pelancongan untuk menggambarkan destinasi dan mempengaruhi persepsi pelancong. Walau bagaimanapun, kajian tentang penggunaan kata adjektif dalam laman web rasmi pelancongan Malaysia masih terhad. Oleh itu, kajian ini bertujuan untuk menganalisis penggunaan kata adjektif dalam teks promosi di laman web pelancongan Malaysia (Malaysia.travel). Kajian ini menggunakan pendekatan penyelidikan deskriptif kualitatif melalui analisis kandungan kualitatif. Data kajian dikumpulkan daripada bahagian "Explore Malaysia" dalam laman web rasmi pelancongan Malaysia. Analisis kajian memfokuskan kepada susun atur dan struktur organisasi teks promosi, jenis kata adjektif yang paling kerap digunakan serta fungsi komunikatifnya. Data dianalisis secara manual berdasarkan kerangka Kerbrat-Orecchioni (1980), dan prosedur kebolehpercayaan antara pengekod turut dijalankan bagi meningkatkan kebolehpercayaan dapatan kajian. Dapatan kajian menunjukkan bahawa teks promosi secara umumnya mempunyai susun atur yang konsisten, iaitu terdiri daripada tajuk, gambaran keseluruhan dan kandungan deskriptif. Kata adjektif deskriptif merupakan jenis yang paling kerap digunakan, diikuti oleh kata adjektif evaluatif dan afektif. Dapatan kajian ini juga menunjukkan bahawa kata adjektif deskriptif digunakan untuk memberikan maklumat tentang destinasi, kata adjektif evaluatif yang digunakan untuk menyatakan penilaian positif, manakala kata adjektif afektif digunakan untuk mewujudkan daya tarikan emosi. Dapatan kajian ini menyumbang kepada pemahaman tentang penggunaan kata adjektif dalam wacana promosi pelancongan serta menunjukkan bahawa teks promosi daripada laman web rasmi pelancongan Malaysia boleh digunakan sebagai bahan pengajaran di bilik darjah bahasa Inggeris sebagai Bahasa Kedua. Kajian ini juga memberikan pandangan yang berguna kepada penulis kandungan pelancongan, pengamal Bahasa Inggeris untuk Tujuan Khusus, serta penyelidikan masa hadapan dalam bidang wacana pelancongan.

Adjectives important language features used in tourism promotional texts to describe destinations and influence tourists' perceptions. However, limited studies have examined the use of adjectives in the official Malaysia tourism website. Therefore, this study aimed to analyse the use of adjectives in the promotional texts of the official Malaysia tourism website (Malaysia.travel). This study adopted a qualitative descriptive research approach using qualitative content analysis. The data were collected from the "Explore Malaysia" section of the official Malaysia tourism website. The analysis focused on the layout and organisational structure of the promotional texts, the most frequently used types of adjectives, and their communicative functions. The data were analysed manually based on Kerbrat-Orecchioni's (1980) framework, and an inter-coder reliability procedure was conducted to improve the trustworthiness of the findings. The findings showed that the promotional texts generally followed a consistent layout consisting of a title, an overview, and descriptive content. Descriptive adjectives were the most frequently used, followed by evaluative and affective adjectives. The findings also showed that descriptive adjectives provided information about destinations, evaluative adjectives expressed positive judgements, and affective adjectives created emotional appeal. The findings contribute to the understanding of adjective use in

tourism promotional discourse and suggest that promotional texts from the official Malaysia tourism website can be used as teaching materials in ESL classrooms. The study also provides useful insights for tourism content writers, English for Specific Purposes (ESP) practitioners, and future research on tourism discourse.

THE IMPACT OF TAMIL L1 INTERFERENCE ON ENGLISH WRITING AMONG MALAYSIAN SECONDARY SCHOOL LEARNERS

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Penulisan merupakan salah satu kemahiran penting dalam pembelajaran bahasa Inggeris. Namun, ramai pelajar ESL menghadapi kesukaran dalam menghasilkan penulisan yang tepat akibat pengaruh bahasa pertama (L1) mereka. Kajian ini bertujuan untuk mengkaji pengaruh interferens bahasa Tamil sebagai bahasa pertama terhadap penulisan bahasa Inggeris dalam kalangan pelajar penutur bahasa Tamil. Secara khusus, kajian ini bertujuan mengenal pasti jenis-jenis kesalahan yang terdapat dalam esei pelajar serta meneliti bagaimana struktur bahasa Tamil menyumbang kepada berlakunya kesalahan tersebut. Kajian ini menggunakan reka bentuk kajian kualitatif, dan data dikumpulkan melalui tugasan penulisan esei yang dijalankan dalam kalangan pelajar penutur bahasa Tamil. Esei yang dikumpulkan dianalisis menggunakan Teori Analisis Kesalahan dan Hipotesis Analisis Kontrastif bagi mengenal pasti pola kesalahan yang berulang serta menjelaskan pengaruh pemindahan bahasa daripada bahasa Tamil kepada bahasa Inggeris. Dapatan kajian menunjukkan bahawa pelajar menghasilkan kesalahan tatabahasa, morfologi, leksikal dan wacana dalam penulisan mereka. Analisis mendapati bahawa kebanyakan kesalahan tersebut berkait rapat dengan perbezaan struktur antara bahasa Tamil dan bahasa Inggeris, terutamanya dari aspek penggunaan kala, struktur ayat, susunan perkataan, penggunaan artikel, pemilihan kosa kata dan organisasi wacana. Dapatan kajian turut menunjukkan bahawa pelajar sering memindahkan ciri-ciri linguistik bahasa Tamil ke dalam penulisan bahasa Inggeris mereka, sekali gus menghasilkan penyimpangan yang sistematik daripada konvensi bahasa Inggeris standard. Kajian ini menyimpulkan bahawa interferens bahasa Tamil sebagai bahasa pertama memainkan peranan yang signifikan dalam mempengaruhi prestasi penulisan bahasa Inggeris pelajar. Dapatan kajian ini diharapkan dapat membantu guru bahasa Inggeris merancang strategi pengajaran yang lebih berkesan serta menjadi rujukan kepada penyelidik pada masa hadapan yang berminat dalam bidang pemindahan bahasa dan perkembangan kemahiran menulis dalam kalangan pelajar ESL.

Writing is an essential skill in English language learning, yet many ESL learners encounter difficulties in producing accurate written texts due to the influence of their first language (L1). This study investigates the influence of Tamil L1 interference on the English writing of Tamil-speaking learners. Specifically, the study aims to identify the types of errors found in learners' essays and examine how Tamil language structures contribute to these errors. A qualitative research design was employed, and data were collected through essay writing tasks completed by Tamil-speaking learners. The collected essays were analysed using Error Analysis and the Contrastive Analysis Hypothesis to identify recurring error patterns and explain the influence of language transfer from Tamil to English. The findings revealed that learners produced grammatical, morphological, lexical, and discourse errors in their writing. The analysis showed that many of these errors were associated with differences between Tamil and English in areas such as tense usage, sentence structure, word order, article usage, vocabulary selection, and discourse organisation. The findings further indicate that learners frequently transferred Tamil linguistic features into their English writing, resulting in systematic deviations from standard English conventions. The study concludes that Tamil L1 interference plays a significant role in shaping the writing performance of Tamil-speaking ESL learners. The findings may provide useful insights for English language teachers in developing appropriate instructional strategies and may serve as a valuable reference for future research on language transfer and English writing development among ESL learners.

THE EFFECT OF MOTHER TONGUE INTERFERENCE IN THE WRITING OF ENGLISH AS A SECOND LANGUAGE (ESL) MALAY PART-TIME UNDERGRADUATE LEARNERS

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Kajian ini dilakukan bertujuan untuk mengkaji kesan gangguan bahasa ibunda terhadap penulisan bahasa Inggeris sebagai bahasa kedua (ESL) pelajar sarjana muda separuh masa Melayu di Universiti Teknologi Malaysia (UTM). Kajian ini bertujuan untuk menganalisis jenis-jenis kesalahan dalam penulisan bahasa Inggeris pelajar akibat gangguan bahasa pertama. Kajian ini menyatakan bahawa terdapat tiga jenis kesilapan utama yang dilakukan oleh khalayak sasaran iaitu pemindahan peraturan, pengurangan redundansi, dan kesilapan intralingual. Majoriti jenis kesilapan pertama adalah berkaitan secara langsung dengan bahasa ibunda mereka dan tulisan Inggeris. Data juga menunjukkan bahawa mereka secara amnya mempunyai sikap positif terhadap penulisan dalam bahasa Inggeris, dan purata tahap keyakinan yang sederhana dalam kemahiran menulis mereka dan melaporkan bahawa mereka tidak dapat menulis dalam bahasa Inggeris tanpa menggunakan bahasa ibunda mereka untuk membantu mereka menulis. Di samping penggunaan bahasa pertama untuk menulis, dapatan melaporkan bahawa sampel sasaran menggunakan beberapa strategi untuk menangani kesilapan semasa menulis dalam bahasa Inggeris. Strategi ini termasuk penyemakan kendiri, mendapatkan bantuan daripada pensyarah dan rakan sebaya, menggunakan teknologi untuk membantu dalam penulisan mereka, merujuk kepada esei bertulis terdahulu, dan kerap berlatih menulis dalam bahasa Inggeris. Kesimpulan yang telah dibuat ialah gangguan bahasa ibunda merupakan faktor yang paling ketara menyumbang kepada kesilapan pelajar dalam penulisan bahasa Inggeris.

The purpose of this study is to investigate the effects of mother tongue interference on the writing of English as a second language (ESL) Malay part-time undergraduate learners at Universiti Teknologi Malaysia (UTM). This study aimed to analyse the types of errors in learners English writing due to first language interference. This study noted that there were three main types of errors made by targeted audience which are the transfer of rules, redundancy reduction, and intralingual errors. The majority of the first type of error were directly related to their mother tongue and English writing. The data also showed that they generally had a positive attitude towards writing in English, and averaged moderate levels of confidence in their writing skills and reported that they were unable to write in English without utilising their mother tongue to assist them in writing. In addition to the utilisation of first language for writing, the findings reported that the target sample used several strategies to deal with errors when writing in English. These strategies included self-revision, seek help from lecturer and peers, utilised technology to assist in their writing, referring to previous written essays, and regularly practicing writing in English. The conclusion that has been made is that the interference of mother tongue language has been the most significant factor contributing to learners' errors in English writing.

EMOTIONAL LABOUR STRATEGIES OF MALAYSIAN TESL PRE-SERVICE TEACHERS: A MIXED-METHODS STUDY OF PRACTICUM EXPERIENCE

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Profesion keguruan memerlukan individu yang bergelar guru untuk mengawal emosi di samping mengekalkan etika profesionalisme. Walau bagaimanapun, emotional labour masih kurang diterokai dan dibicarakan dalam pendidikan guru di Malaysia, terutamanya dalam kalangan guru pelatih TESL semasa latihan mengajar—juga dikenal sebagai praktikum. Kajian ini mengkaji strategi pengurusan dan pengalaman emotional labour dalam kalangan guru pra-servis TESL semasa praktikum selama 16 minggu di sekolah-sekolah menengah di Malaysia dengan menggunakan reka bentuk kaedah campuran jujukan penjelasan (explanatory sequential mixed-methods design). Peserta tahun akhir daripada program TESL (N = 22) telah melengkapkan tinjauan Skala Strategi Kerja Emosi Guru (Teacher Emotional Labour Strategy Scale - TELSS), dan sub-sampel bertujuan terbenam bagi jurnal reflektif (n = 10) telah dinilai melalui analisis tematik refleksif. Dapatan kajian menunjukkan bahawa Emotion of Naturally Felt Emotions (Penzahiran Emosi yang Dirasai Secara Semulajadi) merupakan strategi yang paling kerap digunakan (M = 4.36), manakala analisis korelasi Pearson menunjukkan hubungan positif yang signifikan antara Lakonan Luaran (Surface Acting) dan Lakonan Dalaman (Deep Acting) ($r (20) = .447$, $p < .05$). Naratif kualitatif mengkontekstualisasikan corak-corak ini melalui tiga tema: perang dalaman dan konflik emosi, pengawalan emosi melalui Lakonan Luaran dan Dalaman, serta pertumbuhan melalui daya tindak (coping) dan hubungan yang sihat. Secara keseluruhan, dapatan kajian meletakkan kerja emosi sebagai komponen penting dalam perkembangan profesional guru pelatih dan menyokong integrasi modul daya tahan afektif dalam pendidikan guru.

Teaching requires one to regulate emotions while maintaining professional expectations; however, emotional labour remains underexplored in Malaysian teacher education, especially among TESL pre-service teachers (PSTs) during practicum. This study examined emotional labour strategies and experiences among TESL PSTs during the 16-week practicum in secondary schools in Malaysia using an explanatory sequential mixed-methods design. Final-year participants (N = 22) completed the Teacher Emotional Labour Strategy Scale (TELSS) survey, and a nested purposive sub-sample of reflective journals (n = 10) was evaluated via reflexive thematic analysis. Findings showed that the Expression of Naturally Felt Emotions was most frequently used strategy (M = 4.36), while Pearson correlation analysis indicated a significant positive relationship between Surface Acting and Deep Acting ($r (20) = .447$, $p < .05$). Qualitative narratives contextualised these patterns through three themes: internal struggles and emotional conflict, emotional regulation through Surface and Deep Acting, and growth through coping and healthy connection. Overall, the findings position emotional labour as a vital component of PSTs' professional development and supports affective resilience module integration in teacher education.

SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA SAINS DENGAN PENDIDIKAN (MATEMATIK) DENGAN KEPUJIAN [SHPMH]

PEMBANGUNAN MODUL PENGAJARAN TOPIK TRANSLASI ISOMETRI TINGKATAN 2 DALAM MENYOKONG ELEMEN MATLAMAT PEMBANGUNAN MAMPAN 13 (SDG 13) TINDAKAN IKLIM

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Kajian ini dijalankan berasaskan keperluan untuk memperkukuh pengajaran Matematik melalui integrasi elemen kelestarian alam sekitar khususnya SDG 13: Tindakan Iklim dalam topik Translasi Isometri Tingkatan 2. Namun, pendekatan pengajaran sedia ada didapati kurang menekankan hubungan antara konsep Matematik dengan isu global sebenar yang boleh meningkatkan kesedaran murid terhadap kelestarian alam sekitar. Kajian ini bertujuan untuk membangunkan dan menilai kesesuaian modul pengajaran Translasi Isometri Tingkatan 2 yang mengintegrasikan elemen SDG 13: Tindakan Iklim. Kajian ini menggunakan pendekatan kualitatif. Seramai lima orang pakar kurikulum dan enam orang guru Matematik telah dipilih sebagai responden kajian. Kajian dijalankan di universiti dan sekolah menengah. Instrumen kajian yang digunakan ialah soal selidik penilaian modul. Data dianalisis menggunakan analisis tematik bagi mengenal pasti tema utama berkaitan kesesuaian, kebolehgunaan dan keberkesanan kandungan modul. Dapatan kajian menunjukkan bahawa modul yang dibangunkan adalah sesuai digunakan dalam pengajaran dan pembelajaran kerana menghubungkan konsep translasi isometri dengan situasi dunia sebenar berkaitan perubahan iklim. Pakar dan guru berpandangan bahawa modul ini membantu meningkatkan kefahaman murid terhadap konsep geometri serta meningkatkan kesedaran terhadap isu alam sekitar. Selain itu, modul ini juga dianggap menarik, tersusun dan sesuai digunakan dalam aktiviti PdP berpusatkan murid. Walau bagaimanapun, penambahbaikan dicadangkan dari aspek reka bentuk aktiviti dan penambahan contoh aplikasi yang lebih dekat dengan pengalaman murid. Kesimpulannya, pembangunan modul ini berpotensi menjadi bahan bantu mengajar yang efektif dalam menyokong pengajaran Matematik berteraskan pendidikan lestari. Implikasinya, guru disarankan untuk mengintegrasikan elemen SDG dalam PdP bagi meningkatkan pemahaman konsep dan kesedaran global murid.

This study was conducted to enhance Mathematics teaching by integrating sustainability elements, specifically SDG 13: Climate Action, into the topic of Isometric Translation for Form 2 students. However, existing teaching approaches often lack explicit connections between mathematical concepts and real-world global issues that can promote environmental awareness among students. The purpose of this study is to develop and evaluate the suitability of a teaching module on Isometric Translation for Form 2 that integrates SDG 13: Climate Action elements. This study employed a qualitative approach. A total of five curriculum experts and six Mathematics teachers were selected as respondents. The study was conducted in universities and secondary schools. The research instrument used was a module evaluation questionnaire. Data were analysed using thematic analysis to identify key themes related to the module's suitability, usability, and content effectiveness. The findings show that the developed module is suitable for teaching and learning as it connects the concept of isometric translation with real-world climate change contexts. Both experts and teachers agreed that the module helps improve students' understanding of geometric concepts while increasing awareness of environmental issues. In addition, the module was considered engaging, well-structured, and suitable for student-centred learning activities. However, improvements were suggested in terms of activity design and the inclusion of more relatable real-life examples for students. In conclusion, the developed module has strong potential as an effective teaching aid in supporting sustainable Mathematics education. It is recommended that teachers

integrate SDG elements into classroom instruction to enhance conceptual understanding and global awareness among students.

TAHAP KESEDIAAN BAKAL GURU TERHADAP PEMBELAJARAN BERBANTUKAN PERMAINAN DIGITAL DALAM KALANGAN PELAJAR JURUSAN PENDIDIKAN MATEMATIK DI UNIVERSITI

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Perkembangan teknologi digital dalam pendidikan telah mendorong penggunaan pelbagai pendekatan pengajaran yang lebih interaktif dan berpusatkan murid, termasuk pembelajaran berasaskan permainan digital atau Game-Based Learning (GBL). Dalam konteks pengajaran Matematik, GBL berpotensi menjadikan proses pembelajaran lebih menarik, menyeronokkan dan bermakna. Namun demikian, keberkesanan pelaksanaan GBL dalam bilik darjah banyak bergantung pada tahap kesediaan bakal guru dari aspek pengetahuan, kemahiran dan sikap terhadap penggunaan permainan digital. Justeru, kajian ini bertujuan untuk mengenal pasti tahap kesediaan bakal guru jurusan Pendidikan Matematik di universiti terhadap pembelajaran berasaskan permainan digital dalam pengajaran Matematik. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Seramai 51 orang pelajar jurusan Pendidikan Matematik di Universiti Teknologi Malaysia telah dipilih sebagai responden. Kajian ini menggunakan reka bentuk tinjauan kuantitatif dengan pengumpulan data melalui soal selidik. Data dianalisis menggunakan statistik deskriptif yang melibatkan kekerapan, peratusan dan median. Dapatan kajian menunjukkan bahawa tahap pengetahuan bakal guru terhadap pembelajaran berbantukan permainan digital berada pada tahap sangat tinggi. Tahap kemahiran bakal guru dalam menggunakan aplikasi permainan digital pula berada pada tahap tinggi, manakala tahap sikap bakal guru terhadap penggunaan GBL berada pada tahap sangat tinggi. Secara keseluruhannya, dapatan kajian menunjukkan bahawa bakal guru Pendidikan Matematik mempunyai tahap kesediaan yang tinggi hingga sangat tinggi untuk mengintegrasikan pembelajaran berbantukan permainan digital dalam pengajaran Matematik. Implikasi kajian ini mencadangkan agar pihak universiti dan fakulti memperkukuh latihan berbentuk praktikal berkaitan reka bentuk, pemilihan dan pelaksanaan permainan digital supaya bakal guru lebih yakin serta berkemahiran untuk mengaplikasikan GBL secara berkesan dalam bilik darjah.

The advancement of digital technology in education has encouraged the use of various interactive and student-centred teaching approaches, including Game-Based Learning (GBL). In the context of Mathematics teaching, GBL has the potential to make the learning process more engaging, enjoyable, and meaningful. However, the effective implementation of GBL in the classroom largely depends on pre-service teachers' readiness in terms of their knowledge, skills, and attitudes towards the use of digital games. Therefore, this study aimed to identify the level of readiness among pre-service Mathematics teachers at university towards the use of GBL in Mathematics teaching. This study employed a quantitative approach using a survey design. A total of 51 Mathematics Education students at Universiti Teknologi Malaysia were selected as respondents. Data were collected through a questionnaire and analysed using descriptive statistics, including frequency, percentage, and median. The findings showed that the pre-service teachers' level of knowledge towards digital game-based learning was very high. Their skills in using digital game applications were at a high level, while their attitudes towards the use of GBL were at a very high level. Overall, the

findings indicate that pre-service Mathematics teachers demonstrate a high to very high level of readiness to integrate digital game-based learning into Mathematics teaching. The study suggests that universities and faculties should strengthen practical training related to the design, selection, and implementation of digital games to enhance pre-service teachers' confidence and skills in implementing GBL effectively in the classroom.

REKA BENTUK DAN PEMBANGUNAN FOLDMASTER AR DENGAN TEORI MINAT DAN MOTIVASI DALAM PEMBELAJARAN GEOMETRI TINGKATAN DUA

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Pembelajaran geometri merupakan komponen penting dalam kurikulum matematik sekolah menengah kerana iamenuntut keupayaan murid untuk memvisualisasikan bentuk dua dan tiga dimensi serta memahami hubungan ruang antara objek. Namun, murid sering menghadapi kesukaran dalam memahami konsep abstrak seperti lipatan dan bentangan geometri, yang menjejaskan minat dan motivasi mereka. Kekangan bahan pembelajaran interaktif serta pendekatan pengajaran tradisional yang statik menambahkan lagi cabaran ini.
Tujuan kajian ini adalah untuk mereka bentuk dan membangunkan aplikasi Foldmaster AR berasaskan teknologi realiti terimbuh (AR) bagi meningkatkan minat dan motivasi murid dalam pembelajaran geometri. Metodologi kajian menggunakan reka bentuk pembangunan produk berasaskan model ADDIE. Kajian melibatkan panel pakar pendidikan matematik untuk penilaian kandungan. Instrumen kajian terdiri daripada penilaian pakar untuk menilai kesesuaian reka bentuk, kandungan, dan elemen pedagogi aplikasi. Data dianalisis secara deskriptif bagi mengenal pasti tahap kesesuaian aplikasi serta potensi keberkesanannya dalam bilik darjah. Dapatan utama dari penilian pakar, aplikasi ini memenuhi keperluan psikologi asas murid seperti autonomi murid bebas meneroka, kompetensi iaitu maklum balas segera. Penilaian pakar turut mengesahkan bahawa reka bentuk aplikasi ini selaras dengan prinsip pedagogi dan berpotensi diaplikasikan dalam bilik darjah sebenar.

Geometry learning is an essential component of the secondary school mathematics curriculum as it requires students to visualize two- and three-dimensional shapes and understand spatial relationships between objects. However, students often face difficulties in comprehending abstract concepts such as folding and unfolding geometry, which negatively affects their interest and motivation. The lack of suitable interactive learning materials and reliance on traditional static teaching approaches further intensify these challenges. The purpose of this study is to design and develop the Foldmaster AR application based on Augmented Reality (AR) technology to enhance students' interest and motivation in learning geometry. The methodology adopts a product development design guided by the ADDIE model. The study involved a panel of mathematics education experts for content validation. Research instruments consisted of expert evaluation forms to assess the suitability of the application's design, content, and pedagogical elements. Data were analyzed descriptively to determine the appropriateness of the application and its potential effectiveness in classroom settings.

PEMBANGUNAN E-MAJALAH MATEMATIK BERASASKAN KEUNIKAN WARISAN DAN BUDAYA NEGERI SABAH

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Kajian ini bertujuan untuk membangunkan e-majalah Matematik berasaskan warisan dan budaya Sabah sebagai bahan pembelajaran digital yang kontekstual. Kajian ini melibatkan tiga objektif, iaitu menganalisis konsep Matematik dalam warisan dan budaya Sabah, membangunkan e-majalah Matematik serta mendapatkan pandangan pakar terhadap e-majalah yang dihasilkan. Kajian menggunakan pendekatan kaedah gabungan dan berpandukan Model ADDIE yang melibatkan fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Analisis dokumen mendapati bahawa data pelancongan Sabah, corak linangkit, anyaman, manik, rumah tradisional, tarian Sumazau serta gong dan kulintangan mengandungi konsep seperti statistik, peratus, nisbah, geometri, perimeter, luas, sudut, pola, simetri, transformasi, bulatan dan pecahan. E-majalah dibangunkan melalui penggunaan teks, visual, grafik, contoh pengiraan, kod QR serta aktiviti Google Form dan Wordwall. Penilaian melibatkan lima orang pakar dan dianalisis menggunakan Content Validity Index (CVI) serta analisis kandungan. Dapatan menunjukkan nilai keseluruhan S-CVI/Ave sebanyak 0.98 dan A-CVI/UA sebanyak 0.90, yang menunjukkan tahap kesahan kandungan yang sangat tinggi. E-majalah ini berpotensi digunakan sebagai bahan bantu mengajar berasaskan etnomatematik untuk menjadikan pembelajaran Matematik lebih menarik, kontekstual dan bermakna.

This study aims to develop a Mathematics e-magazine based on the heritage and culture of Sabah as a contextual digital learning material. The study involves three objectives: to analyse the mathematical concepts embedded in Sabah's heritage and culture, to develop a Mathematics e-magazine, and to obtain experts' views on the developed e-magazine. The study employed a mixed-method approach guided by the ADDIE Model, which consists of the analysis, design, development, implementation, and evaluation phases. Document analysis found that Sabah tourism data, linangkit patterns, weaving, beadwork, traditional houses, the Sumazau dance, as well as gongs and kulintangan contain mathematical concepts such as statistics, percentages, ratios, geometry, perimeter, area, angles, patterns, symmetry, transformations, circles, and fractions. The e-magazine was developed using texts, visuals, graphics, calculation examples, QR codes, as well as Google Form and Wordwall activities. The evaluation involved five experts and was analysed using the Content Validity Index (CVI) and content analysis. The findings showed an overall S-CVI/Ave value of 0.98 and an ACVI/UA value of 0.90, indicating a very high level of content validity. This emagazine has the potential to be used as an ethnomathematics-based teaching aid to make Mathematics learning more engaging, contextual, and meaningful.

PEMBANGUNAN MODUL PENGAJARAN MATEMATIK PENGGUNA : PENGURUSAN KEWANGAN TINGKATAN EMPAT DALAM MENYOKONG ELEMEN MATLAMAT PEMBANGUNAN MAMPAN 1 (SDG 1) TIADA KEMISKINAN

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Pengintegrasian elemen Matlamat Pembangunan Mampan 1 (SDG 1), iaitu Tiada Kemiskinan, dalam pengajaran Matematik Pengguna: Pengurusan Kewangan Tingkatan Empat masih belum diberi penekanan secara menyeluruh. Keadaan ini berpunca daripada kekangan guru dalam menghubungkan konsep pengurusan kewangan dengan isu kemiskinan melalui situasi kehidupan seharian murid, di samping keterbatasan bahan pengajaran yang sistematik dan berasaskan konteks. Kajian ini bertujuan untuk menganalisis keperluan, membangunkan dan menilai kebolehgunaan Modul Pengajaran Matematik Pengguna: Pengurusan Kewangan Tingkatan Empat Dalam Menyokong Elemen Matlamat Pembangunan Mampan 1 (SDG 1) Tiada Kemiskinan. Kajian ini menggunakan reka bentuk kajian pembangunan yang melibatkan fasa analisis keperluan, reka bentuk dan pembangunan, serta penilaian. Fasa penilaian dilaksanakan menggunakan pendekatan kuantitatif melalui kaedah Fuzzy Delphi. Seramai 11 orang pakar dipilih secara pensampelan bertujuan, terdiri daripada seorang pakar SDG, empat orang pakar Pendidikan Matematik dan enam orang guru Matematik sekolah menengah. Instrumen soal selidik yang mengandungi 21 item digunakan untuk menilai kebolehgunaan modul dari aspek pengintegrasian elemen SDG 1, pembelajaran secara kontekstual dan modul pengajaran berstruktur. Data dianalisis berdasarkan nilai ambang, peratus kesepakatan pakar dan skor Fuzzy. Dapatan kajian menunjukkan bahawa pakar mencapai tahap kesepakatan yang tinggi terhadap semua aspek kebolehgunaan modul yang dinilai. Modul ini didapati dapat membantu guru mengintegrasikan elemen SDG 1 dalam pengajaran topik Pengurusan Kewangan secara lebih terancang dan bermakna. Selain itu, modul ini menyokong pelaksanaan pembelajaran kontekstual dengan menghubungkan konsep Matematik kepada situasi kewangan yang dekat dengan kehidupan seharian murid. Pakar turut berpandangan bahawa modul yang dibangunkan mempunyai susunan kandungan, arahan dan aktiviti yang sesuai untuk digunakan oleh guru dalam PdPc. Kesimpulannya, Modul Pengajaran Matematik Pengguna : Pengurusan Kewangan Tingkatan Empat Dalam Menyokong Elemen Matlamat Pembangunan Mampan 1 (SDG 1) Tiada Kemiskinan mempunyai tahap kebolehgunaan yang tinggi sebagai panduan pengajaran guru. Modul ini berpotensi membantu guru melaksanakan PdPc yang lebih sistematik, kontekstual dan bermakna, di samping menyokong penerapan literasi kewangan serta kesedaran terhadap isu kemiskinan dalam kalangan murid.

The integration of Sustainable Development Goal 1 (SDG 1): No Poverty into the teaching of Consumer Mathematics: Financial Management for Form Four students has not yet been comprehensively emphasized. This situation is largely attributed to teachers' constraints in linking financial management concepts with poverty-related issues through students' real-life contexts, as well as the limited availability of systematic and context-based teaching materials. Therefore, this study aims to analyse the needs, develop, and evaluate the usability of the Consumer Mathematics Teaching Module: Form Four Financial Management in Supporting Sustainable Development Goal 1 (SDG 1) No Poverty. The study employed a development research design comprising three phases: needs analysis, design and development, and evaluation. The evaluation phase adopted a quantitative approach using the Fuzzy Delphi Method (FDM). A total of 11 experts were selected through purposive sampling, consisting of one SDG expert, four Mathematics Education experts, and six

secondary school Mathematics teachers. A questionnaire comprising 21 items was used to evaluate the module's usability in terms of the integration of SDG 1 elements, contextual learning, and structured instructional design. The data were analysed based on threshold values, percentage of expert consensus, and Fuzzy scores. The findings indicated that the experts reached a high level of consensus on all aspects of the module's usability. The module was found to assist teachers in integrating SDG 1 elements into the teaching of the Financial Management topic in a more systematic and meaningful manner. In addition, the module supports the implementation of contextual learning by connecting mathematical concepts to financial situations that are closely related to students' daily lives. The experts also agreed that the module contains well-organised content, clear instructions, and appropriate learning activities for classroom teaching and learning. In conclusion, the Consumer Mathematics Teaching Module: Form Four Financial Management in Supporting Sustainable Development Goal 1 (SDG 1) No Poverty demonstrates a high level of usability as a teaching guide for teachers. The module has the potential to support teachers in implementing more systematic, contextual, and meaningful teaching and learning processes while promoting financial literacy and raising students' awareness of poverty-related issues.

HUBUNGAN ANTARA TAHAP PENGETAHUAN TEKNOLOGI PEDAGOGI KANDUNGAN (TPACK) DAN KESEDIAAN PENGGUNAAN TEKNOLOGI DALAM PEMBELAJARAN DAN PEMUDAHCARAAN (PDPC) DALAM KALANGAN GURU PELATIH SAINS DAN MATEMATIK

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Kajian ini dijalankan bagi mengenal pasti hubungan antara tahap Pengetahuan Teknologi Pedagogi Kandungan (TPACK) dan kesediaan penggunaan teknologi dalam pembelajaran dan pemudahcaraan (PdPc) dalam kalangan guru pelatih sains dan matematik. Perkembangan teknologi digital dalam pendidikan menuntut guru pelatih untuk bukan sahaja mahir menggunakan teknologi, tetapi juga mampu mengintegrasikannya dengan pedagogi dan kandungan mata pelajaran secara berkesan. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk korelasi. Seramai 70 orang guru pelatih sains dan matematik di Universiti Teknologi Malaysia (UTM) terlibat sebagai responden kajian. Instrumen kajian terdiri daripada soal selidik tahap TPACK dan soal selidik kesediaan guru pelatih yang menggunakan skala Likert empat mata. Data dianalisis secara deskriptif menggunakan kekerapan, peratusan dan median, manakala analisis inferensi dijalankan menggunakan ujian korelasi Spearman. Dapatan kajian menunjukkan bahawa tahap penguasaan TPACK guru pelatih sains dan matematik berada pada tahap sangat tinggi. Tahap kesediaan guru pelatih terhadap penggunaan teknologi dalam PdPc juga berada pada tahap sangat tinggi. Analisis korelasi Spearman menunjukkan terdapat hubungan positif yang sederhana dan signifikan antara tahap penguasaan TPACK dengan kesediaan guru pelatih terhadap penggunaan teknologi dalam PdPc, iaitu $r= 0.554$, $p < .005$. Dapatan ini menunjukkan bahawa semakin tinggi tahap penguasaan TPACK guru pelatih, semakin tinggi kesediaan mereka untuk menggunakan teknologi dalam PdPc. Kajian ini memberi implikasi kepada guru pelatih, pensyarah, pihak universiti, guru pembimbing, sekolah dan Kementerian Pendidikan Malaysia dalam memperkukuh latihan serta sokongan berkaitan penggunaan teknologi dalam pendidikan sains dan matematik.

This study was conducted to determine the relationship between Technological Pedagogical Content Knowledge (TPACK) and the readiness of pre-service Science and Mathematics teachers to integrate technology into teaching and learning (T&L). The rapid advancement of digital technology in education requires pre-service teachers not only to possess technological competencies but also to effectively integrate technology with pedagogical approaches and subject content. This study employed a quantitative approach using a correlational research design. A total of 70 pre-service Science and Mathematics teachers from Universiti Teknologi Malaysia (UTM) participated as respondents. Data were collected using two questionnaires measuring TPACK and teachers' readiness, both employing a four-point Likert scale. Descriptive statistics, including frequency, percentage, and median, were used to analyse the data, while Spearman's rank correlation was employed for inferential analysis. The findings revealed that the respondents demonstrated a very high level of TPACK. Similarly, the level of readiness to integrate technology into teaching and learning was also found to be very high. Spearman's correlation analysis indicated a moderate, positive, and statistically significant relationship between TPACK and the readiness of pre-service teachers to integrate technology into teaching and learning ($r = 0.554$, $p < .005$). These findings suggest that higher levels of TPACK are associated with greater readiness to integrate technology in classroom practice. This study provides valuable implications for pre-service teachers, teacher educators, universities, mentor teachers, schools, and the Ministry of Education Malaysia in strengthening teacher preparation programmes and enhancing technology integration in Science and Mathematics education.

PERSPEKTIF GURU TENTANG PENGGUNAAN GEOGEBRA BAGI TOPIK

FUNGSI DAN PERSAMAAN KUADRATIK

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Pengajaran topik fungsi dan persamaan kuadratik memerlukan murid menghubungkan bentuk persamaan algebra dengan ciri graf parabola, seperti arah bukaan, paksi simetri, titik puncak dan pintasan paksi. Namun demikian, hubungan tersebut sukar dijelaskan secara dinamik melalui kaedah pengajaran yang hanya bergantung pada pengiraan dan lukisan graf secara manual. Kajian ini bertujuan untuk meneroka perspektif guru Matematik terhadap penggunaan GeoGebra dalam pengajaran topik fungsi dan persamaan kuadratik. Kajian ini menggunakan reka bentuk kualitatif deskriptif. Seramai empat orang guru Matematik sekolah menengah dari daerah Kulai dan Johor Bahru, Johor telah terlibat sebagai peserta kajian. Data dikumpulkan melalui temu bual separa berstruktur bagi memperoleh pandangan dan pengalaman guru berkaitan penggunaan GeoGebra dalam PdP. Data temu bual dianalisis secara tematik melalui proses pengekodan manual untuk membentuk subtema dan tema utama. Dapatan kajian menunjukkan bahawa guru berpandangan GeoGebra sesuai digunakan untuk membantu menerangkan hubungan antara persamaan algebra dengan graf parabola secara visual dan dinamik. Penggunaan peluncur nilai membolehkan murid memerhati perubahan graf apabila nilai atau pekali dalam persamaan diubah. Guru turut menekankan keperluan menyediakan fail GeoGebra, lembaran kerja, soalan berpandu dan bahan alternatif sebelum aktiviti dijalankan. Walau bagaimanapun, pelaksanaan GeoGebra berhadapan cabaran seperti capaian internet yang tidak stabil, kekurangan peranti, masa persediaan yang terhad, perbezaan tahap penguasaan murid dan kemahiran teknologi guru. Guru mencadangkan agar latihan praktikal, perkongsian bahan pengajaran, bank aktiviti digital dan sokongan kemudahan ICT dipertingkatkan. Secara keseluruhannya, kajian ini menunjukkan bahawa penggunaan GeoGebra memerlukan gabungan pengetahuan teknologi, pedagogi dan kandungan seperti yang dihuraikan dalam kerangka TPACK. Dapatan kajian memberikan implikasi kepada amalan pedagogi guru serta keperluan sokongan sekolah dalam melaksanakan penggunaan GeoGebra secara lebih terancang dalam pengajaran Matematik.

Teaching functions and quadratic equations requires students to relate algebraic equations to the characteristics of parabolic graphs, such as the direction of opening, axis of symmetry, vertex and intercepts. However, these relationships may be difficult to explain dynamically through teaching approaches that rely only on calculations and manual graph sketching. This study aimed to explore Mathematics teachers' perspectives on the use of GeoGebra in teaching functions and quadratic equations. The study employed a descriptive qualitative design. Four secondary school Mathematics teachers from the districts of Kulai and Johor Bahru, Johor, participated in the study. Data were collected through semi-structured interviews to obtain teachers' views and experiences regarding the use of GeoGebra in teaching and learning. The interview data were analysed thematically through a manual coding process to develop subthemes and main themes. The findings showed that teachers perceived GeoGebra as suitable for explaining the relationship between algebraic equations and parabolic graphs in a visual and dynamic manner. The use of sliders enabled students to observe changes in graphs when values or coefficients in an equation were modified. Teachers also highlighted the need to prepare GeoGebra files, worksheets, guided questions and alternative materials before conducting the activities. Nevertheless, the implementation of GeoGebra was constrained by unstable internet access, limited devices, insufficient preparation time, differences in students' mastery levels and teachers' technological skills. Teachers suggested that practical training, the sharing of teaching materials, digital activity banks and improved ICT facilities should be strengthened. Overall, the study indicates that

the use of GeoGebra requires the integration of technological, pedagogical and content knowledge, as described in the TPACK framework. The findings have implications for teachers' pedagogical practices and the need for school support in implementing GeoGebra more systematically in Mathematics teaching.

PEMBANGUNAN BUKU CERITA REALITI TERIMBUH TERHADAP KEFAHAMAN DAN PENGLIBATAN AKTIF MURID TOPIK PERIMETER DAN LUAS TAHUN 4

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Kajian ini bertujuan membangunkan sebuah buku cerita realiti terimbuh bertajuk Aira dan Taman Ajaib: Belajar Perimeter dan Luas sebagai bahan pembelajaran tambahan bagi topik perimeter dan luas Matematik Tahun 4. Pembangunan bahan ini dilaksanakan bagi menyediakan pengalaman pembelajaran yang lebih visual, kontekstual dan interaktif, khususnya dalam membantu murid membezakan konsep perimeter sebagai ukuran keliling sesuatu bentuk dan luas sebagai ukuran kawasan di dalam sesuatu bentuk. Kajian ini menggunakan reka bentuk kajian pembangunan dengan pendekatan kuantitatif serta berpandukan model ADDIE yang melibatkan lima fasa utama, iaitu analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Dalam fasa analisis, kandungan buku cerita ditentukan berdasarkan Dokumen Standard Kurikulum dan Pentaksiran Matematik Tahun 4. Buku cerita ini menggabungkan elemen penceritaan, ilustrasi bertemakan taman, bentuk geometri, petak grid, latihan bertulis, kuiz digital dan media realiti terimbuh yang diakses melalui kod QR. Instrumen soal selidik terlebih dahulu dinilai oleh dua orang pensyarah Pendidikan Matematik bagi memastikan kesesuaian kandungan, bahasa dan susunan item sebelum digunakan dalam penilaian pakar. Seterusnya, buku cerita realiti terimbuh yang dibangunkan dinilai oleh enam orang panel pakar yang terdiri daripada dua orang pensyarah Pendidikan Matematik, seorang pensyarah Teknologi Maklumat dan tiga orang guru Matematik sekolah rendah. Data penilaian dianalisis menggunakan kaedah Content Validity Index (CVI) melalui pengiraan nilai I-CVI, S-CVI/Ave dan S-CVI/UA. Dapatan kajian menunjukkan bahawa kesemua 30 item memperoleh nilai I-CVI antara 0.83 hingga 1.00, manakala nilai keseluruhan S-CVI/Ave ialah 0.99 dan S-CVI/UA ialah 0.93. Dapatan ini menunjukkan bahawa buku cerita realiti terimbuh yang dibangunkan mempunyai tahap kesahan kandungan dan kesesuaian yang tinggi dari aspek kandungan, reka bentuk visual, elemen AR, potensi pemahaman konsep, penglibatan murid dan kebolehgunaan dalam pengajaran dan pembelajaran. Kesimpulannya, buku cerita realiti terimbuh ini berpotensi digunakan sebagai bahan pembelajaran tambahan yang menarik, visual, kontekstual dan interaktif bagi membantu pembelajaran topik perimeter dan luas Tahun 4.

This study aims to develop an augmented reality storybook entitled Aira dan Taman Ajaib: Belajar Perimeter dan Luas as supplementary learning material for the topic of perimeter and area in Year 4 Mathematics. The development of this material was carried out to provide a more visual, contextual, and interactive learning experience, particularly in helping pupils differentiate the concept of perimeter as the measurement around a shape and area as the measurement of the space inside a shape. This study employed a developmental research design with a quantitative approach and was guided by the ADDIE model, which consists of five main phases: analysis, design, development, implementation, and evaluation. In the analysis phase, the content of the storybook was determined based on the Year 4 Mathematics

Curriculum and Assessment Standard Document. This storybook integrates storytelling elements, garden-themed illustrations, geometric shapes, grid squares, written exercises, digital quizzes, and augmented reality media accessed through QR codes. The questionnaire instrument was first evaluated by two Mathematics Education lecturers to ensure the appropriateness of the content, language, and item arrangement before being used in the expert evaluation. Subsequently, the developed augmented reality storybook was evaluated by six expert panels consisting of two Mathematics Education lecturers, one Information Technology lecturer, and three primary school Mathematics teachers. The evaluation data were analysed using the Content Validity Index (CVI) method through the calculation of I-CVI, S-CVI/Ave, and S-CVI/UA values. The findings showed that all 30 items obtained I-CVI values ranging from 0.83 to 1.00, while the overall S-CVI/Ave value was 0.99 and the S-CVI/UA value was 0.93. These findings indicate that the developed augmented reality storybook has a high level of content validity and suitability in terms of content, visual design, AR elements, potential for conceptual understanding, pupil engagement, and usability in teaching and learning. In conclusion, this augmented reality storybook has the potential to be used as an engaging, visual, contextual, and interactive supplementary learning material to support the learning of perimeter and area among Year 4 pupils.

HUBUNGAN ANTARA KEMAHIRAN 4C DAN KESEDIAAN GURU PELATIH SAINS DAN MATEMATIK TERHADAP PENGGUNAAN TEKNOLOGI DALAM PDPC

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Kajian ini dijalankan berikutan keperluan pendidikan abad ke-21 yang menuntut guru pelatih menguasai kemahiran 4C, iaitu pemikiran kritis, komunikasi, kolaborasi dan kreativiti, di samping bersedia menggunakan teknologi secara berkesan dalam pembelajaran dan pemudahcaraan (PdPc). Penguasaan kemahiran tersebut penting bagi membolehkan guru pelatih merancang, melaksanakan dan menilai aktiviti PdPc berasaskan teknologi secara lebih bermakna. Kajian ini bertujuan untuk mengenal pasti tahap kemahiran 4C, menentukan tahap kesediaan guru pelatih Sains dan Matematik terhadap penggunaan teknologi dalam PdPc, serta meneliti hubungan antara kedua-dua pemboleh ubah tersebut. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk korelasi. Seramai 70 orang guru pelatih Sains dan Matematik Tahun 4 di Universiti Teknologi Malaysia terlibat sebagai responden kajian. Data dikumpulkan melalui soal selidik yang mengandungi item berkaitan kemahiran 4C dan kesediaan penggunaan teknologi dalam PdPc menggunakan skala Likert empat mata. Data dianalisis secara deskriptif menggunakan kekerapan, peratusan dan median, manakala analisis inferensi dilaksanakan menggunakan ujian korelasi Spearman. Dapatan kajian menunjukkan bahawa tahap kemahiran 4C guru pelatih berada pada tahap sangat tinggi. Tahap kesediaan guru pelatih terhadap penggunaan teknologi dalam PdPc juga berada pada tahap sangat tinggi. Dapatan turut menunjukkan bahawa responden mempunyai keyakinan untuk menggunakan teknologi, menghasilkan bahan digital serta mengintegrasikan teknologi dalam aktiviti pengajaran. Analisis korelasi Spearman menunjukkan terdapat hubungan positif yang sederhana dan signifikan antara kemahiran 4C dengan kesediaan guru pelatih menggunakan teknologi dalam PdPc. Dapatan ini menunjukkan bahawa peningkatan kemahiran 4C berkait dengan peningkatan kesediaan guru pelatih untuk menggunakan teknologi dalam PdPc. Kesimpulannya, penguasaan kemahiran 4C merupakan aspek penting dalam memperkukuh kesiapsiagaan guru pelatih menghadapi keperluan pendidikan digital. Kajian ini memberi

implikasi kepada pihak universiti, pensyarah dan sekolah untuk menyediakan latihan yang mengintegrasikan pembangunan kemahiran 4C dengan penggunaan teknologi dalam PdPc.

This study was conducted in response to the demands of 21st-century education, which require pre-service teachers to possess 4C skills, namely critical thinking, communication, collaboration, and creativity, while being ready to use technology effectively in teaching and learning. These skills are important in enabling pre-service teachers to plan, implement, and evaluate technology-based teaching and learning activities meaningfully. This study aimed to identify the level of 4C skills, determine the readiness of pre-service Science and Mathematics teachers to use technology in teaching and learning, and examine the relationship between these two variables. The study employed a quantitative approach using a correlational research design. A total of 70 fourth-year pre-service Science and Mathematics teachers at Universiti Teknologi Malaysia participated as respondents. Data were collected through questionnaires consisting of items related to 4C skills and readiness to use technology in teaching and learning, using a four-point Likert scale. The data were analysed descriptively using frequency, percentage, and median, while inferential analysis was conducted using Spearman's correlation test. The findings revealed that the level of 4C skills among the pre-service teachers was very high. The level of readiness to use technology in teaching and learning was also found to be very high. The respondents demonstrated confidence in using technology, developing digital teaching materials, and integrating technology into instructional activities. Spearman's correlation analysis showed a moderate, positive, and significant relationship between 4C skills and readiness to use technology in teaching and learning. This finding indicates that higher levels of 4C skills are associated with greater readiness among pre-service teachers to use technology in teaching and learning. In conclusion, the mastery of 4C skills is an important aspect of strengthening pre-service teachers' readiness to meet the demands of digital education. This study has implications for universities, teacher educators, and schools in providing training that integrates the development of 4C skills with technology use in teaching and learning.

PEMBANGUNAN MODUL PENGAJARAN MATEMATIK PENGGUNA TINGKATAN TIGA DALAM MENYOKONG ELEMEN MATLAMAT PEMBANGUNAN MAMPAN 1 (SDG 1) TIADA KEMISKINAN

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Kajian ini berada dalam bidang pendidikan Matematik dan bertujuan membangunkan Modul Pengajaran Matematik Pengguna Tingkatan Tiga Dalam Menyokong Elemen SDG 1 Tiada Kemiskinan serta menilai kebolehgunaan modul tersebut berdasarkan kesepakatan pakar. Kajian ini dilaksanakan bagi menangani keperluan bahan pengajaran yang dapat menghubungkan topik Matematik Pengguna dengan literasi kewangan, pendekatan kontekstual dan isu kehidupan sebenar murid. Kajian ini menggunakan pendekatan kajian reka bentuk dan pembangunan yang melibatkan proses analisis keperluan, reka bentuk, pembangunan dan penilaian kebolehgunaan modul. Seramai 11 orang pakar yang terdiri daripada pensyarah dan guru Matematik terlibat dalam penilaian modul. Data kajian dianalisis menggunakan kaedah Fuzzy Delphi bagi mendapatkan tahap kesepakatan pakar terhadap tiga aspek utama, iaitu penerapan elemen literasi kewangan dan SDG 1, pelaksanaan pendekatan kontekstual serta modul pengajaran berstruktur. Dapatan kajian menunjukkan bahawa kesemua item memenuhi syarat penerimaan berdasarkan nilai threshold (d) ≤ 0.2, peratus kesepakatan pakar $\geq 67\%$ dan nilai defuzzification (A) ≥ 0.50. Kesimpulannya, modul yang dibangunkan mempunyai tahap kebolehgunaan yang baik dan berpotensi membantu guru melaksanakan pengajaran Matematik Pengguna secara lebih sistematik, kontekstual dan bermakna.

This study is in the field of Mathematics education and aims to develop a Form Three Consumer Mathematics Teaching Module Aligned with SDG 1 No Poverty and to evaluate its usability based on expert consensus. The study was conducted to address the need for teaching materials that connect Consumer Mathematics with financial literacy, contextual learning and real-life issues faced by students. This study employed a design and development research approach involving needs analysis, design, development and usability evaluation of the module. A total of 11 experts consisting of lecturers and Mathematics teachers were involved in evaluating the module. The data were analysed using the Fuzzy Delphi method to determine expert consensus on three main aspects, namely the integration of financial literacy and SDG 1 elements, the implementation of a contextual approach and the structured teaching module. The findings showed that all items met the acceptance criteria based on threshold value (d) $\leq$ 0.2, expert consensus percentage $\geq$ 67% and defuzzification value (A) $\geq$ 0.50. In conclusion, the developed module has a good level of usability and has the potential to assist teachers in implementing Consumer Mathematics lessons in a more systematic, contextual and meaningful manner.

INTEGRASI REALITI TERIMBUH DALAM BUKU CERITA MATEMATIK BAGI MENINGKATKAN MINAT DAN PEMAHAMAN KONSEP BENTUK TIGA DIMENSI TAHUN 1

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Kajian ini bertujuan untuk mereka bentuk dan membangunkan sebuah buku cerita Matematik interaktif berasaskan Realiti Terimbuh (AR) bagi topik Bentuk Tiga Dimensi untuk murid Tahun 1, serta menilai potensinya dalam meningkatkan minat dan pemahaman murid terhadap konsep tersebut berdasarkan perspektif pakar. Kajian ini dilaksanakan kerana murid Tahun 1 sering menghadapi kesukaran untuk memvisualisasikan bentuk tiga dimensi seperti kubus, kuboid, kon, piramid, sfera dan silinder apabila pembelajaran hanya bergantung pada ilustrasi dua dimensi serta penerangan secara tradisional. Kajian ini menggunakan pendekatan kuantitatif dan mengaplikasikan Model ADDIE yang merangkumi fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Buku cerita yang dibangunkan mengintegrasikan elemen penceritaan bertemakan pengembaraan, ilustrasi visual, penerangan ringkas, aktiviti pengukuhan dan kod QR yang membolehkan murid meneroka model bentuk tiga dimensi secara interaktif melalui aplikasi Assemblr AR. Penilaian produk dilaksanakan melalui borang soal selidik yang melibatkan enam orang pakar daripada bidang pendidikan Matematik dan teknologi pendidikan. Data dianalisis menggunakan kaedah Content Validity Index (CVI) bagi menilai kesahan kandungan, kesesuaian reka bentuk serta potensi buku cerita AR terhadap minat dan pemahaman murid. Dapatan menunjukkan bahawa semua item memperoleh nilai ItemLevel Content Validity Index (I-CVI) dan Universal Agreement (UA) sebanyak 1.00, manakala nilai keseluruhan Scale-Level Content Validity Index/Average (S-CVI/Ave) juga ialah 1.00. Dapatan ini menunjukkan bahawa buku cerita Matematik berasaskan AR yang dibangunkan mempunyai tahap kesahan kandungan yang sangat tinggi serta sesuai digunakan sebagai bahan bantu mengajar yang inovatif. Kajian ini juga menunjukkan bahawa produk tersebut berpotensi meningkatkan minat dan membantu murid memahami konsep bentuk tiga dimensi dengan lebih jelas, interaktif dan bermakna.

This study aimed to design and develop an interactive Mathematics storybook based on Augmented Reality (AR) for the topic of Three-Dimensional Shapes among Year 1 pupils, as well as to evaluate its potential in enhancing pupils' interest and understanding of the topic from experts' perspectives. This study was conducted because Year 1 pupils often experience difficulties in visualising three-dimensional shapes such as cubes, cuboids, cones, pyramids, spheres and cylinders when learning relies solely on two-dimensional illustrations and conventional explanations. This study employed a quantitative approach and applied the ADDIE Model, which consists of the Analysis, Design, Development, Implementation and Evaluation phases. The developed storybook integrated adventure-based storytelling, visual illustrations, concise explanations, reinforcement activities and QR codes that enabled pupils to explore three-dimensional models interactively through the Assemblr AR application. Product evaluation was conducted using a questionnaire involving six experts from the fields of Mathematics education and educational technology. The data were analysed using the Content Validity Index (CVI) method to assess content validity, design suitability and the potential of the AR storybook to enhance pupils' interest and understanding. The findings revealed that all items obtained an Item-Level Content Validity Index (I-CVI) and Universal Agreement (UA) value of 1.00, while the overall Scale-Level Content Validity Index/Average (S-CVI/Ave) was also 1.00. These findings indicate that the developed AR-based Mathematics storybook has a very high level of content validity and is suitable for use as an innovative teaching aid. The study also suggests that the product has the potential to increase pupils'

interest and assist them in understanding the concept of three-dimensional shapes in a clearer, more interactive and meaningful manner.

PEMBANGUNAN E-MAJALAH MATEMATIK MELALUI WARISAN, SENI BINA DAN BUDAYA NEGERI TERENGGANU

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Kajian ini bertujuan menyokong pengintegrasian elemen budaya tempatan dalam pengajaran Matematik digital yang masih terhad, khususnya melibatkan warisan Terengganu. Objektif utama kajian adalah untuk menganalisis konsep Matematik dalam budaya Terengganu, membangunkan e-Majalah Terengganu Dalam Lensa Matematik, serta menilai kesahan kandungan dan kebolehgunaannya. Kajian menggunakan Model ADDIE yang merangkumi fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Produk dinilai oleh enam panel pakar bidang Matematik dan multimedia. Data dianalisis menggunakan Content Validity Index (CVI) dan analisis kandungan. Hasil kajian berjaya mengesan konsep Matematik pada elemen seperti songket, batik, wau, Rumah Limas Belanda, perikanan dan keropok lekor menerusi bantuan grafik serta aktiviti interaktif. Penilaian pakar menunjukkan Bahagian B (Kandungan) dan C (Budaya) memperoleh S-CVI/Ave 1.00, manakala Bahagian D (Reka Bentuk) mendapat 0.90 dan Bahagian E (Kebolehgunaan) mendapat 0.93. Dapatan ini membuktikan e-Majalah tersebut mempunyai kesahan dan kebolehgunaan yang tinggi untuk dijadikan bahan bantu mengajar digital berasaskan etnomatematik yang lebih kontekstual dan bermakna bagi murid.

This study addresses the scarcity of culturally based digital resources by integrating Terengganu heritage into Mathematics education. It aimed to analyse mathematical concepts in local culture, develop the Terengganu Through the Lens of Mathematics e-Magazine, and evaluate its content validity and usability. The study employed the ADDIE Model, which consists of the analysis, design, development, implementation, and evaluation phases. The product was evaluated by six Mathematics and multimedia experts using the Content Validity Index (CVI) and content analysis. The findings revealed that mathematical concepts were successfully embedded into cultural elements such as songket, batik, wau, Rumah Limas Belanda, fisheries and keropok lekor through graphics and interactive tasks. Expert evaluation yielded an S-CVI/Ave score of 1.00 for Section B (Content) and Section C (Culture), 0.90 for Section D (Design), and 0.93 for Section E (Usability). These results confirm that the developed e-Magazine possesses high validity and usability, offering an effective ethnomathematics-based digital teaching aid that makes Mathematics learning more contextual and meaningful for students.

PEMBANGUNAN MODUL PENGAJARAN BAGI TOPIK PENGENDALIAN DATA TINGKATAN SATU DALAM MENYOKONG ELEMEN MATLAMAT PEMBANGUNAN MAMPAN (SDG) 13 TINDAKAN IKLIM

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Keperluan pendidikan untuk pembangunan mampan (ESD) menuntut guru untuk mengaplikasikan pendekatan pembelajaran yang membentuk murid dengan pengetahuan, kemahiran dan nilai dalam mendepani cabaran global. Sehubungan itu, kajian ini dijalankan bertujuan untuk membangunkan Modul Pengajaran Topik Pengendalian Data Tingkatan Satu dalam Menyokong Elemen Matlamat Pembangunan Mampan (SDG) 13 Tindakan Iklim yang dapat dijadikan panduan oleh guru dalam perancangan Rancangan Pengajaran Harian (RPH) yang tersusun. Kajian ini merupakan kajian menggunakan Model Reka Bentuk dan Pembangunan (Design and Development Research - DDR) yang merangkumi tiga fasa utama iaitu fasa analisis keperluan, reka bentuk dan pembangunan serta penilaian. Fasa penilaian telah menggunakan kaedah Fuzzy Delphi yang terdiri daripada 11 orang pakar melibatkan pensyarah pendidikan matematik, pakar SDG serta guru matematik sekolah menengah. Modul ini dinilai berdasarkan kepada instrumen soal selidik sebanyak 23 item yang telah diadaptasi daripada kajian-kajian lepas mengikut kesesuaian modul pengajaran dengan menggunakan skala Likert 7 mata. Seterusnya, dapatan data dianalisis berpandukan kepada nilai ambang (threshold), peratus kesepakatan dan skor Fuzzy. Dapatan data menunjukkan tahap kesepakatan pakar yang tinggi terhadap aspek pengintegrasian SDG 13: Tindakan Iklim dalam topik pengendalian data, pelaksanaan pengajaran berlandaskan kehidupan realiti serta struktur modul yang sistematik. Secara keseluruhan, Modul Pengajaran Topik Pengendalian Data Tingkatan Satu dalam Menyokong Elemen Matlamat Pembangunan Mampan (SDG) 13 Tindakan Iklim ini berpotensi dalam menjadi rujukan kepada guru dalam menyampaikan pengajaran yang menerapkan elemen kelestarian dalam pendidikan.

The need for education for sustainable development (ESD) requires teachers to apply a learning approach that shapes students with knowledge, skills and values in facing global challenges. Accordingly, this study was conducted to develop a Teaching Module for the Topic of Data Handling for Form One in Supporting Sustainable Development Goals (SDG) Element 13 Climate Action that can be used as a guide by teachers in planning a structured Daily Lesson Plan (RPH). This study employed a Design and Development Research (DDR) Model which includes three main phases, namely the needs analysis phase, design and development and evaluation. The evaluation phase used the Fuzzy Delphi method consisting of 11 experts involving mathematics education lecturers, SDG experts and secondary school mathematics teachers. This module was evaluated based on a questionnaire instrument of 23 items that had been adapted from previous studies according to the suitability of the teaching module using a 7-point Likert scale. Next, the data findings were analyzed based on threshold values, percentage of agreement and Fuzzy scores. The data findings show a high level of expert agreement in the term of integrating SDG 13: Climate Action into the topic of data handling, the implementation of teaching based on real life, and the systematic structure of the module. Overall, the Teaching Module on the Topic of Data Handling for Form One Supporting Sustainable Development Goals (SDG) Element 13 Climate Action has the potential to be a reference for teachers in delivering lessons that incorporate sustainability elements in education.

PEMBANGUNAN E-MAJALAH MATEMATIK MELALUI WARISAN, SENI BINA DAN BUDAYA DI PULAU PINANG

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Kajian ini bertujuan untuk membangunkan sebuah e-majalah Matematik yang mengintegrasikan elemen warisan, seni bina dan budaya di Pulau Pinang. Kajian ini dilaksanakan bagi menyediakan bahan pembelajaran digital yang lebih kontekstual untuk membantu menangani persepsi murid terhadap Matematik sebagai subjek yang sukar, abstrak dan kurang berkaitan dengan kehidupan seharian. Pembangunan e-majalah ini berpandukan Model ADDIE yang melibatkan fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Kerangka konsep kajian pula berasaskan Teori Konstruktivisme Sosial yang menekankan pembinaan pengetahuan melalui interaksi, pengalaman dan konteks budaya. Kandungan e-majalah menghubungkaitkan konsep Matematik seperti nisbah, kadar dan perkadaran, pengendalian data, poligon, transformasi isometri, pelan dan dongakan serta nisbah trigonometri dengan elemen tempatan Pulau Pinang seperti Jambatan Pulau Pinang, bangunan warisan, Masjid Kapitan Keling, jubin Peranakan, rumah kedai di George Town dan lokasi pelancongan. Penilaian e-majalah melibatkan enam orang pakar yang terdiri daripada pakar kandungan dan pedagogi Matematik atau etnomatematik, pakar teknologi pendidikan dan reka bentuk, serta guru Matematik sekolah menengah. Data dianalisis menggunakan Indeks Kesahan Kandungan atau Content Validity Index (CVI) dan analisis maklum balas kualitatif pakar. Dapatan menunjukkan bahawa e-majalah mempunyai tahap kesahan kandungan yang tinggi, dengan nilai S-CVI/Ave sebanyak 0.98 bagi aspek penjajaran kurikulum dan ketepatan konsep Matematik, 1.00 bagi keaslian budaya dan relevansi etnomatematik, 0.94 bagi kesesuaian pedagogi, serta 0.93 bagi reka bentuk, kebolehgunaan dan prestasi teknikal. Secara keseluruhan, nilai purata S-CVI/Ave ialah 0.96, yang menunjukkan bahawa e-majalah yang dibangunkan mempunyai kesahan kandungan yang sangat baik. Maklum balas pakar turut menunjukkan bahawa e-majalah ini berpotensi menjadi bahan bantu mengajar digital yang menarik, interaktif dan relevan untuk menyokong pembelajaran Matematik berasaskan konteks budaya tempatan dalam kalangan murid menengah rendah.

This study aimed to develop a Mathematics e-magazine that integrates heritage, architectural, and cultural elements of Penang. The study was conducted to provide a more contextual digital learning resource that could help address students' perceptions of Mathematics as a difficult, abstract subject that is not closely related to daily life. The development of the e-magazine was guided by the ADDIE Model, which consists of the analysis, design, development, implementation, and evaluation phases. The conceptual framework of the study was based on Social Constructivism Theory, which emphasises the construction of knowledge through interaction, experience, and cultural context. The e-magazine content connects Mathematics topics such as ratios, rates and proportions, data handling, polygons, isometric transformations, plans and elevations, and trigonometric ratios with local Penang elements, including the Penang Bridge, heritage buildings, Kapitan Keling Mosque, Peranakan tiles, shophouses in George Town, and tourist attractions. The e-magazine was evaluated by six experts consisting of Mathematics and ethnomathematics content and pedagogy experts, educational technology and design experts, as well as secondary school Mathematics teachers. Data were analysed using the Content Validity Index (CVI) and qualitative feedback from the experts. The findings indicated that the e- magazine demonstrated a high level of content validity, with S-CVI/Ave values of 0.98 for curriculum alignment and accuracy of Mathematics concepts, 1.00 for cultural authenticity and

ethnomathematical relevance, 0.94 for pedagogical suitability, and 0.93 for design, usability, and technical performance. Overall, the average S-CVI/Ave value was 0.96, indicating that the developed e-magazine has excellent content validity. Expert feedback also suggested that the e-magazine has the potential to serve as an engaging, interactive, and relevant digital teaching and learning resource to support Mathematics learning through local cultural contexts among lower secondary school students.

HUBUNGAN ANTARA KEKELIRUAN KONSEP DAN PROSEDUR PENGIRAAN, FAKTOR INTRAPERSONAL MURID, DAN FAKTOR PENGAJARAN DENGAN KERESAHAN MATEMATIK DALAM MATEMATIK PENGGUNA DALAM KALANGAN MURID TINGKATAN TIGA

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Kajian ini dijalankan untuk mengenal pasti tahap keresahan matematik serta hubungannya dengan kekeliruan konsep dan prosedur pengiraan, faktor intrapersonal murid serta faktor pengajaran dalam topik Matematik Pengguna, khususnya Simpanan dan Pelaburan, Kredit dan Hutang. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kajian korelasi. Sampel kajian terdiri daripada 100 orang murid Tingkatan Tiga daripada sebuah sekolah menengah di daerah Pontian. Data dikumpulkan secara bersemuka menggunakan borang soal selidik berstruktur dan dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS). Analisis deskriptif melibatkan median, kekerapan dan peratusan, manakala analisis inferensi menggunakan ujian Korelasi Spearman rho. Dapatan kajian menunjukkan bahawa tahap keresahan matematik dan kekeliruan konsep serta prosedur pengiraan berada pada tahap sederhana, manakala faktor intrapersonal murid berada pada tahap tinggi. Analisis korelasi menunjukkan terdapat hubungan positif yang kuat dan signifikan antara kekeliruan konsep dan prosedur pengiraan dengan keresahan matematik (r_s = 0.734, $p < 0.001$). Faktor pengajaran pula menunjukkan hubungan positif yang lemah tetapi signifikan dengan keresahan matematik (r_s = 0.409, $p < 0.001$). Sebaliknya, faktor intrapersonal murid tidak menunjukkan hubungan yang signifikan dengan keresahan matematik (r_s = -0.115, p = 0.256). Kesimpulannya, kekeliruan konsep dan prosedur pengiraan merupakan faktor yang paling berkait dengan keresahan matematik murid dalam topik Matematik Pengguna. Kajian ini memberi implikasi kepada guru dan pihak sekolah dalam merancang pendekatan pengajaran yang lebih jelas, berstruktur dan kontekstual.

This study was conducted to identify the level of mathematics anxiety and its relationship with conceptual and procedural confusion, students' intrapersonal factors and teaching factors in Consumer Mathematics, specifically Savings and Investments as well as Credit and Debt. This study employed a quantitative approach with a correlational research design. The sample consisted of 100 Form Three students from one secondary school in the Pontian district. Data were collected face-to-face using a structured questionnaire and analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive analysis involved median, frequency and percentage, while inferential analysis was conducted using Spearman's rho correlation test. The findings showed that the level of mathematics anxiety and conceptual and procedural confusion were at a moderate level, while students' intrapersonal factors were at a high level. The correlation analysis indicated a strong, positive and significant relationship between conceptual and procedural confusion and mathematics anxiety (r_s = 0.734, $p < 0.001$). Teaching factors showed a weak but significant positive relationship with mathematics anxiety (r_s = 0.409, $p < 0.001$). However, students' intrapersonal factors did not show a significant relationship with mathematics anxiety (r_s = -0.115, p = 0.256). In conclusion, conceptual and procedural confusion was the factor most strongly related to students' mathematics anxiety in Consumer Mathematics. This study provides implications for teachers and schools in planning clearer, more structured and contextual teaching approaches.

PEMBANGUNAN MODUL PENGAJARAN MATEMATIK BERASASKAN AKTIVITI DAN GEOGEBRA BAGI MENINGKATKAN VISUALISASI SERTA PENGUASAAN KONSEP TOPIK TRANSFORMASI ISOMETRI DALAM KALANGAN MURID TINGKATAN DUA

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Topik Transformasi Isometri merupakan antara topik dalam pelajaran Matematik yang memerlukan kemahiran visualisasi ruang dan kefahaman konsep yang baik bagi membolehkan murid menguasai konsep transformasi geometri dengan berkesan. Sehubungan itu, penggunaan pendekatan pengajaran yang menggabungkan aktiviti pembelajaran dan aplikasi teknologi dilihat berpotensi meningkatkan penglibatan murid serta membantu mereka memahami konsep yang bersifat abstrak. Namun demikian, setiap murid masih menghadapi kesukaran untuk memvisualisasikan dan memahami konsep Transformasi Isometri akibat amalan pedagogi konvensional yang terlalu berpusatkan guru, serta kekurangan bahan bantu mengajar yang interaktif. Oleh itu, kajian ini bertujuan membangunkan dan menilai kebolehgunaan Modul Pengajaran Matematik berasaskan aktiviti dan aplikasi teknologi bagi topik Transformasi Isometri Tingkatan Dua. Kajian ini menggunakan pendekatan Reka Bentuk dan Pembangunan (Design and Development Research – DDR) yang melibatkan tiga fasa, iaitu analisis keperluan, reka bentuk pembangunan, serta penilaian. Modul ini dibangunkan berasaskan Prinsip-Prinsip Pengajaran Utama dengan mengintegrasikan aktiviti fizikal dan penerokaan simulasi dinamik menggunakan perisian GeoGebra. Penilaian kebolehgunaan modul diukur menggunakan pendekatan kuantitatif melalui kaedah Fuzzy Delphi (FDM) yang melibatkan 11 orang pakar, terdiri daripada pensyarah dan guru sekolah. Data dikumpul menggunakan soal selidik berskala Likert 7 mata yang menilai tiga aspek utama, iaitu modul pengajaran berstruktur, pembelajaran berasaskan aktiviti dan pengintegrasian teknologi. Data dianalisis berdasarkan nilai jarak ambang d, peratus kesepakatan pakar dan skor Fuzzy (A). Dapatan kajian menunjukkan bahawa semua pakar mencapai kesepakatan terhadap kebolehgunaan modul, dengan nilai jarak ambang memenuhi syarat yang ditetapkan ($d \leq 0.2$), peratus kesepakatan pakar yang mencapai 100%, serta nilai skor Fuzzy ($A \geq .50$). Dapatan ini menunjukkan bahawa modul yang dibangunkan memperoleh tahap persetujuan yang sangat tinggi daripada pakar bagi ketiga-tiga aspek yang dinilai. Kesimpulannya, modul pengajaran yang dibangunkan mempunyai tahap kebolehgunaan yang tinggi dan sesuai dijadikan panduan pembelajaran yang sistematik bagi membantu guru melaksanakan pengajaran Transformasi Isometri secara lebih interaktif. Modul ini juga berpotensi meningkatkan penglibatan murid serta menyokong perkembangan kemahiran visualisasi ruang dan kefahaman konsep Transformasi Isometri.

The topic of Isometric Transformation is one of the topics in Mathematics that requires good spatial visualisation skills and conceptual understanding to enable students to master the concepts of geometric transformation effectively. Therefore, the use of a teaching approach that integrates learning activities and technology applications is considered to have the potential to enhance students' engagement and help them understand abstract concepts. Nevertheless, students still encounter difficulties in visualising and understanding the concepts of Isometric Transformation due to conventional teacher-centred pedagogical practices and the lack of interactive teaching and learning materials. Therefore, this study aimed to develop and evaluate the usability of a Mathematics Teaching Module based on activity-based learning and technology applications for the Form Two Isometric Transformation topic. This study employed the Design and Development Research (DDR) approach, which consisted of three phases, namely needs analysis, design and development,

and evaluation. The module was developed based on the First Principles of Instruction by integrating physical activities and dynamic simulation exploration using the GeoGebra software. The usability of the module was evaluated using a quantitative approach through the Fuzzy Delphi Method (FDM), involving 11 experts comprising lecturers and school teachers. Data were collected using a seven-point Likert scale questionnaire that evaluated three main aspects, namely the structured teaching module, activity-based learning, and technology integration. The data were analysed based on the threshold value (d), the percentage of expert consensus, and the Fuzzy score (A). The findings showed that all experts reached a consensus regarding the usability of the module, with the threshold value meeting the required criterion ($d \leq 0.2$), the percentage of expert consensus reaching 100%, and the Fuzzy score satisfying the required value ($A \geq .50$). These findings indicate that the developed module received a very high level of agreement from the experts across all three aspects evaluated. In conclusion, the developed teaching module demonstrated a high level of usability and is suitable to be used as a systematic teaching guide to assist teachers in implementing more interactive instruction on the topic of Isometric Transformation. The module also has the potential to enhance students' engagement while supporting the development of spatial visualisation skills and conceptual understanding of Isometric Transformation.

PEMBANGUNAN BUKU CERITA REALITI TERIMBUH (AR) BAGI TOPIK TAMBAH TOLAK TAHUN 1

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Kajian ini bertujuan untuk membangunkan buku cerita Matematik berasaskan Augmented Reality (AR) bertajuk "Tambah Tolak di Zoo" bagi topik tambah dan tolak Tahun 1 serta menilai kesesuaiannya dalam membantu kefahaman dan menyokong motivasi murid berdasarkan pandangan pakar. Kajian ini menggunakan pendekatan kuantitatif deskriptif dengan Model ADDIE sebagai panduan pembangunan yang melibatkan fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Buku cerita AR dibangunkan dengan menggabungkan elemen naratif bertemakan zoo, ilustrasi berwarna, nota ringkas, latihan pengukuhan, kuiz digital dan elemen AR melalui aplikasi Assemblr Edu. Seramai tujuh orang pakar yang terdiri daripada guru Matematik sekolah rendah, pensyarah Matematik dan pensyarah teknologi pendidikan telah dipilih secara persampelan bertujuan untuk menilai bahan yang dibangunkan. Data dianalisis menggunakan kaedah Content Validity Index (CVI) bagi menentukan tahap kesahan kandungan dan kesesuaian buku cerita AR. Dapatan menunjukkan bahawa kandungan buku cerita memperoleh nilai S-CVI/Ave sebanyak 0.98, manakala reka bentuk visual dan elemen AR memperoleh nilai S-CVI/Ave sebanyak 0.95. Selain itu, konstruk kefahaman dan motivasi murid masing-masing memperoleh nilai S-CVI/Ave sebanyak 1.00. Dapatan ini menunjukkan bahawa buku cerita AR "Tambah Tolak di Zoo" mempunyai tahap kesahan kandungan yang tinggi serta sesuai dan berpotensi membantu murid memahami konsep tambah dan tolak secara lebih visual, interaktif dan kontekstual. Buku cerita ini juga berpotensi menyokong minat, fokus dan penglibatan aktif murid dalam pembelajaran Matematik. Namun demikian, dapatan kajian ini adalah berdasarkan pandangan pakar dan tidak mengukur kesan penggunaan bahan secara langsung terhadap murid. Secara keseluruhannya, buku cerita AR yang dibangunkan boleh dijadikan sebagai bahan bantu mengajar alternatif bagi topik tambah dan tolak Tahun 1.

This study aimed to develop an Augmented Reality (AR)-based Mathematics storybook entitled "Tambah Tolak di Zoo" for the topic of addition and subtraction in Year 1, as well as to evaluate its suitability in supporting pupils' understanding and motivation based on expert views. This study employed a descriptive quantitative approach and applied the ADDIE Model as the development framework, comprising the analysis, design, development, implementation, and evaluation phases. The AR storybook was developed by integrating a zoo-themed narrative, colourful illustrations, concise notes, reinforcement exercises, digital quizzes, and AR elements through the Assemblr Edu application. A total of seven experts, consisting of primary school Mathematics teachers, Mathematics lecturers, and an educational technology lecturer, were selected through purposive sampling to evaluate the developed material. The data were analysed using the Content Validity Index (CVI) to determine the content validity and suitability of the AR storybook. The findings showed that the storybook content obtained an S-CVI/Ave value of 0.98, while the visual design and AR elements obtained an S-CVI/Ave value of 0.95. In addition, the constructs of pupils' understanding and motivation each obtained an S-CVI/Ave value of 1.00. These findings indicate that the "Tambah Tolak di Zoo" AR storybook has a high level of content validity and is suitable and potentially beneficial in helping Year 1 pupils understand addition and subtraction concepts in a more visual, interactive, and contextual manner. The storybook also has the potential to support pupils' interest, focus, and active engagement in Mathematics learning. However, the findings are based on expert evaluations and do not directly measure the effects of the material on pupils. Overall, the developed AR storybook can be used as an alternative teaching aid for the topic of addition and subtraction in Year 1.

HUBUNGAN ANTARA KEMAHIRAN PENYELESAIAN MASALAH DENGAN

PENCAPAIAN BAGI TOPIK TRIGONOMETRI DALAM KALANGAN MURID TINGKATAN 3

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Kemahiran penyelesaian masalah merupakan aspek penting dalam pembelajaran Matematik kerana membolehkan murid berfikir secara kritis dan kreatif dalam menyelesaikan sesuatu masalah. Penguasaan kemahiran ini berpotensi meningkatkan pencapaian akademik murid, khususnya dalam topik yang memerlukan penaakulan matematik seperti trigonometri. Sehubungan itu, kajian ini bertujuan menganalisis hubungan antara kemahiran penyelesaian masalah berdasarkan Model Polya dengan pencapaian murid dalam topik trigonometri. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk korelasi. Sampel kajian terdiri daripada 30 orang murid Tingkatan 3 di sebuah sekolah menengah di daerah Johor Bahru. Instrumen kajian ialah satu set soalan penyelesaian masalah yang dibangunkan berdasarkan Model Polya bagi mengukur tahap penguasaan kemahiran penyelesaian masalah murid. Data yang dikumpulkan dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui analisis deskriptif yang melibatkan min, median, frekuensi dan peratusan serta analisis inferensi menggunakan Ujian Korelasi Spearman bagi menentukan tahap penguasaan kemahiran penyelesaian masalah, tahap pencapaian murid dan hubungan antara kedua-dua pemboleh ubah tersebut. Dapatan kajian menunjukkan bahawa penguasaan kemahiran penyelesaian masalah berdasarkan Model Polya berada pada tahap rendah bagi kemhairan merancang strategi, melaksakan strategi dan menyemak semula. Dari segi pencapaian, kebanyakan murid belum mencapai tahap minimum (0 sehingga 19%) bagi topik trigonometri. Analisis Korelasi Spearman menunjukkan bahawa terdapat hubungan yang signifikan antara kemahiran penyelesaian masalah dengan pencapaian murid dalam topik trigonometri (rmemahami = .735, p = .001; rmerancang strategi = .586, p = .001; rmelaksanakan strategi = .555, p = .001; rrmenyemak semula = .525, p = .003). Kesimpulannya, penguasaan kemahiran penyelesaian masalah merupakan salah satu faktor yang berkait dengan pencapaian murid dalam topik trigonometri. Implikasi kajian ini menunjukkan bahawa guru, pihak sekolah dan ibu bapa perlu bekerjasama merancang strategi pengajaran, pembelajaran dan intervensi yang lebih berkesan bagi meningkatkan kemahiran penyelesaian masalah serta seterusnya membantu meningkatkan pencapaian murid dalam Matematik.

Problem-solving skills are an important aspect of Mathematics learning as they enable students to think critically and creatively in solving problems. Mastery of these skills has the potential to improve students' academic achievement, particularly in topics that require mathematical reasoning, such as trigonometry. Therefore, this study was conducted to analyse the relationship between students' problem-solving skills based on Polya's Model and their achievement in the topic of trigonometry. This study employed a quantitative approach with a correlational research design. The sample consisted of 30 Form Three students from a secondary school in the Johor Bahru district. The research instrument was a set of problem-solving questions developed based on Polya's Model to measure students' level of mastery of problem-solving skills. The data collected were analysed using the Statistical Package for the Social Sciences (SPSS) software through descriptive analysis involving the mean, median, frequency, and percentage, as well as inferential analysis using Spearman's rho correlation test to determine the level of mastery of problem-solving skills, students' level of achievement, and the relationship between the two variables. The findings showed that students' mastery of problem-solving skills based on Polya's Model was at a low level in the skills of planning

strategies, implementing strategies, and reviewing. In terms of achievement, the majority of students had not achieved the minimum level (0% to 19%) in the topic of trigonometry. Spearman's rho correlation analysis showed that there was a significant relationship between problem-solving skills and students' achievement in the topic of trigonometry (r_understanding = .735, p = .001; r_(planning strategy)= .586, p = .001; r_(implementing strategy) = .555, p = .001; r_(looking back) = .525, p = .003). In conclusion, mastery of problem-solving skills is one of the factors associated with students' achievement in the topic of trigonometry. The findings of this study imply that teachers, school administrators, and parents should work together to plan more effective teaching, learning, and intervention strategies to enhance students' problem-solving skills and subsequently improve their achievement in Mathematics.

PEMBANGUNAN E-MAJALAH MATEMATIK MELALUI WARISAN, SENI BINA DAN BUDAYA NEGERI KEDAH

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Kajian ini bertujuan membangunkan e-Majalah Jejak Matematik Kedah yang mengintegrasikan elemen warisan, seni bina dan budaya Negeri Kedah dalam pembelajaran Matematik. Kajian ini dijalankan kerana pembelajaran Matematik sering dianggap abstrak dan kurang dikaitkan dengan kehidupan sebenar murid, manakala bahan pembelajaran digital berasaskan budaya tempatan masih terhad. Kajian ini menggunakan model ADDIE yang melibatkan fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. E-Majalah dibangunkan menggunakan Canva dan AnyFlip serta mengandungi elemen multimedia seperti grafik, video, kod QR dan kuiz interaktif. Dapatan kajian menunjukkan bahawa pelbagai konsep Matematik seperti luas kawasan, bentuk geometri, poligon, simetri, kadar dan nisbah, graf, statistik serta koordinat berjaya diintegrasikan melalui konteks sawah padi, Rumah Tradisional Kedah, Masjid Zahir, Terusan Wan Mat Saman, Langkawi dan Lembah Bujang. Penilaian panel pakar turut menunjukkan bahawa e-Majalah yang dibangunkan mempunyai tahap kesahan kandungan yang tinggi dengan nilai S-CVI sebanyak 0.96 bagi kandungan Matematik, 1.00 bagi integrasi warisan dan budaya Negeri Kedah, 0.96 bagi reka bentuk dan elemen multimedia serta 0.92 bagi aspek kebolehgunaan. Dapatan ini membuktikan bahawa e-Majalah yang dibangunkan sesuai digunakan sebagai bahan pembelajaran Matematik. Kajian ini memberi implikasi bahawa e-Majalah berasaskan budaya tempatan berpotensi menjadi bahan bantu mengajar yang menarik, kontekstual dan relevan dalam meningkatkan pengalaman pembelajaran Matematik murid.

This study aimed to develop the Jejak Matematik Kedah e-Magazine by integrating the heritage, architecture, and culture of Kedah into Mathematics learning. The study was conducted due to the abstract nature of Mathematics learning and the limited availability of digital learning materials that incorporate local cultural contexts. The study employed the ADDIE model, which consists of the Analysis, Design, Development, Implementation, and Evaluation phases. The e-Magazine was developed using Canva and AnyFlip and incorporated multimedia elements such as graphics, videos, QR codes, and interactive quizzes. The findings revealed that various Mathematics concepts, including area, geometric shapes, polygons, symmetry, ratio, rates, graphs, statistics, and coordinates, were successfully integrated with the contexts of paddy fields, Kedah Traditional House, Zahir Mosque, Wan Mat Saman Canal, Langkawi, and Bujang Valley. Expert evaluation showed that the e-Magazine obtained high content validity, with S-CVI values of 0.96 for Mathematics content, 1.00 for the integration of Kedah heritage and culture, 0.96 for design and multimedia elements, and 0.92 for usability. These findings indicate that the developed e-Magazine is suitable for use as a Mathematics learning material. This study implies that a culture-based Mathematics e-Magazine has the potential to serve as an engaging, contextual, and relevant teaching aid that enhances students' Mathematics learning experiences.

HUBUNGAN ANTARA STRATEGI PENGAJARAN DAN AMALAN PEMIKIRAN REFLEKTIF DALAM KALANGAN GURU PELATIH SAINS DAN MATEMATIK DI UNIVERSITI TEKNOLOGI MALAYSIA

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Strategi pengajaran yang berkesan merupakan elemen penting dalam meningkatkan kualiti proses pengajaran dan pembelajaran, manakala amalan pemikiran reflektif membantu guru menilai serta menambah baik amalan pengajaran secara berterusan. Walau bagaimanapun, kajian yang meneliti hubungan antara strategi pengajaran dengan amalan pemikiran reflektif dalam kalangan guru pelatih, khususnya dalam bidang Sains dan Matematik, masih terhad. Sehubungan itu, kajian ini bertujuan mengenal pasti strategi pengajaran yang diamalkan oleh guru pelatih Sains dan Matematik di Universiti Teknologi Malaysia (UTM), mengenal pasti tahap amalan pemikiran reflektif mereka, serta meneliti hubungan antara kedua-dua konstruk tersebut. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Seramai 113 orang guru pelatih Sains dan Matematik yang telah menjalani latihan mengajar dipilih sebagai responden kajian. Instrumen kajian terdiri daripada soal selidik yang merangkumi tiga bahagian, iaitu maklumat demografi, strategi pengajaran dan amalan pemikiran reflektif. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 31.0. Analisis deskriptif melibatkan median, kekerapan dan peratusan, manakala analisis inferensi menggunakan Ujian Korelasi Spearman bagi menentukan hubungan antara strategi pengajaran dengan amalan pemikiran reflektif. Dapatan kajian menunjukkan bahawa terdapat hubungan positif yang signifikan dan sederhana kuat antara strategi pengajaran dengan amalan pemikiran reflektif dalam kalangan guru pelatih Sains dan Matematik di UTM ($r = .493$, $p < .001$). Dapatan ini menunjukkan bahawa semakin tinggi tahap kekerapan pelaksanaan strategi pengajaran, semakin tinggi tahap amalan pemikiran reflektif guru pelatih. Kesimpulannya, strategi pengajaran merupakan salah satu faktor yang berkait dengan amalan pemikiran reflektif guru pelatih. Implikasi kajian ini mencadangkan agar institusi pendidikan guru, pensyarah dan guru pembimbing terus memperkukuh latihan profesional yang memberi penekanan kepada penguasaan strategi pengajaran dan amalan pemikiran reflektif bagi melahirkan guru yang lebih kompeten serta mengamalkan pembelajaran sepanjang hayat.

Effective teaching strategies are an important element in enhancing the quality of the teaching and learning process, while reflective thinking practices help teachers evaluate and continuously improve their teaching practices. However, studies examining the relationship between teaching strategies and reflective thinking practices among pre-service teachers, particularly in the field of Science and Mathematics, remain limited. Therefore, this study aimed to identify the teaching strategies practised by Science and Mathematics pre-service teachers at Universiti Teknologi Malaysia (UTM), identify their level of reflective thinking practices, and examine the relationship between these two constructs. This study employed a quantitative approach using a survey research design. A total of 113 Science and Mathematics pre-service teachers who had completed their teaching practicum were selected as the respondents. The research instrument consisted of a questionnaire comprising three sections, namely demographic information, teaching strategies, and reflective thinking practices. The data were analysed using the Statistical Package for the Social Sciences (SPSS) version 31.0. Descriptive analysis involved the median, frequency, and percentage, while inferential analysis was conducted using Spearman's rho correlation test to determine the relationship between teaching strategies and reflective thinking practices. The findings showed that there

was a significant and moderately strong positive relationship between teaching strategies and reflective thinking practices among Science and Mathematics pre-service teachers at UTM ($r = .493$, $p < .001$). These findings indicate that the higher the frequency of teaching strategies implementation, the higher the level of reflective thinking practices among pre-service teachers. In conclusion, teaching strategies are one of the factors associated with pre-service teachers' reflective thinking practices. The findings of this study suggest that teacher education institutions, lecturers, and mentor teachers should continue to strengthen professional training that emphasises the mastery of teaching strategies and reflective thinking practices in order to produce more competent teachers who embrace lifelong learning.

APLIKASI PEMBELAJARAN BERASASKAN PERMAINAN "ALGEMASTER: ALGEBRA MADE EASY" BAGI TOPIK UNGKAPAN ALGEBRA TINGKATAN SATU

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Penggunaan teknologi digital dalam pendidikan Matematik semakin diberi perhatian, khususnya melalui aplikasi pembelajaran berasaskan permainan yang berpotensi menjadikan pembelajaran lebih interaktif dan bermakna. Namun, murid Tingkatan Satu sering menghadapi kesukaran dalam memahami topik Ungkapan Algebra yang bersifat abstrak serta kurangnya bahan pembelajaran kendiri yang menarik dan bermotivasi. Sehubungan itu, kajian ini dijalankan bertujuan untuk membangunkan aplikasi pembelajaran berasaskan permainan "AlgeMaster: Algebra Made Easy" bagi menyokong pembelajaran topik Ungkapan Algebra Tingkatan Satu secara lebih berkesan. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk Penyelidikan dan Pembangunan (Design and Development Research) berasaskan model Richey dan Klein (2007) serta kaedah Fuzzy Delphi yang melibatkan seramai 11 orang pakar terdiri daripada guru Matematik sekolah menengah dan pensyarah Pendidikan Matematik yang dipilih melalui persampelan bertujuan. Instrumen kajian yang digunakan ialah soal selidik yang merangkumi tiga aspek utama iaitu kefahaman konsep algebra, latihan kendiri interaktif dan motivasi murid, manakala kesahan muka dan kandungan telah dilaksanakan serta kajian rintis menunjukkan nilai kebolehpercayaan Alpha Cronbach yang tinggi. Dapatan kajian menunjukkan tahap kesepakatan pakar yang tinggi terhadap kebolehgunaan aplikasi "AlgeMaster: Algebra Made Easy" dalam membantu murid memahami konsep algebra, melaksanakan latihan kendiri secara interaktif serta meningkatkan motivasi murid dalam topik Ungkapan Algebra. Secara keseluruhan, kajian ini menunjukkan bahawa aplikasi pembelajaran berasaskan permainan "AlgeMaster: Algebra Made Easy" berpotensi menjadi alat sokongan pembelajaran yang berkesan dalam pengajaran dan pembelajaran Matematik Tingkatan Satu.

The integration of digital technology in Mathematics education has received increasing attention, particularly through game-based learning applications that support interactive and meaningful learning. However, Form One students often face difficulties in understanding Algebraic Expressions due to their abstract nature, limited access to engaging self-learning materials, and low learning motivation. Therefore, this study aims to develop a game-based learning application, "AlgeMaster: Algebra Made Easy", to support the learning of Algebraic Expressions at the Form One level more effectively. This study employed a quantitative approach using a Design and Development Research methodology based on the Richey and Klein (2007) model and the Fuzzy Delphi method, involving 11 experts comprising secondary school Mathematics teachers and Mathematics education lecturers selected through purposive sampling. The research instrument was a questionnaire covering three main aspects: understanding of algebraic concepts, interactive self-learning practice, and student motivation, with face and content validity conducted and a pilot study indicating a high Cronbach's Alpha reliability value. The findings revealed a high level of expert consensus on the usability of the "AlgeMaster: Algebra Made Easy" application in supporting students' understanding of algebraic concepts, providing interactive self-learning practice, and enhancing student motivation in learning Algebraic Expressions. Overall, this study demonstrates that the game-based learning application has strong potential as an effective learning support tool in Form One Mathematics instruction.

PEMBANGUNAN E-MAJALAH MATEMATIK BERASASKAN WARISAN BUDAYA JOHOR (JOHO-MATHS) UNTUK PEMBELAJARAN MATEMATIK SEKOLAH MENENGAH

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Pengintegrasian warisan budaya tempatan dalam pembelajaran matematik penting bagi mewujudkan pengalaman pembelajaran yang lebih bermakna, kontekstual dan menarik kepada murid. Dalam konteks pendidikan matematik sekolah menengah, bahan pembelajaran digital yang menghubungkan konsep matematik dengan elemen budaya setempat berpotensi meningkatkan pemahaman murid di samping memupuk penghargaan terhadap warisan budaya. Namun demikian, kajian yang memfokuskan pembangunan dan penilaian kesahan e-majalah matematik berasaskan warisan budaya Johor masih terhad. Oleh itu, kajian ini bertujuan untuk (i) menganalisis konsep matematik yang terdapat dalam warisan budaya Johor, (ii) membangunkan JOHO-MATHS, iaitu e-majalah matematik berasaskan warisan budaya Johor untuk pembelajaran matematik sekolah menengah, dan (iii) menilai kesahan kandungan JOHO-MATHS. Kajian ini menggunakan reka bentuk kajian pembangunan berasaskan model ADDIE yang melibatkan lima fasa, iaitu analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. JOHO-MATHS dinilai oleh lima orang pakar yang terdiri daripada dua orang pensyarah pendidikan matematik, dua orang guru matematik sekolah menengah dan seorang pereka bentuk teknologi pendidikan. Data dianalisis menggunakan Indeks Kesahan Kandungan (CVI). Dapatan kajian menunjukkan bahawa semua item bagi aspek kandungan matematik, integrasi warisan budaya Johor, serta reka bentuk dan multimedia memperoleh nilai I-CVI = 1.00 dengan nilai keseluruhan S-CVI/Ave = 1.00, yang menunjukkan tahap kesahan kandungan yang sangat tinggi.
Dapatan ini membuktikan bahawa JOHO-MATHS sesuai digunakan sebagai bahan pembelajaran matematik digital yang mengintegrasikan warisan budaya Johor bagi menyokong pembelajaran matematik yang lebih bermakna dalam kalangan murid sekolah menengah.

The integration of local cultural heritage into mathematics learning is important in creating a more meaningful, contextual and engaging learning experience for students. In the context of secondary mathematics education, digital learning materials that connect mathematical concepts with local cultural elements have the potential to enhance students' understanding while fostering appreciation of cultural heritage. However, studies focusing on the development and validation of mathematics e-magazines based on Johor cultural heritage remain limited. Therefore, this study aimed to (i) analyse the mathematical concepts embedded in Johor cultural heritage, (ii) develop JOHO-MATHS, an e-magazine based on Johor cultural heritage for secondary school mathematics learning, and (iii) evaluate the content validity of JOHO-MATHS. This study employed a developmental research design based on the ADDIE model, which involves five phases, namely analysis, design, development, implementation and evaluation. JOHO-MATHS was evaluated by five experts comprising two mathematics education lecturers, two secondary school mathematics teachers and one educational technology designer. Data were analysed using the Content Validity Index (CVI). The findings showed that all items for the aspects of mathematical content, integration of Johor cultural heritage, as well as design and multimedia obtained an I-CVI value of 1.00, with an overall S-CVI/Ave value of 1.00, indicating a very high level of content validity. These findings demonstrate that JOHO-MATHS is suitable to be used as a digital mathematics learning material that integrates Johor cultural heritage in supporting more meaningful mathematics learning among secondary school students.

PERSEPSI, PENGALAMAN DAN CABARAN UTAMA GURU CEMERLANG MATEMATIK DALAM MENGAPLIKASIKAN QUIZIZZ DI DALAM KELAS

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Kajian ini bertujuan untuk meneroka persepsi, pengalaman dan cabaran utama guru cemerlang Matematik dalam mengaplikasikan Quizizz di dalam kelas. Kajian ini menggunakan pendekatan kualitatif melalui kaedah temu bual separa berstruktur. Seramai tiga orang guru cemerlang Matematik sekolah menengah di daerah Johor Bahru telah dipilih sebagai peserta kajian menggunakan kaedah persampelan bertujuan dan persampelan 'Snowball'. Data temu bual telah ditranskripsikan dan dianalisis menggunakan analisis tematik bagi mengenal pasti tema-tema utama yang selaras dengan objektif kajian. Dapatan kajian menunjukkan bahawa guru cemerlang Matematik mempunyai persepsi positif terhadap penggunaan Quizizz kerana aplikasi ini bersifat interaktif, menarik, menyediakan maklum balas segera dan sesuai digunakan sebagai alat sokongan pedagogi dalam PdPc Matematik. Dari aspek pengalaman, guru menggunakan Quizizz untuk penilaian formatif digital, pelaksanaan aktiviti yang fleksibel serta refleksi dan tindakan susulan terhadap tahap kefahaman murid. Walau bagaimanapun, pelaksanaan Quizizz masih berhadapan dengan cabaran seperti kekangan infrastruktur, kekangan masa, kemahiran teknologi guru dan penyesuaian bahan kandungan Matematik. Dapatan kajian turut menunjukkan bahawa kekangan infrastruktur merupakan cabaran utama kerana penggunaan Quizizz bergantung kepada capaian internet, peranti dan kemudahan teknologi sekolah. Secara keseluruhannya, Quizizz berpotensi menjadi aplikasi sokongan PdPc Matematik yang berkesan sekiranya penggunaannya dirancang secara sistematik, disesuaikan dengan objektif pembelajaran dan disokong oleh kemudahan teknologi yang mencukupi.

This study aims to explore the perceptions, experiences and main challenges of Excellent Mathematics Teachers in applying Quizizz in the classroom. This study employed a qualitative approach through semi-structured interviews. A total of three secondary school Excellent Mathematics Teachers in the district of Johor Bahru were selected as participants using purposive sampling and snowball sampling methods. The interview data were transcribed and analysed using thematic analysis to identify the main themes aligned with the research objectives. The findings show that Excellent Mathematics Teachers have positive perceptions of using Quizizz because the application is interactive, engaging, provides immediate feedback and is suitable as a pedagogical support tool in Mathematics teaching and learning. In terms of experience, teachers used Quizizz for digital formative assessment, flexible activity implementation, as well as reflection and follow-up actions to support students' understanding. However, the implementation of Quizizz still faces several challenges, including infrastructure constraints, time constraints, teachers' technological skills and the adaptation of Mathematics content materials. The findings also show that infrastructure constraints are the main challenge, as the use of Quizizz depends on internet access, devices and school technology facilities. Overall, Quizizz has the potential to be an effective support application in Mathematics teaching and learning when its use is systematically planned, aligned with learning objectives and supported by adequate technological facilities.

PEMBANGUNAN BUKU CERITA INTERAKTIF BERASASKAN REALITI TERIMBUH UNTUK PEMBELAJARAN KONSEP JISIM BAGI MURID TAHUN 2

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Kajian ini bertujuan untuk membangunkan dan mengenal pasti kesesuaian buku cerita interaktif berasaskan realiti terimbuh bagi konsep jisim murid Tahun 2 dalam menyokong penglibatan kolaboratif dan pembelajaran kontekstual dari perspektif panel pakar. Kajian ini menggunakan reka bentuk kajian reka bentuk dan pembangunan atau Design and Development Research (DDR) yang didasari oleh Model ADDIE yang merangkumi fasa analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Kandungan buku cerita interaktif berasaskan realiti terimbuh yang bertajuk Rahsia Barang Ringan dan Berat: Belajar Jisim Bersama Imran dan Nisa dibangunkan berdasarkan topik jisim Matematik Tahun 2 yang melibatkan pengenalan unit gram dan kilogram, penggunaan penimbang, perbandingan jisim serta penyusunan objek mengikut jisim. Buku cerita interaktif berasaskan realiti terimbuh ini menggunakan situasi membeli-belah di pasar raya bersama watak Imran, Nisa dan ibu mereka bagi menghubungkan konsep jisim dengan kehidupan harian murid. Elemen realiti terimbuh seperti video penerangan, kuiz interaktif dan aktiviti perbincangan secara berpasangan turut dimasukkan bagi menyokong pembelajaran yang lebih visual, kolaboratif dan kontekstual. Seramai enam orang panel pakar yang terdiri daripada guru Matematik sekolah rendah dan pensyarah dalam bidang pendidikan matematik atau teknologi pendidikan terlibat dalam penilaian produk. Data dikumpulkan melalui borang penilaian pakar berskala Likert empat mata dan dianalisis menggunakan Content Validity Index (CVI), iaitu I-CVI, S-CVI/Ave dan S-CVI/UA. Dapatan kajian menunjukkan bahawa semua item bagi aspek kandungan Matematik, reka bentuk buku cerita, penglibatan kolaboratif dan pembelajaran kontekstual memperoleh nilai I-CVI sebanyak 1.00. Nilai S-CVI/Ave dan S-CVI/UA bagi setiap konstruk juga mencatatkan nilai 1.00. Secara keseluruhannya, buku cerita interaktif berasaskan realiti terimbuh ini mempunyai tahap kesahan kandungan yang sangat tinggi dan sesuai digunakan sebagai bahan sokongan dalam PdPc Matematik Tahun 2.

This study aims to develop and determine the suitability of an augmented reality-based interactive storybook for the concept of mass among Year 2 pupils in supporting collaborative engagement and contextual learning from the perspectives of expert panels. This study employed a Design and Development Research (DDR) design guided by the ADDIE Model, which consists of five phases: analysis, design, development, implementation and evaluation. The content of the augmented reality-based interactive storybook, entitled The Secret of Light and Heavy Objects: Learning Mass with Imran and Nisa, was developed based on the Year 2 Mathematics topic of mass, which includes the introduction of grams and kilograms, the use of weighing scales, comparison of mass and arrangement of objects according to mass. The augmented reality-based interactive storybook uses a supermarket shopping situation involving the characters Imran, Nisa and their mother to relate the concept of mass to pupils' daily lives. Augmented reality elements such as explanatory videos, interactive quizzes and paired discussion activities were also included to support more visual, collaborative and contextual learning. A total of six expert panels, consisting of primary school Mathematics teachers and lecturers in Mathematics education or educational technology, were involved in evaluating the product. Data were collected using an expert evaluation form with a four-point Likert scale and were analysed using the Content Validity Index (CVI), namely I-CVI, S-CVI/Ave and S-CVI/UA. The findings showed that all items related to Mathematics content, storybook design, collaborative *engagement and contextual learning obtained an I-CVI value of 1.00. The S-CVI/Ave and S-CVI/UA values for each construct also recorded a value of 1.00.*

Overall, this augmented reality-based interactive storybook has a very high level of content validity and is suitable to be used as a supporting material in Year 2 Mathematics teaching and learning.

PEMBANGUNAN MODUL PENGAJARAN MATEMATIK PENGGUNA: INSURANS TINGKATAN 5 DALAM MENYOKONG ELEMEN MATLAMAT PEMBANGUNAN MAMPAN (SDG) 1 "TIADA KEMISKINAN"

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Pengintegrasian elemen kelestarian dalam pendidikan matematik semakin diberi penekanan, khususnya melalui penerapan Matlamat Pembangunan Mampan (SDG) bagi menyokong pengajaran yang relevan dengan realiti ekonomi global. Penggunaan modul pengajaran yang berstruktur berpotensi membantu guru menghubungkan konsep matematik dengan isu kemiskinan dan perancangan kewangan secara lebih bermakna. Sehubungan itu, kajian ini dijalankan bertujuan untuk membangunkan Modul Pengajaran Matematik Pengguna: Insurans Tingkatan 5 dalam Menyokong Elemen SDG 1 "Tiada Kemiskinan" bagi membantu guru matematik melaksanakan pengajaran topik insurans dengan lebih berkesan. Kajian ini menggunakan reka bentuk kuantitatif dengan pendekatan Fuzzy Delphi yang melibatkan seramai 11 orang pakar, terdiri daripada pakar lapangan dan pakar profesional dalam bidang Pendidikan Matematik, yang telah dipilih melalui kaedah persampelan bertujuan. Instrumen kajian yang digunakan adalah soal selidik yang merangkumi empat bahagian iaitu maklumat demografi, penilaian terhadap aspek pengintegrasian elemen SDG 1, pendekatan pembelajaran berasaskan kehidupan seharian, dan modul pengajaran yang berstruktur. Kesahan muka dan kandungan telah dilaksanakan dan semua item diterima dengan pelaksanaan penambahbaikan, manakala kajian rintis menunjukkan nilai kebolehpercayaan Alpha Cronbach ialah 0.971. Seterusnya, nilai ambang (threshold), peratusan kesepakatan, dan skor Fuzzy telah digunakan untuk menganalisis data. Dapatan fasa penilaian menunjukkan pakar mempunyai tahap kesepakatan yang sangat tinggi terhadap kebolehgunaan modul pengajaran ini dari aspek pengintegrasian SDG 1, pembelajaran berasaskan kehidupan seharian, dan struktur modul. Secara keseluruhan, kajian ini menunjukkan bahawa modul pengajaran yang dibangunkan berpotensi menjadi panduan yang efektif kepada guru dalam memperkukuh perancangan kewangan murid serta menyokong usaha global bagi membasmi kemiskinan melalui pendekatan pengajaran yang sistematik, kontekstual, dan bermakna.

The integration of sustainability elements in mathematics education is increasingly emphasized, particularly through the application of the Sustainable Development Goals (SDGs) to support teaching that is relevant to global economic realities. The use of structured teaching modules has the potential to assist teachers in connecting mathematical concepts with poverty issues and financial planning more meaningfully. Consequently, this study aims to develop a Consumer Mathematics Teaching Module: Form 5 Insurance in Supporting SDG 1 Element "No Poverty" to assist mathematics teachers in implementing insurance topic instruction more effectively. This study employs a quantitative research design using the Fuzzy Delphi approach, involving 11 experts comprising field practitioners and professionals in the field of Mathematics Education, selected through purposive sampling. The research instrument used is a questionnaire consisting of four sections: demographic information, assessment of the SDG 1 integration aspect, daily life-based learning approaches, and the

structured teaching module. Face and content validity were established, and all items were accepted with implemented improvements, while a pilot study indicated a Cronbach's Alpha reliability value of 0.971. Subsequently, threshold values, consensus percentages, and Fuzzy scores were used to analyze the data. The findings from the evaluation phase indicate that experts reached a very high level of consensus on the usability of this teaching module regarding the aspects of SDG 1 integration, daily life□based learning, and module structure. Overall, this study demonstrates that the developed teaching module has the potential to serve as an effective guide for teachers in strengthening students' financial planning and supporting global efforts to eradicate poverty through a systematic, contextual, and meaningful teaching approach.

PEMBANGUNAN BUKU CERITA REALITI TERIMBUH (AR) SEBAGAI ALAT PEMBELAJARAN INTERAKSI DALAM PENGAJARAN MATEMATIK TAHUN 3 TOPIK WANG

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Kaedah pengajaran tradisional yang bersifat satu hala didapati kurang sesuai untuk generasi Alpha pada zaman kini dan menyebabkan murid mudah hilang fokus dan sukar memahami konsep matematik, khususnya dalam topik Wang Tahun 3. Hal ini disebabkan kerana bahan bantu mengajar (BBM) interaktif berasaskan teknologi dalam topik Wang masih sangat terhad. Oleh yang demikian, kajian ini dijalankan untuk membangunkan sebuah buku cerita mengintegrasikan Realiti Terimbuh (AR) yang bertajuk "Misi Simpanan Bijak Adam dan Ringbot" untuk topik Wang Tahun 3 serta menilai kesannya terhadap tahap kefahaman dan minat murid daripada perspektif pakar. Buku cerita AR dalam kajian ini telah berjaya dibangunkan dengan menggunakan model ADDIE dan telah dinilai oleh enam orang pakar. Data kajian ini telah dianalisis melalui kaedah Indeks Kesahan Kandungan (CVI). Hasil analisis kuantitatif telah merekodkan nilai purata S-CVI/Ave yang cemerlang iaitu 1.00 bagi aspek kesan kefahaman dan minat murid. Data ini telah membuktikan bahawa semua pakar telah bersetuju dan mengesahkan bahawa buku cerita AR dapat membawa kesan yang sangat positif dan signifikan kepada tahap kefahaman dan minat murid Tahun 3 dalam topik Wang. Tindakan pembetulan secara kualitatif turut dilaksanakan berdasarkan komen dan cadangan penambahbaikan pakar demi meningkatkan kualiti buku cerita AR. Kajian ini telah memberikan implikasi praktikal kepada guru untuk mempelbagaikan pedagogi yang kreatif dan menarik di dalam kelas. Kajian ini juga dapat menjadi rujukan atau cadangan untuk penggubal kurikulum dalam proses perancangan sistem pendidikan pada masa depan.

Traditional teaching methods are found to be less suitable for the Alpha generation nowadays. This issue has caused students to lose focus easily and facing difficulties in understanding mathematical concepts, especially in Year 3 Money topic. This is because interactive teaching aids (BBM) based on technology for Money topic are still very limited. Therefore, this study was conducted to develop an Augmented Reality (AR) storybook titled "Misi Simpanan Bijak Adam dan Ringbot" for the Year 3 Money topic and to evaluate its impact on the level of understanding and interest of students from the perspective of experts. The AR storybook in this study was successfully developed by using the ADDIE model and was evaluated by six experts. The data in this study was analysed by using Content Validity Index (CVI) method. The results of quantitative analysis recorded an excellent average S-CVI/Ave value of 1.00 for the impact on students' understanding and interest. This data proved that all experts agreed and confirmed that AR storybooks have a very positive and significant impact on the level of understanding and interest of Year 3 students in the Money topic. Not just that, corrective actions were implemented based on comments and suggestions of improvement from the experts to improve the quality of the AR storybook. This study has provided practical implications for teachers to diversify creative and interesting pedagogies in the classroom. This study can also be a reference or recommendation for curriculum developers in planning the education system in the future.

DEVELOPMENT AND VALIDATION OF A SARAWAK CULTURE AND HERITAGE-BASED ETHNOMATHEMATICS E-MAGAZINE

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Pendidikan matematik di Malaysia sering menghadapi cabaran dalam menghubungkan konsep matematik yang abstrak dengan pengalaman harian murid, sekali gus menyumbang kepada penurunan minat dalam kalangan murid sekolah menengah rendah. Kajian ini bertujuan untuk membangunkan dan mengesahkan E-majalah Etnomatematik Sarawak interaktif yang telah direka untuk meningkatkan penglibatan murid melalui pembelajaran reponsif budaya. Oleh itu, E-majalah ini telah mengintegrasikan motif budaya peribumi Sarawak seperti Pua Kumbu dan kraf tangan Seroa dengan kurikulum matematik sekolah menengah rendah dengan menggunakan model ADDIE. Seterusnya, kesahan kandungan telah ditetapkan melalui penilaian panel pakar dan menghasilkan skor Indeks Kesahan Kandungan (CVI) yang tinggi, iaitu 0.96, yang mengesahkan bahawa bahan tersebut tepat dari segi budaya, mantap dari segi pedagogi dan sedia untuk pelaksanaan di dalam bilik darjah. Oleh itu, dapatan kajian telah menunjukkan bahawa E-majalah ini berfungsi sebagau intervensi digital yang kukuh dalam menghubungkan identiti budaya tempatan dengan pengetahuan matematik. Kajian ini menyediakan rangka kerja yang boleh diambil oleh pendidik untuk mentransformasikan kurikulum matematik yang abstrak ini menjadi pengalaman digital yang bermakna dan inklusif budaya dan sekali gus menawarkan penyelesaian yang berskala untuk memupuk minat matematik di kalangan murid sekolah menengah rendah dalam pelbagai persekitaran pendidikan.

Mathematics education in Malaysia often faces challenges in connecting abstract mathematical concepts to students' lived experiences, contributing to diminished interest among lower secondary students. This study aims to develop and validate an interactive Sarawak Ethnomathematics E-magazine that is designed to foster students' engagement through culturally responsive learning. The E-magazine will integrate indigenous Sarawak cultural motifs and heritage, such as Pua Kumbu and Seroa crafts, into the lower forms of the mathematics curriculum by utilising the ADDIE instructional design model. Content validity was established through an expert panel evaluation, yielding a high Content Validity Index (CVI) score of 0.96. This result provides assurance that the resource is culturally accurate, pedagogically sound, and ready for classroom implementation. These findings indicate that the E-magazine has served as a strong digital intervention, bridging the gap between local cultural identity and abstract mathematical knowledge. Therefore, this study provides a replicable framework for educators to transform the abstract mathematics curriculum into a meaningful and culturally inclusive digital experience that offers a measurable solution for enhancing mathematical interest in diverse educational settings.

HUBUNGAN ANTARA PENGLIBATAN DALAM PENGGUNAAN CHATGPT SEBAGAI ALAT SOKONGAN PEMBELAJARAN DENGAN PENCAPAIAN MATEMATIK MURID TINGKATAN 4

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Penggunaan teknologi kecerdasan buatan (Artificial Intelligence, AI), khususnya ChatGPT, dalam bidang pendidikan semakin berkembang sebagai alat sokongan pembelajaran. Walau bagaimanapun, keberkesanan penggunaannya terhadap pencapaian akademik murid, terutamanya dalam mata pelajaran Matematik yang memerlukan kemahiran penaakulan dan penyelesaian masalah, masih memerlukan penelitian empirikal. Sehubungan itu, kajian ini bertujuan mengenal pasti tahap penglibatan murid menggunakan ChatGPT sebagai alat sokongan pembelajaran, menentukan tahap pencapaian Matematik murid sekolah menengah, serta menilai hubungan antara penglibatan penggunaan ChatGPT dengan pencapaian Matematik mereka. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk korelasi. Seramai 76 orang murid Tingkatan 4 di sebuah sekolah menengah di Johor Bahru dipilih sebagai sampel kajian. Data dikumpulkan melalui soal selidik bagi mengukur tahap penglibatan murid menggunakan ChatGPT, manakala pencapaian Matematik diperoleh daripada rekod keputusan peperiksaan. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui analisis deskriptif yang melibatkan min, median, frekuensi, dan peratusan serta analisis inferensi menggunakan Ujian Korelasi Spearman Rho. Dapatan kajian menunjukkan bahawa tahap penglibatan murid menggunakan ChatGPT sebagai alat sokongan pembelajaran berada pada tahap tinggi, manakala tahap pencapaian Matematik secara keseluruhannya berada pada tahap sederhana. Analisis Korelasi Spearman menunjukkan terdapat hubungan positif yang sangat lemah dan tidak signifikan antara penglibatan murid menggunakan ChatGPT dengan pencapaian Matematik ($r = 0.188$, $p = 0.105$). Dapatan ini menunjukkan bahawa tahap penglibatan atau penggunaan ChatGPT sebagai alat sokongan pembelajaran tidak mempunyai hubungan yang signifikan dengan pencapaian Matematik murid. Kesimpulannya, ChatGPT berpotensi berfungsi sebagai alat sokongan pembelajaran, namun keberkesanannya terhadap pencapaian akademik bergantung kepada faktor lain seperti penguasaan konsep asas, strategi pembelajaran dan bimbingan guru. Implikasi kajian ini mencadangkan agar guru dan pihak sekolah merancang penggunaan ChatGPT secara lebih sistematik melalui bimbingan dan intervensi yang bersesuaian bagi mengoptimumkan manfaat teknologi AI dalam pembelajaran Matematik.

The use of artificial intelligence (AI) technology, particularly ChatGPT, in education is increasingly expanding as a learning support tool. However, the effectiveness of its use in relation to students' academic achievement, particularly in Mathematics, which requires reasoning and problem-solving skills, still requires empirical investigation. Therefore, this study aimed to identify the level of students' engagement in using ChatGPT as a learning support tool, determine the level of Mathematics achievement among secondary school students, and examine the relationship between students' engagement in using ChatGPT and their Mathematics achievement. This study employed a quantitative approach with a correlational research design. A total of 76 Form Four students from a secondary school in Johor Bahru were selected as the study sample. Data were collected through a questionnaire to measure the level of students' engagement in using ChatGPT, while students' Mathematics achievement was obtained from their examination records. The data were analysed using the Statistical Package for the Social Sciences (SPSS) software. Descriptive analysis involving the calculation of the mean, median, frequency, and percentage, as well as inferential analysis using Spearman's rho correlation test, was conducted. The findings showed that the level of

students' engagement in using ChatGPT as a learning support tool was high, whereas the overall level of Mathematics achievement among the Form Four students was moderate. Spearman's rho correlation analysis revealed a very weak positive and non-significant relationship between students' engagement in using ChatGPT and their Mathematics achievement ($r = 0.188$, $p = 0.105$). These findings indicate that the level of students' engagement in, or use of, ChatGPT as a learning support tool has no significant relationship with their Mathematics achievement. In conclusion, ChatGPT has the potential to function as a learning support tool; however, its effectiveness in improving academic achievement depends on other factors, such as students' mastery of fundamental concepts, learning strategies, and teacher guidance. The findings of this study suggest that teachers and school administrators should plan the use of ChatGPT more systematically through appropriate guidance and interventions to optimise the benefits of AI technology in supporting students' Mathematics learning.

SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA SAINS DENGAN PENDIDIKAN (SAINS SUKAN) DENGAN KEPUJIAN [SHPSH]

PENGOPTIMUMAN TETAPAN KERUSI RODA MELALUI AI DAN ANALISIS BIOMEKANIK BAGI KUASA DAN KETANGKASAN ATLET PARA BADMINTON MALAYSIA

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Kajian ini bertujuan mengoptimumkan konfigurasi kerusi roda bagi meningkatkan komponen kuasa dan ketangkasan atlet para badminton berkerusi roda melalui integrasi analisis biomekanik dan kecerdasan buatan (AI). Kajian menggunakan reka bentuk eksperimen ukuran berulang yang melibatkan enam atlet elit kategori WH1 dan WH2. Enam konfigurasi diuji berdasarkan gabungan tiga sudut camber, iaitu 15°, 18° dan 20°, dengan tiga saiz roda belakang, iaitu 24, 25 dan 26 inci. Data biomekanik dikumpulkan menggunakan sistem Vicon Motion Capture, unit pengukuran inersia, elektromiografi dan force plate semasa pelaksanaan empat tugasan pergerakan. Data dianalisis menggunakan statistik deskriptif dan Repeated-Measures Analysis of Variance pada aras signifikan $p < 0.05$. Dapatan menunjukkan bahawa sudut camber dan saiz roda belakang memberikan kesan signifikan terhadap prestasi biomekanik atlet. Camber 20° menghasilkan kestabilan lateral dan kawalan perubahan arah yang lebih baik, manakala roda 24 inci meningkatkan pecutan dan respons pergerakan. Atlet WH1 menunjukkan perubahan biomekanik yang lebih ketara berbanding atlet WH2. Model XGBoost menghasilkan ketepatan ramalan tertinggi sebanyak 93.1%. Kesimpulannya, integrasi biomekanik dan AI berpotensi menyokong pemilihan konfigurasi kerusi roda secara objektif, sistematik dan berdasarkan profil individu atlet.

This study aimed to optimise wheelchair configuration to improve the power and agility components of wheelchair Para Badminton athletes through the integration of biomechanical analysis and artificial intelligence (AI). A repeated-measures experimental design involving six elite athletes from the WH1 and WH2 classifications was employed. Six configurations were tested based on combinations of three camber angles, namely 15°, 18°, and 20°, and three rear-wheel sizes, namely 24, 25, and 26 inches. Biomechanical data were collected using the Vicon Motion Capture system, inertial measurement units, electromyography, and a force plate while the athletes performed four movement tasks. The data were analysed using descriptive statistics and Repeated-Measures Analysis of Variance at a significance level of $p < 0.05$. The findings demonstrated that camber angle and rear-wheel size significantly affected the athletes' biomechanical performance. A 20° camber provided better lateral stability and directional control, whereas 24-inch rear wheels improved acceleration and movement responsiveness. WH1 athletes demonstrated greater biomechanical changes than WH2 athletes. The XGBoost model achieved the highest prediction accuracy of 93.1%. In conclusion, integrating biomechanics and AI can support objective, systematic, and individualised wheelchair configuration selection based on each athlete's biomechanical profile.

KEBERKESANAN INTERVENSI LATIHAN PSIKOLOGI TERHADAP MOTIVASI ATLET SEPAK TAKRAW UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini bertujuan menilai keberkesanan intervensi latihan psikologi terhadap motivasi atlet sepak takraw Universiti Teknologi Malaysia (UTM). Reka bentuk kajian menggunakan pendekatan kuasi-eksperimen dengan ujian pra dan pasca melibatkan dua kumpulan iaitu kumpulan kawalan (tidak menjalani intervensi) dan kumpulan intervensi (menjalani latihan psikologi). Seramai 20 atlet sepak takraw UTM dipilih sebagai sampel kajian dan tahap motivasi mereka diukur menggunakan soal selidik Sport Motivation Scale II (SMS-II) yang merangkumi enam konstruk motivasi. Intervensi latihan psikologi dilaksanakan selama empat minggu dengan komponen penetapan matlamat, visualisasi, self-talk, kawalan emosi, tumpuan dan relaksasi. Hasil analisis deskriptif menunjukkan kumpulan intervensi mencatatkan peningkatan skor purata daripada 4.05 (ujian pra) kepada 5.87 (ujian pasca), manakala kumpulan kawalan kekal stabil pada skor 4.15. Analisis inferensi melalui ujian T-Sampel Berpasangan turut mengesahkan dapatan ini dengan nilai signifikan $p < 0.001$ bagi kumpulan intervensi, sekali gus menolak hipotesis nol kajian. Kesimpulannya, intervensi latihan psikologi terbukti berkesan dalam meningkatkan motivasi atlet sepak takraw UTM dan memberikan implikasi praktikal kepada jurulatih serta pengurus pasukan untuk merancang program latihan psikologi yang lebih sistematik dan berkesan. Kajian ini juga menyumbang kepada pembangunan atlet universiti sebagai pelapis atlet kebangsaan yang holistik dari segi fizikal, teknikal dan psikologi.

This study aims to evaluate the effectiveness of psychological training interventions on the motivation of sepak takraw athletes at Universiti Teknologi Malaysia (UTM). A quasi-experimental design was employed with pre- and post-tests involving two groups: a control group (no intervention) and an intervention group (psychological training). A total of 20 UTM sepak takraw athletes were selected as the study sample, and their motivation levels were measured using the Sport Motivation Scale II (SMS-II), which encompasses six motivational constructs. The psychological training intervention was implemented over four weeks, incorporating components such as goal setting, visualization, self-talk, emotional regulation, concentration, and relaxation. Descriptive analysis revealed that the intervention group recorded an increase in mean scores from 4.05 (pre-test) to 5.87 (post-test), while the control group remained stable at 4.15. Inferential analysis using paired-sample t-tests confirmed these findings with a significant value of $p < 0.001$ for the intervention group, thereby rejecting the null hypothesis. In conclusion, psychological training interventions proved effective in enhancing the motivation of UTM sepak takraw athletes and provided practical implications for coaches and team managers to design more systematic and effective psychological training programs. This study also contributes to the development of university athletes as holistic successors to national athletes in terms of physical, technical, and psychological aspects.

HUBUNGAN ANTARA KEYAKINAN KENDIRI (SELF-CONFIDENCE) DAN KEUPAYAAN MEMBUAT KEPUTUSAN (DECISION-MAKING) DALAM KALANGAN PEMAIN FUTSAL UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini dijalankan bertujuan untuk mengenal pasti hubungan antara keyakinan kendiri dan keupayaan membuat keputusan dalam kalangan pemain futsal Universiti Teknologi Malaysia. Secara khususnya, kajian ini mempunyai tiga objektif utama, iaitu mengukur tahap keyakinan kendiri, menilai tahap keupayaan membuat keputusan serta mengenal pasti hubungan antara keyakinan kendiri dan keupayaan membuat keputusan dalam kalangan pemain futsal Universiti Teknologi Malaysia. Kajian ini menggunakan reka bentuk kajian tinjauan berbentuk kuantitatif dengan menggunakan borang soal selidik sebagai instrumen kajian. Seramai 15 orang pemain futsal Universiti Teknologi Malaysia telah dipilih sebagai responden kajian. Instrumen kajian terdiri daripada tiga bahagian, iaitu Bahagian A berkaitan maklumat demografi responden, Bahagian B berkaitan keyakinan kendiri dan Bahagian C berkaitan keupayaan membuat keputusan. Data yang diperoleh dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui analisis deskriptif dan inferensi. Analisis deskriptif digunakan untuk mendapatkan kekerapan, peratus, min dan sisihan piawai, manakala analisis inferensi menggunakan ujian korelasi Pearson bagi mengenal pasti hubungan antara kedua-dua pemboleh ubah kajian. Dapatan kajian menunjukkan bahawa tahap keyakinan kendiri pemain futsal Universiti Teknologi Malaysia berada pada tahap tinggi dengan nilai min 4.51 dan sisihan piawai 0.40. Selain itu, tahap keupayaan membuat keputusan juga berada pada tahap tinggi dengan nilai min 4.46 dan sisihan piawai 0.29. Keputusan ujian korelasi Pearson pula menunjukkan terdapat hubungan positif yang kuat dan signifikan antara keyakinan kendiri dan keupayaan membuat keputusan, $r = 0.673$, $p = 0.006$. Dapatan ini menunjukkan bahawa semakin tinggi tahap keyakinan kendiri pemain, semakin tinggi juga keupayaan mereka dalam membuat keputusan semasa permainan. Kesimpulannya, keyakinan kendiri merupakan aspek psikologi yang penting dalam membantu pemain futsal membuat keputusan dengan lebih baik, khususnya dalam situasi permainan yang memerlukan tindakan pantas dan tepat. Kajian ini memberi implikasi kepada pemain, jurulatih dan pihak pengurusan sukan universiti agar memberi perhatian kepada pembangunan aspek psikologi selain latihan fizikal, teknikal dan taktikal.

This study was conducted to identify the relationship between self-confidence and decision-making ability among futsal players at Universiti Teknologi Malaysia. Specifically, this study had three main objectives, namely to measure the level of self-confidence, to assess the level of decision-making ability, and to identify the relationship between self-confidence and decision-making ability among futsal players at Universiti Teknologi Malaysia. This study employed a quantitative survey research design using a questionnaire as the research instrument. A total of 15 futsal players from Universiti Teknologi Malaysia were selected as respondents. The research instrument consisted of three sections: Section A focused on respondents' demographic information, Section B measured self-confidence, and Section C measured decision-making ability. The data obtained were analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive and inferential analyses. Descriptive analysis was used to obtain frequency, percentage, mean and standard deviation, while inferential analysis using Pearson correlation was conducted to determine the relationship between the two research variables. The findings showed that the level of self-confidence among futsal players at Universiti Teknologi Malaysia was high, with a mean score of 4.51 and a standard deviation of 0.40. In addition, the level of decision-making ability

was also high, with a mean score of 4.46 and a standard deviation of 0.29. The Pearson correlation results indicated a strong and significant positive relationship between self-confidence and decision-making ability, r = 0.673, p = 0.006. These findings indicate that the higher the players' level of self-confidence, the higher their ability to make decisions during the game. In conclusion, self-confidence is an important psychological aspect that helps futsal players make better decisions, particularly in game situations that require quick and accurate actions. This study provides implications for players, coaches and university sports management to emphasise psychological development alongside physical, technical and tactical training.

KESAN LATIHAN CIRCUIT TERHADAP JARAK LEMPARAN CAKERA, KEKUATAN OTOT DAN KUASA EKSPLOSIF ATLET LEMPAR CAKERA.

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Kajian ini bertujuan untuk mengenal pasti keberkesanan latihan circuit terhadap kekuatan otot bahagian atas badan, kuasa eksplosif dan prestasi lempar cakera dalam kalangan atlet lempar cakera di peringkat sekolah menengah. Kajian ini menggunakan reka bentuk eksperimen yang melibatkan seramai 20 orang atlet lempar cakera berumur 16 hingga 17 tahun. Peserta telah dibahagikan kepada dua kumpulan, iaitu kumpulan rawatan (n = 10) yang mengikuti program latihan circuit selama lapan minggu dan kumpulan kawalan (n = 10) yang meneruskan latihan biasa. Kekuatan otot bahagian atas badan diukur menggunakan ujian tekan tubi, kuasa eksplosif diukur menggunakan ujian Single Hand Medicine Ball Throw, manakala prestasi lempar cakera dinilai berdasarkan jarak lemparan cakera. Data dianalisis menggunakan analisis deskriptif (min dan sisihan piawai) serta analisis inferensi melalui ujian□t berpasangan dan ujian-t sampel bebas menggunakan perisian SPSS pada aras signifikan $p < 0.05$. Keputusan ujian-t berpasangan menunjukkan kumpulan rawatan mengalami peningkatan yang signifikan dalam ujian tekan tubi, Single Hand Medicine Ball Throw dan jarak lemparan cakera selepas mengikuti latihan circuit, manakala kumpulan kawalan tidak menunjukkan perubahan yang signifikan bagi kekuatan otot dan prestasi lempar cakera. Analisis ujian-t sampel bebas pula menunjukkan terdapat perbezaan yang signifikan antara kumpulan rawatan dan kumpulan kawalan bagi perubahan skor ujian tekan tubi, Single Hand Medicine Ball Throw dan jarak lemparan cakera selepas intervensi. Dapatan kajian membuktikan bahawa latihan circuit berkesan dalam meningkatkan kekuatan otot bahagian atas badan, kuasa eksplosif dan prestasi lempar cakera dalam kalangan atlet sekolah menengah. Kajian ini diharapkan dapat dijadikan sebagai rujukan kepada guru, jurulatih dan penyelidik dalam merancang program latihan yang lebih sistematik dan berkesan bagi meningkatkan prestasi atlet lempar cakera.

This study aimed to determine the effectiveness of circuit training on upper body muscular strength, explosive power, and discus throw performance among discus throw athletes at the secondary school level. A quasi-experimental research design was employed involving 20 discus throw athletes aged between 16 and 17 years. The participants were divided into two groups: a treatment group (n = 10), which underwent an eight-week circuit training programme, and a control group (n = 10), which continued with their regular training routine. Upper body muscular strength was assessed using the push-up test, explosive power was measured using the Single Hand Medicine Ball Throw test, while discus throw performance was evaluated based on the throwing distance. The collected data were analysed

using descriptive statistics (mean and standard deviation) as well as inferential statistics through paired-samples t-tests and independent-samples t-tests using SPSS at a significance level of $p < 0.05$. The paired-samples t-test results indicated that the treatment group demonstrated significant improvements in push-up performance, Single Hand Medicine Ball Throw, and discus throw distance following the circuit training intervention, whereas the control group showed no significant improvements in upper body muscular strength and discus throw performance. Furthermore, the independent- samples t-test revealed significant differences between the treatment and control groups in the changes observed for push-up performance, Single Hand Medicine Ball Throw, and discus throw distance after the intervention. The findings indicate that circuit training is an effective training method for improving upper body muscular strength, explosive power, and discus throw performance among secondary school athletes. It is hoped that the findings of this study will serve as a useful reference for teachers, coaches, and future researchers in designing more systematic and effective training programmes to enhance discus throw performance.

KESAN LATIHAN IMAGERI TERHADAP TAHAP KEBIMBANGAN DAN PRESTASI SERVIS ATLET BOLA TAMPAR REMAJA

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Latihan psikologi dalam sukan sering kurang diberi penekanan berbanding latihan fizikal dan teknikal walaupun aspek mental memainkan peranan penting dalam mempengaruhi prestasi atlet. Tahap kebimbangan yang tinggi dan keyakinan diri yang rendah boleh menjejaskan prestasi kemahiran servis atlet bola tampar, khususnya semasa pertandingan. Oleh itu, kajian ini bertujuan untuk mengkaji kesan latihan imageri terhadap tahap kebimbangan dan prestasi kemahiran servis dalam kalangan atlet bola tampar remaja. Kajian ini menggunakan reka bentuk kuasi eksperimen yang melibatkan 15 orang atlet bola tampar remaja berumur 13 hingga 17 tahun. Peserta dibahagikan kepada tiga kumpulan, iaitu kumpulan imageri visual, kumpulan imageri audio dan kumpulan kawalan. Intervensi dijalankan selama empat minggu dengan kekerapan tiga sesi seminggu. Tahap kebimbangan diukur menggunakan Competitive State Anxiety Inventory-2 Revised (CSAI-2R) yang merangkumi komponen somatic anxiety, cognitive anxiety dan self-confidence, manakala prestasi kemahiran servis dinilai menggunakan American Alliance for Health, Physical Education, Recreation and Dance (AAPERD) Volleyball Serving Test. Data dianalisis menggunakan statistik deskriptif dan Ujian Kruskal-Wallis. Dapatan kajian menunjukkan kumpulan imageri visual mencatat peningkatan yang signifikan bagi komponen somatic anxiety selepas intervensi ($p < 0.05$), manakala tiada perubahan yang signifikan bagi komponen cognitive anxiety dan self-confidence. Dari segi prestasi kemahiran servis, ketiga-tiga kumpulan menunjukkan peningkatan skor min selepas intervensi dengan kumpulan imageri visual merekodkan peningkatan tertinggi. Walau bagaimanapun, keputusan Kruskal-Wallis Test menunjukkan tiada perbezaan yang signifikan antara kumpulan imageri visual, imageri audio dan kawalan terhadap tahap kebimbangan serta prestasi kemahiran servis ($p > 0.05$). Kesimpulannya, latihan imageri berpotensi meningkatkan aspek psikologi dan prestasi kemahiran servis atlet bola tampar remaja, namun kajian lanjut dengan saiz sampel yang lebih besar dan tempoh intervensi yang lebih panjang disarankan bagi mendapatkan dapatan yang lebih kukuh.

Psychological training in sports is often given less emphasis than physical and technical training, despite the important role that mental factors play in influencing athletic

performance. High levels of anxiety and low self-confidence may negatively affect volleyball athletes' serving performance, particularly during competition. Therefore, this study aimed to examine the effects of imagery training on anxiety levels and serving performance among adolescent volleyball athletes. This study employed a quasi-experimental research design involving 15 adolescent volleyball athletes aged between 13 and 17 years. The participants were divided into three groups: the visual imagery group, the audio imagery group, and the control group. The intervention was conducted over four weeks, with three sessions per week. Anxiety levels were measured using the Competitive State Anxiety Inventory-2 Revised (CSAI-2R), which consists of the somatic anxiety, cognitive anxiety, and self-confidence components, while serving performance was assessed using the American Alliance for Health, Physical Education, Recreation and Dance (AAPERD) Volleyball Serving Test. The data were analysed using descriptive statistics and the Kruskal-Wallis test. The findings revealed that the visual imagery group demonstrated a significant improvement in the somatic anxiety component following the intervention ($p < 0.05$), whereas no significant changes were found in cognitive anxiety and self-confidence. In terms of serving performance, all three groups showed improvements in their mean scores after the intervention, with the visual imagery group recording the greatest improvement. However, the results of the Kruskal-Wallis test indicated that there were no significant differences among the visual imagery, audio imagery, and control groups in terms of anxiety levels and serving performance ($p > 0.05$). In conclusion, imagery training has the potential to enhance the psychological aspects and serving performance of adolescent volleyball athletes. Nevertheless, future studies involving larger sample sizes and longer intervention periods are recommended to obtain more robust findings.

PENGLIBATAN IBU BAPA DALAM MENYOKONG PERKEMBANGAN PRESTASI ANAK-ANAK DI BAWAH PROGRAM PEMBANGUNAN BOLA SEPAK DTC-JDTKIDS

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Kajian ini dijalankan untuk menilai penglibatan ibu bapa dalam menyokong perkembangan prestasi anak-anak di bawah Program Pembangunan Bola Sepak DTC-JDTKids. Secara khususnya, kajian ini bertujuan untuk mengukur tahap penglibatan ibu bapa dari aspek sokongan emosi, sosial, disiplin dan motivasi, mengenal pasti bentuk sokongan ibu bapa yang paling dominan, serta menganalisis hubungan antara sokongan ibu bapa dengan harapan terhadap prestasi menyeluruh anak-anak. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan dengan soal selidik sebagai instrumen kajian. Seramai 63 orang ibu bapa atau penjaga yang mempunyai anak terlibat dalam Program Pembangunan Bola Sepak DTC-JDTKids telah dipilih sebagai responden kajian. Data dianalisis menggunakan statistik deskriptif yang melibatkan kekerapan, peratusan, min dan sisihan piawai, manakala ujian korelasi Spearman digunakan bagi menganalisis hubungan antara sokongan ibu bapa dengan harapan terhadap prestasi anak-anak. Dapatan kajian menunjukkan bahawa tahap penglibatan ibu bapa berada pada tahap yang baik bagi keempat-empat aspek sokongan yang dikaji. Sokongan disiplin mencatatkan nilai min tertinggi, iaitu 36.05, diikuti oleh sokongan sosial dengan min 35.37, sokongan motivasi dengan min 35.10 dan sokongan emosi dengan min 33.44. Dapatan ranking turut menunjukkan bahawa sokongan disiplin merupakan bentuk sokongan paling dominan apabila 32 orang responden bersamaan 50.8 peratus memilihnya sebagai sokongan utama. Selain itu, keputusan korelasi Spearman menunjukkan terdapat hubungan positif yang kuat dan signifikan antara sokongan ibu bapa dengan harapan terhadap prestasi menyeluruh anak-anak, iaitu $r = .768$, $p < .001$. Dapatan ini menunjukkan bahawa semakin tinggi sokongan yang diberikan oleh ibu bapa, semakin tinggi juga kecenderungan harapan mereka terhadap perkembangan prestasi anak-anak. Kesimpulannya, penglibatan ibu bapa memainkan peranan penting dalam membentuk persekitaran yang positif bagi perkembangan atlet muda di peringkat akar umbi. Sokongan yang seimbang dari aspek disiplin, motivasi, sosial dan emosi perlu diberi perhatian agar perkembangan prestasi anak-anak dapat berlaku secara lebih menyeluruh, sihat dan berkesan.

This study was conducted to examine parental involvement in supporting children's performance development under the DTC-JDTKids Football Development Programme. Specifically, the study aimed to measure the level of parental involvement in terms of emotional, social, disciplinary and motivational support, identify the most dominant form of parental support, and analyse the relationship between parental support and parents' expectations toward their children's overall performance. This study employed a quantitative survey design using a questionnaire as the research instrument. A total of 63 parents or guardians whose children were involved in the DTC-JDTKids Football Development Programme were selected as respondents. The data were analysed using descriptive statistics, including frequency, percentage, mean and standard deviation, while Spearman's correlation test was used to examine the relationship between parental support and parents' expectations toward their children's performance. The findings showed that the level of parental involvement was generally good across all four support dimensions. Disciplinary support recorded the highest mean score of 36.05, followed by social support with a mean of 35.37, motivational support with a mean of 35.10 and emotional support with a mean of 33.44. The ranking results also showed that disciplinary support was the most dominant form of support, with 32 respondents, equivalent to 50.8 percent, selecting it as the main form of support. In

addition, the Spearman correlation results revealed a strong and significant positive relationship between parental support and parents' expectations toward their children's overall performance, r = .768, p < .001. This finding indicates that the higher the support provided by parents, the higher their tendency to place expectations on their children's performance development. In conclusion, parental involvement plays an important role in creating a positive environment for the development of young football players at the grassroots level. Balanced support in terms of discipline, motivation, social involvement and emotional encouragement should be emphasised to ensure that children's performance development occurs in a more holistic, healthy and effective manner.

PERSEPSI ATLET MAHASISWA UTM TERHADAP SOKONGAN AUTONOMI JURULATIH DAN HUBUNGANNYA DENGAN MOTIVASI ATLET DALAM SUKAN

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Kajian ini bertujuan mengenalpasti tahap persepsi atlet terhadap sokongan autonomi jurulatih, mengenalpasti tahap motivasi atlet dan mengkaji hubungan antara persepsi atlet terhadap sokongan autonomi jurulatih dengan motivasi atlet. Kajian ini menggunakan pendekatan kuantitatif dan kaedah purposive sampling yang melibatkan 87 orang atlet mahasiswa UTM pelbagai sukan. Instrumen Sport Climate Questionnaire (SCQ) digunakan bagi mengukur persepsi atlet terhadap sokongan autonomi jurulatih dan Sport Motivation Scale II (SMS-II) bagi mengukur motivasi dalaman, motivasi luaran dan amotivasi. Analisis data dilakukan menggunakan sistem IBM SPSS V3.1. Dapatan kajian menunjukkan bahawa persepsi atlet terhadap sokongan autonomi jurulatih berada pada tahap tinggi (Min = 5.67, SP = 0.76). Selain itu, motivasi dalaman berada pada tahap tinggi (Min = 5.82, SP = 0.79), manakala motivasi luaran (Min = 4.30, SP = 1.34) dan amotivasi (Min = 3.99, SP = 1.70) berada pada tahap sederhana. Analisis Korelasi Spearman menunjukkan terdapat hubungan positif yang signifikan pada tahap sederhana antara sokongan autonomi jurulatih dengan motivasi dalaman ($r_s = .58$, $p < 0.001$), serta hubungan positif yang signifikan pada tahap lemah dengan motivasi luaran ($r_s = .32$, $p = 0.002$). Walau bagaimanapun, tiada hubungan yang signifikan ditemui antara sokongan autonomi jurulatih dengan amotivasi ($r = .09$, $p = 0.41$). Secara keseluruhan, kajian ini membuktikan bahawa sokongan autonomi jurulatih mempengaruhi atlet dalam meningkatkan motivasi terutama dari aspek motivasi dalaman.

This study aimed to identify the level of athletes' perception of coaches' autonomy support, identify athletes' motivational levels and examine the relationship between athletes' perceptions of coaches' autonomy support and athletes' motivation. This study used a quantitative approach and purposive sampling method involving 87 UTM student athletes from various sports. The Sport Climate Questionnaire (SCQ) instrument was used to measure athletes' perceptions of the coach's autonomy support and the Sport Motivation Scale II (SMS-II) to measure internal motivation, external motivation and amotivation. Data analysis was carried out using the IBM SPSS V3.1 system. The findings of the study showed that the athletes' perception of the coach's autonomy support was at a high level (Mean = 5.67, SP = 0.76). Additionally, internal motivation was at a high level (Mean = 5.82, SP = 0.79), while external motivation (Mean = 4.30, SP = 1.34) and motivation (Mean = 3.99, SP = 1.70) was at a moderate level. Spearman's correlation analysis showed that there was a significant positive relationship at a moderate level between the coach's autonomy support and internal motivation ($r_s = .58$, $p < 0.001$), as well as a significant positive relationship at the weak level with external motivation ($r_s = .32$, $p = 0.002$). However, no significant association was found between trainer autonomy support and motivation ($r_s = .09$, $p = 0.41$). Overall, this study proves that the autonomy support of coaches influences athletes in increasing motivation especially from the aspect of internal motivation.

PERBANDINGAN PROFIL SOMATOTAIP ANTARA ATLET TINJU NOVIS DAN ELIT

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Kajian ini bertujuan membandingkan profil somatotaip antara atlet tinju novis dan atlet tinju elit di Johor. Kajian menggunakan reka bentuk perbandingan keratan rentas (comparative cross-sectional study) yang melibatkan seramai 12 orang atlet lelaki, terdiri daripada enam atlet novis dan enam atlet elit dalam kategori berat badan 55 hingga 60 kilogram. Pengumpulan data antropometri dijalankan menggunakan kaedah Heath-Carter yang melibatkan pengukuran ketinggian tubuh badan, berat badan, lipatan kulit (trisep, subskapula, suprailiak dan gastroknemius), lebar humerus dan femur serta lilitan lengan dan gastroknemius. Nilai endomorfi, mesomorfi dan ektomorfi dikira berdasarkan formula Heath-Carter. Analisis statistik deskriptif digunakan untuk menentukan profil somatotaip atlet, manakala ujian Independent Samples t-test digunakan bagi membandingkan komponen somatotaip antara atlet novis dan elit pada aras signifikan $p < 0.05$. Keputusan kajian menunjukkan atlet tinju novis mempunyai profil somatotaip Mesomorphic Endomorph dengan nilai purata endomorfi 4.29 ± 0.76, mesomorfi 3.90 ± 1.04 dan ektomorfi 3.33 ± 1.10. Atlet tinju elit pula menunjukkan profil Balanced Mesomorph dengan nilai purata endomorfi 2.63 ± 0.32, mesomorfi 5.14 ± 0.20 dan ektomorfi 3.15 ± 0.38. Ujian Independent Samples t-test menunjukkan terdapat perbezaan yang signifikan bagi komponen endomorfi ($t(10) = 4.921$, $p < 0.001$) dan mesomorfi ($t(10) = -2.868$, $p = 0.017$), manakala tiada perbezaan yang signifikan bagi komponen ektomorfi ($t(10) = 0.368$, $p = 0.721$) antara kedua-dua kumpulan. Kesimpulannya, atlet tinju elit mempunyai dominasi komponen mesomorfi yang lebih tinggi berbanding atlet novis, manakala atlet novis menunjukkan nilai endomorfi yang lebih tinggi. Dapatan kajian ini dapat dijadikan rujukan kepada jurulatih, penyelidik dan organisasi sukan dalam proses pemilihan atlet, pembangunan bakat serta perancangan program latihan yang lebih sistematik.

This study aimed to compare the somatotype profiles between novice and elite boxers in Johor. A comparative cross-sectional study research design was employed involving twelve male athletes, comprising six novice and six elite boxers in the 55–60 kg weight category. Anthropometric data were collected using the Heath-Carter somatotype method, including measurements of height, body weight, skinfold thickness (triceps, subscapular, suprailiac and gastrocnemius), humerus and femur biepicondylar breadths, as well as upper arm and gastrocnemius girths. Endomorphy, mesomorphy and ectomorphy ratings were calculated using the Heath-Carter equations. Descriptive statistics were used to determine the athletes' somatotype profiles, while an Independent Samples t-test was conducted to compare somatotype components between novice and elite athletes at a significance level of $p < 0.05$. The findings revealed that novice boxers demonstrated a Mesomorphic Endomorph somatotype with mean values of 4.29 ± 0.76 for endomorphy, 3.90 ± 1.04 for mesomorphy and 3.33 ± 1.10 for ectomorphy. In contrast, elite boxers exhibited a Balanced Mesomorph somatotype with mean values of 2.63 ± 0.32, 5.14 ± 0.20 and 3.15 ± 0.38, respectively. The Independent Samples t-test indicated significant differences in endomorphy ($t(10) = 4.921$, $p < 0.001$) and mesomorphy ($t(10) = -2.868$, $p = 0.017$), whereas no significant difference was observed for ectomorphy ($t(10) = 0.368$, $p = 0.721$). In conclusion, elite boxers exhibited a greater dominance of the mesomorphic component compared to novice boxers, while novice athletes demonstrated higher endomorphy values. The findings provide useful references for coaches, researchers and sports organisations in athlete identification, talent development and the design of more systematic training programmes.

PERBANDINGAN TAHAP TEKANAN ANTARA ATLET BERPASUKAN DAN INDIVIDU DALAM KALANGAN ATLET UTM

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Kajian ini dijalankan bagi mengenalpasti tahap tekanan dalam kalangan atlet sukan berpasukan dan atlet sukan individu serta membandingkan tahap tekanan antara kedua-dua kategori atlet di Universiti Teknologi Malaysia (UTM). Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kajian tinjauan. Seramai 108 orang atlet UTM yang terdiri daripada 54 atlet sukan individu dan 54 atlet sukan berpasukan telah dipilih sebagai responden kajian. Instrumen Perceived Stress Scale (PSS-10) digunakan bagi mengukur tahap tekanan responden. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 29 melalui analisis deskriptif dan inferensi. Analisis deskriptif melibatkan kekerapan, peratusan, min dan sisihan piawai, manakala analisis inferensi menggunakan ujian Independent Samples t-test. Hasil kajian menunjukkan bahawa atlet UTM mengalami tahap tekanan sederhana dengan skor min keseluruhan sebanyak 24.38 (SP = 3.78). Selain itu, atlet sukan individu mencatatkan skor min tekanan yang lebih tinggi (M = 25.50, SP = 3.79) berbanding atlet sukan berpasukan (M = 23.26, SP = 3.46). Keputusan ujian Independent Samples t-test menunjukkan bahawa terdapat perbezaan yang signifikan antara tahap tekanan atlet sukan individu dan atlet sukan berpasukan, t(106) = 3.211, p = .002. Dapatan kajian menunjukkan bahawa kategori sukan mempengaruhi tahap tekanan yang dialami oleh atlet. Oleh itu, pihak universiti, jurulatih dan pengurusan sukan disarankan untuk memberi perhatian terhadap aspek pengurusan tekanan, khususnya dalam kalangan atlet sukan individu bagi memastikan kesejahteraan psikologi dan prestasi sukan dapat dikekalkan pada tahap optimum.

This study was conducted to identify the level of stress among team sport athletes and individual sport athletes, as well as to compare the stress levels between both categories of athletes at Universiti Teknologi Malaysia (UTM). A quantitative approach with a survey research design was employed. A total of 108 UTM athletes, consisting of 54 individual sport athletes and 54 team sport athletes, participated in this study. The Perceived Stress Scale (PSS-10) was used to measure the respondents' stress levels. Data were analysed using Statistical Package for the Social Sciences (SPSS) version 29 through descriptive and inferential analyses. Descriptive analysis involved frequency, percentage, mean and standard deviation, while inferential analysis utilised the Independent Samples t-test. The findings revealed that UTM athletes experienced a moderate level of stress with an overall mean score of 24.38 (SD = 3.78). In addition, individual sport athletes recorded a higher mean stress score (M = 25.50, SD = 3.79) compared to team sport athletes (M = 23.26, SD = 3.46). The results of the Independent Samples t-test indicated a significant difference in stress levels between individual sport athletes and team sport athletes, t(106) = 3.211, p = .002. The findings suggest that the type of sport influences the level of stress experienced by athletes. Therefore, universities, coaches and sports management personnel are encouraged to pay greater attention to stress management, particularly among individual sport athletes, to ensure optimal psychological well-being and sports performance.

KESAN PENGAMBILAN MINUMAN BERBEZA TERHADAP PERUBAHAN TAHAP GLUKOSA DARAH DALAM KALANGAN PEMAIN BOLA SEPAK UTM

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Kajian ini bertujuan untuk mengenal pasti dan membandingkan perubahan tahap glukosa darah pemain bola sepak Universiti Teknologi Malaysia (UTM) selepas pengambilan tiga jenis minuman, iaitu air kosong, minuman isotonik dan jus tembikai selepas perlawanan bola sepak. Kajian ini menggunakan reka bentuk eksperimental dengan pendekatan kaedah kuantitatif. Seramai 11 orang pemain bola sepak UTM telah dipilih sebagai sampel kajian. Tahap glukosa darah pemain diukur menggunakan glukometer sebelum dan selepas pengambilan setiap minuman, iaitu selepas perlawanan dan 30 minit selepas minuman diberikan. Data kajian dianalisis menggunakan analisis deskriptif yang melibatkan min dan sisihan piawai, serta analisis inferensi menggunakan ujian-t sampel berpasangan. Dapatan kajian menunjukkan bahawa bacaan glukosa darah baseline pemain ialah 5.18 ± 0.18 mmol/L. Bagi air kosong, bacaan glukosa darah meningkat daripada 4.66 ± 0.16 mmol/L kepada 4.73 ± 0.16 mmol/L. Minuman isotonik menunjukkan peningkatan daripada 4.65 ± 0.15 mmol/L kepada 5.78 ± 0.18 mmol/L, manakala jus tembikai meningkat daripada 4.65 ± 0.16 mmol/L kepada 5.48 ± 0.18 mmol/L. Keputusan ujian-t sampel berpasangan menunjukkan terdapat perbezaan yang signifikan antara bacaan glukosa darah sebelum dan selepas pengambilan air kosong, minuman isotonik dan jus tembikai. Secara keseluruhannya, minuman isotonik menunjukkan peningkatan tahap glukosa darah yang paling tinggi, diikuti oleh jus tembikai dan air kosong. Walau bagaimanapun, jus tembikai menghasilkan bacaan glukosa darah yang paling hampir dengan bacaan baseline pemain. Kesimpulannya, jus tembikai berpotensi digunakan sebagai alternatif semula jadi kepada minuman isotonik dalam membantu proses pemulihan tahap glukosa darah selepas perlawanan bola sepak.

This study aimed to identify and compare changes in blood glucose levels among Universiti Teknologi Malaysia (UTM) football players after consuming three different types of beverages, namely plain water, isotonic drink and watermelon juice, following a football match. This study employed design using a quantitative approach. A total of 11 UTM football players were selected as the study sample. The players' blood glucose levels were measured using a glucometer before and after the consumption of each beverage, specifically after the match and 30 minutes after the beverage was consumed. The data were analysed using descriptive statistics involving mean and standard deviation, as well as inferential analysis using paired sample t-tests. The findings showed that the players' baseline blood glucose level was 5.18 ± 0.18 mmol/L. For plain water, blood glucose levels increased from 4.66 ± 0.16 mmol/L to 4.73 ± 0.16 mmol/L. The isotonic drink showed an increase from 4.65 ± 0.15 mmol/L to 5.78 ± 0.18 mmol/L, while watermelon juice increased from 4.65 ± 0.16 mmol/L to 5.48 ± 0.18 mmol/L. The paired sample t-test results indicated significant differences between blood glucose readings before and after the consumption of plain water, isotonic drink and watermelon juice. Overall, the isotonic drink produced the highest increase in blood glucose levels, followed by watermelon juice and plain water. However, watermelon juice produced blood glucose readings that were closest to the players' baseline level. In conclusion, watermelon juice has the potential to be used as a natural alternative to isotonic drinks in supporting blood glucose recovery after a football match.

PERBANDINGAN TAHAP PENGUASAAN KEMAHIRAN ASAS ATLET SEPAK TAKRAW BAGI PELAJAR SMK PULAI JAYA DAN SMK SRI PULAI PERDANA

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Penguasaan kemahiran asas merupakan faktor penting dalam pembangunan atlet kerana kemahiran seperti kawalan bola serta koordinasi mata dan kaki akan mempengaruhi kecekapan pelaksanaan teknik dalam permainan sepak takraw. Sehubungan itu, kajian ini bertujuan mengenal pasti dan membandingkan tahap penguasaan kemahiran asas atlet sepak takraw antara pelajar SMK Pulai Jaya dan SMK Seri Pulai Perdana. Kajian ini melibatkan 30 orang atlet sepak takraw lelaki berumur 13 hingga 15 tahun, terdiri daripada 15 orang atlet bagi setiap sekolah. Instrumen kajian merangkumi Ujian Menimang Bola dalam Bulatan dan Ujian Koordinasi Mata dan Kaki. Data dianalisis secara deskriptif menggunakan min dan sisihan piawai serta secara inferensi menggunakan ujian-t sampel bebas pada aras signifikan $p < 0.05$. Dapatan kajian menunjukkan bahawa atlet SMK Pulai Jaya memperoleh skor min yang lebih tinggi dalam Ujian Menimang Bola dalam Bulatan ($M = 48.84$, $SD = 3.02$) berbanding atlet SMK Seri Pulai Perdana ($M = 42.31$, $SD = 3.12$). Bagi Ujian Koordinasi Mata dan Kaki, atlet SMK Pulai Jaya turut mencatatkan skor min yang lebih tinggi ($M = 14.20$, $SD = 1.36$) berbanding atlet SMK Seri Pulai Perdana ($M = 10.33$, $SD = 1.25$). Analisis inferensi menunjukkan terdapat perbezaan yang signifikan bagi kedua-dua komponen kemahiran antara kedua-dua sekolah ($p < 0.001$). Kesimpulannya, atlet SMK Pulai Jaya mempunyai tahap penguasaan kemahiran asas dan koordinasi mata dan kaki yang lebih baik berbanding atlet SMK Seri Pulai Perdana. Dapatan ini menunjukkan bahawa kedua-dua komponen tersebut merupakan aspek penting yang perlu diberi perhatian dalam pembangunan dan latihan atlet sepak takraw.

Fundamental skills and eye-foot coordination are important performance-related components in sepak takraw, as they contribute to the effective execution of technical skills during play. Therefore, this study aimed to identify and compare the level of fundamental skill proficiency among sepak takraw athletes from SMK Pulai Jaya and SMK Seri Pulai Perdana. The study involved 30 male sepak takraw athletes aged 13 to 15 years, comprising 15 athletes from each school. The research instruments consisted of the Ball Juggling in a Circle Test and the Eye-Foot Coordination Test. Data were analysed using descriptive statistics (mean and standard deviation) and inferential statistics using an independent samples t-test at a significance level of $p < 0.05$. The findings revealed that athletes from SMK Pulai Jaya obtained a higher mean score in the Ball Juggling in a Circle Test ($M = 48.84$, $SD = 3.02$) than athletes from SMK Seri Pulai Perdana ($M = 42.31$, $SD = 3.12$). Likewise, athletes from SMK Pulai Jaya achieved a higher mean score in the Eye-Foot Coordination Test ($M = 14.20$, $SD = 1.36$) compared with athletes from SMK Seri Pulai Perdana ($M = 10.33$, $SD = 1.25$). Inferential analysis indicated significant differences between the two schools for both skill components ($p < 0.001$). In conclusion, athletes from SMK Pulai Jaya demonstrated significantly better fundamental skill proficiency and eye-foot coordination than athletes from SMK Seri Pulai Perdana. These findings highlight the importance of developing these components as part of sepak takraw training programmes.

KESAN GABUNGAN LATIHAN PLIOMETRIK DAN OTOT TERAS TERHADAP PRESTASI KUASA EKSPLOSIF PEMAIN BOLA TAMPAR LELAKI UNIVERSITI

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Kajian ini bertujuan untuk mengenal pasti kesan gabungan latihan pliometrik dan otot teras terhadap prestasi kuasa eksplosif pemain bola tampar lelaki Universiti Teknologi Malaysia (UTM), di samping membandingkan perubahan prestasi kuasa eksplosif antara kumpulan rawatan dan kumpulan kawalan selepas intervensi. Kajian ini menggunakan reka bentuk kuantitatif berbentuk eksperimen dengan ujian pra dan pasca yang melibatkan seramai 14 orang pemain bola tampar lelaki UTM yang dipilih menggunakan persampelan bertujuan dan dibahagikan kepada dua kumpulan, iaitu kumpulan rawatan (n=7) dan kumpulan kawalan (n=7). Kumpulan rawatan menjalani program gabungan latihan pliometrik dan otot teras selama empat minggu dengan kekerapan tiga sesi seminggu (12 sesi), manakala kumpulan kawalan meneruskan latihan rutin tanpa intervensi khusus. Prestasi kuasa eksplosif diukur menggunakan ujian Sargent Jump bagi menilai kuasa eksplosif menegak dan ujian Standing Broad Jump bagi menilai kuasa eksplosif mendatar. Data dianalisis menggunakan statistik deskriptif, ujian-t berpasangan (paired sample t-test) dan ujian-t sampel bebas (independent sample t-test) melalui Perisian IBM Statistical Package for the Social Sciences (IBM SPSS) Statistics Versi 31.0. Dapatan kajian menunjukkan bahawa kumpulan rawatan mengalami peningkatan yang signifika n dalam prestasi kuasa eksplosif menegak dan mendatar selepas menjalani intervensi ($p < 0.05$). Selain itu, terdapat perbezaan yang signifikan dalam perubahan prestasi kuasa eksplosif antara kumpulan rawatan dan kumpulan kawalan selepas intervensi, menunjukkan kumpulan rawatan memperoleh peningkatan yang lebih tinggi berbanding kumpulan kawalan. Kesimpulannya, gabungan latihan pliometrik dan otot teras merupakan pendekatan latihan yang berkesan dalam meningkatkan prestasi kuasa eksplosif pemain bola tampar lelaki. Kesimpulannya, gabungan latihan pliometrik dan otot teras berpotensi dijadikan sebagai pendekatan latihan yang praktikal dan berkesan untuk meningkatkan prestasi kuasa eksplosif pemain bola tampar lelaki.

This study aimed to determine the effects of combined plyometric and core training on the explosive power performance of male volleyball players at Universiti Teknologi Malaysia (UTM), as well as to compare the changes in explosive power performance between the treatment and control groups following the intervention. A quantitative experimental research design employing pre-test and post-test measurements was adopted. Fourteen male volleyball players from UTM were selected using purposive sampling and were divided into two groups: a treatment group (n=7) and a control group (n=7). The treatment group participated in a combined plyometric and core training programme for four weeks, consisting of three training sessions per week (12 sessions), whereas the control group continued their regular volleyball training without any specific intervention. Explosive power performance was assessed using the Sargent Jump test to measure vertical explosive power and the Standing Broad Jump test to measure horizontal explosive power. Data were analysed using descriptive statistics, paired sample t-tests, and independent sample t-tests through IBM Statistical Package for the Social Sciences (IBM SPSS) Statistics Version 31.0 software. The findings revealed that the treatment group demonstrated significant improvements in both vertical and horizontal explosive power following the intervention ($p < 0.05$). Furthermore, a significant difference was observed in the changes in explosive power performance between the treatment and control groups after the intervention, indicating that the treatment group achieved greater improvements than the control group. In conclusion, the combination of plyometric and core training is an effective training approach for enhancing the explosive

power performance of male volleyball players. Therefore, the combination of plyometric and core training has the potential to serve as a practical and effective training approach for enhancing the explosive power performance of male volleyball players.

KESAN LATIHAN SPEED ENDURANCE TERHADAP DAYA TAHAN KARDIOVASKULAR ATLET BOLA SEPAK UTM

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Kajian ini dijalankan bagi mengenal pasti keberkesanan latihan Speed Endurance terhadap peningkatan daya tahan kardiovaskular dalam kalangan atlet bola sepak Universiti Teknologi Malaysia (UTM). Kajian ini bertujuan untuk (1) mengukur perubahan daya tahan kardiovaskular atlet sebelum dan selepas mengikuti latihan Speed Endurance serta (2) membandingkan daya tahan kardiovaskular antara kumpulan eksperimen yang mengikuti latihan Speed Endurance dengan kumpulan kawalan selepas tempoh intervensi. Kajian menggunakan reka bentuk eksperimental yang melibatkan 30 orang atlet lelaki bola sepak UTM yang dibahagikan kepada kumpulan eksperimen (n = 15) dan kumpulan kawalan (n = 15). Kumpulan eksperimen menjalani program latihan Speed Endurance selama empat minggu, manakala kumpulan kawalan meneruskan latihan rutin pasukan. Tahap daya tahan kardiovaskular diukur menggunakan Yo-Yo Intermittent Recovery Test Level 2 (Yo-Yo IR2) sebelum dan selepas intervensi. Data dianalisis menggunakan Statistical Package for the Social Sciences (SPSS) melalui statistik deskriptif, ujian normaliti, Ujian-t Berpasangan dan Ujian-t Tidak Bersandar pada aras signifikan $p < 0.05$. Dapatan kajian menunjukkan kumpulan eksperimen mencatat peningkatan purata jarak larian daripada 1190.67 ± 145.78 meter kepada 1418.67 ± 161.50 meter, manakala kumpulan kawalan hanya meningkat daripada 1140.00 ± 70.10 meter kepada 1186.67 ± 74.71 meter. Keputusan Ujian-t Berpasangan menunjukkan terdapat perbezaan yang signifikan antara ujian pra dan ujian pos bagi kumpulan eksperimen ($t = -14.187$, $p < 0.001$), manakala Ujian-t Tidak Bersandar turut menunjukkan perbezaan yang signifikan antara kumpulan eksperimen dan kumpulan kawalan selepas intervensi ($t = -5.049$, $p < 0.001$). Kesimpulannya, latihan Speed Endurance berkesan dalam meningkatkan daya tahan kardiovaskular atlet bola sepak UTM dan sesuai diaplikasikan dalam program latihan atlet di peringkat universiti.

This study was conducted to determine the effectiveness of Speed Endurance training in improving cardiovascular endurance among football athletes at Universiti Teknologi Malaysia (UTM). The objectives of this study were to (1) measure the changes in cardiovascular endurance before and after participating in a Speed Endurance training programme and (2) comparing cardiovascular endurance between the experimental group undergoing speed-endurance training and the control group after the intervention period. A quasi-experimental research design was employed involving 30 male UTM football athletes, who were divided into an experimental group (n = 15) and a control group (n = 15). The experimental group underwent a four-week Speed Endurance training programme, while the control group continued their regular team training. Cardiovascular endurance was assessed using the Yo-Yo Intermittent Recovery Test Level 2 (Yo-Yo IR2) before and after the intervention. Data were analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive statistics, normality tests, paired-samples t-tests, and independent-samples t-tests at a significance level of $p < 0.05$. The findings showed that the experimental group demonstrated an increase in the mean running distance from 1190.67 ± 145.78 m to

1418.67 ± 161.50 m, whereas the control group showed only a slight improvement from 1140.00 ± 70.10 m to 1186.67 ± 74.71 m. The paired-samples t-test revealed a significant difference between the pre-test and post-test scores for the experimental group ($t = -14.187$, $p < 0.001$). Furthermore, the independent-samples t-test indicated a significant difference between the experimental and control groups after the intervention ($t = -5.049$, $p < 0.001$). In conclusion, Speed Endurance training was found to be effective in improving the cardiovascular endurance of UTM football athletes and is recommended as a training method for enhancing football performance at the university level.

PERBANDINGAN KESAN REGANGAN DINAMIK DAN REGANGAN STATIK TERHADAP PRESTASI LOMPATAN MENEGAK PELAJAR UNIVERSITI TEKNOLOGI MALAYSIA

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Regangan adalah komponen penting dalam rutin pemanasan badan sebelum melakukan aktiviti fizikal kerana ia berpotensi mempengaruhi prestasi atlet khususnya aktiviti yang memerlukan kuasa eksplosif anggota bawah badan. Walau bagaimanapun, masih terdapat perdebatan mengenai jenis regangan yang paling berkesan untuk meningkatkan prestasi lompatan menegak. Kajian ini dijalankan bagi membandingkan kesan regangan dinamik dan regangan statik terhadap prestasi lompatan menegak dalam kalangan pelajar Universiti Teknologi Malaysia (UTM). Objektif kajian ini adalah untuk menilai keberkesanan regangan dinamik dan regangan statik terhadap prestasi lompatan menegak serta membandingkan prestasi lompatan menegak antara kumpulan regangan dinamik, kumpulan regangan statik dan kumpulan kawalan. Kajian ini menggunakan reka bentuk eksperimental yang melibatkan seramai 15 orang pelajar UTM yang dibahagikan kepada tiga kumpulan, iaitu kumpulan regangan dinamik, kumpulan regangan statik dan kumpulan kawalan yang
masing-masing terdiri daripada lima orang peserta. Intervensi telah dijalankan selama empat minggu dan prestasi lompatan menegak diukur melalui ujian pra dan ujian pasca menggunakan skor tertinggi yang diperoleh oleh peserta. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) yang melibatkan statistik deskriptif, ujian-t berpasangan, analisis varians satu hala (ANOVA) dan analisis Post Hoc Tukey HSD. Dapatan kajian menunjukkan bahawa kumpulan regangan dinamik mencatatkan peningkatan purata tertinggi sebanyak 6.40 cm, diikuti oleh kumpulan regangan statik sebanyak 3.60 cm dan kumpulan kawalan sebanyak 1.00 cm. Keputusan analisis inferensi menunjukkan bahawa kedua-dua kumpulan eksperimen mengalami peningkatan yang signifikan, manakala analisis ANOVA menunjukkan terdapat perbezaan yang signifikan antara ketiga-tiga kumpulan kajian. Dapatan ini selari dengan kajian yang menyatakan bahawa regangan dinamik lebih berkesan dalam meningkatkan prestasi aktiviti yang melibatkan kuasa eksplosif berbanding regangan statik. Kesimpulannya, regangan dinamik didapati merupakan kaedah yang paling berkesan dalam meningkatkan prestasi lompatan menegak dan wajar dijadikan komponen utama dalam rutin pemanasan badan sebelum melakukan sebarang aktiviti sukan yang melibatkan penggunaan kuasa bahagian bawah badan.

Stretching is an essential component of a warm-up routine before engaging in physical activity, as it has the potential to influence athletic performance, particularly in activities requiring explosive lower-body power. However, there is still ongoing debate regarding the

most effective type of stretching for enhancing vertical jump performance. This study was conducted to compare the effects of dynamic stretching and static stretching on vertical jump performance among students at Universiti Teknologi Malaysia (UTM). The objectives of this study were to evaluate the effectiveness of dynamic and static stretching on vertical jump performance and to compare vertical jump performance among the dynamic stretching group, static stretching group, and control group. This study employed an experimental research design involving 15 UTM students, who were divided into three groups: a dynamic stretching group, a static stretching group, and a control group, with five participants in each group. The intervention was carried out over a period of four weeks, and vertical jump performance was assessed through pre-test and post-test measurements using each participant's highest recorded jump score. The data were analysed using the Statistical Package for the Social Sciences (SPSS), employing descriptive statistics, paired-samples t-tests, one-way analysis of variance (ANOVA), and Tukey's Honestly Significant Difference (HSD) post hoc analysis. The findings revealed that the dynamic stretching group demonstrated the greatest mean improvement of 6.40 cm, followed by the static stretching group with an improvement of 3.60 cm, while the control group showed an improvement of 1.00 cm. Inferential analysis indicated that both experimental groups experienced statistically significant improvements, while the one-way ANOVA demonstrated a significant difference among the three study groups. These findings are consistent with previous studies suggesting that dynamic stretching is more effective than static stretching in enhancing performance in activities involving explosive power. In conclusion, dynamic stretching was found to be the most effective method for improving vertical jump performance and should be considered a key component of warm-up routines before participating in sports or physical activities that require lower-body explosive power.

KESAN TERAPI BIOELEKTRIK MERIDIAN (BMT) TERHADAP DELAYED ONSET MUSCLE SORENESS (DOMS)

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Delayed Onset Muscle Soreness (DOMS) merupakan ketidakselesaan otot yang dialami individu selepas melakukan aktiviti fizikal berintensiti tinggi dan boleh menjejaskan fungsi serta prestasi otot. Walaupun pelbagai kaedah pemulihan digunakan bagi mengurangkan simptom DOMS, keberkesanan Terapi Bioelektrik Meridian (BMT) masih kurang dikaji berbanding urutan sukan. Kajian ini bertujuan membandingkan keberkesanan BMT dan urutan sukan terhadap pemulihan DOMS berdasarkan perubahan julat pergerakan (ROM) dan tahap ketidakselesaan otot. Kajian eksperimen ini melibatkan 10 orang pelajar atlet lelaki berumur 20 hingga 25 tahun yang dibahagikan secara rawak kepada 2 kumpulan iaitu kumpulan BMT dan kumpulan urutan sukan. Protokol DOMS dilaksanakan melalui aktiviti unilateral eccentric biceps curl pada intensiti 80% daripada satu pengulangan maksimum (1RM). Julat pergerakan (ROM) diukur menggunakan Kinetisense manakala tahap ketidakselesaan otot diukur menggunakan Visual Analogue Scale (VAS) pada 24, 48 dan 72 jam selepas protokol DOMS. Data dianalisis menggunakan Multivariate Analysis of Variance (MANOVA) melalui perisian SPSS versi 31. Keputusan menunjukkan tiada kesan signifikan kumpulan terhadap gabungan nilai ROM, Wilks' $\Lambda = 0.512$, $F(4,5) = 1.190$, $p = 0.417$, $\eta^2 = 0.488$. Begitu juga, tiada kesan signifikan kumpulan terhadap gabungan skor VAS, Wilks' $\Lambda = 0.527$, $F(3,6) = 1.798$, $p = 0.248$, $\eta^2 = 0.473$. Analisis univariat susulan turut menunjukkan tiada perbezaan signifikan antara kumpulan bagi ROM dan VAS pada semua tempoh pengukuran ($p > 0.05$). Dapatan kajian menunjukkan bahawa kedua-dua intervensi mempunyai keberkesanan yang setara dalam membantu proses pemulihan DOMS. Walaupun tiada perbezaan signifikan diperoleh, BMT menunjukkan kecenderungan yang lebih baik secara deskriptif dan berpotensi menjadi alternatif kepada urutan sukan dalam pengurusan DOMS serta berupaya mengurangkan kebergantungan terhadap tekanan manual secara berterusan oleh ahli terapi.

Delayed Onset Muscle Soreness (DOMS) is a condition of muscle discomfort experienced following high-intensity physical activity, which may impair muscle function and athletic performance. Although various recovery interventions have been employed to alleviate DOMS symptoms, the effectiveness of Bioelectric Meridian Therapy (BMT) remains underexplored compared to sports massage. This study aimed to compare the effectiveness of BMT and sports massage in promoting DOMS recovery based on changes in Range of Motion (ROM) and muscle discomfort. This experimental study involved 10 male student-athletes aged 20 to 25 years, who were randomly assigned to either the BMT group or the sports massage group. DOMS was induced using a unilateral eccentric biceps curl protocol at 80% of one-repitition maximum (1RM). ROM was assessed using Kinetisense, while muscle discomfort was measured using the Visual Analogue Scale (VAS) at 24, 48 and 72 hours following the DOMS protocol. Data were analysed using Multivariate Analysis of Variance (MANOVA) in IBM SPSS Statistics Version 31. The results revealed no significant group effect on the combined ROM outcomes (Wilks' $\Lambda = 0.512$, $F(4,5) = 1.190$, $p = 0.417$, $\eta^2 = 0.488$). Similarly, no significant group effect was found on the combined VAS outcomes (Wilks' $\Lambda = 0.527$, $F(3,6) = 1.798$, $p = 0.248$, $\eta^2 = 0.473$). Follow-up univariate analyses also demonstrated no significant differences between the groups for ROM and VAS across all measurement time points ($p > 0.05$). The findings indicate that both interventions were equally effective in facilitating DOMS recovery. Although no statistically significant differences were observed, BMT demonstrated a trend towards better recovery descriptively

and has the potential to serve as an alternative to sports massage in DOMS management. Furthermore, BMT may reduce therapists' reliance on continuous manual pressure during treatment.

KESAN LATIHAN KEKUATAN OTOT BAWAH BADAN TERHADAP PRESTASI KESEIMBANGAN BADAN DALAM KALANGAN PEMAIN BOLA TAMPAR REKREASI LELAKI

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Kajian ini dijalankan adalah untuk mengenal pasti kesan latihan otot bawah badan terhadap prestasi keseimbangan badan dalam kalangan pemain bola tampar rekreasi lelaki di Universiti Teknologi Malaysia. Keseimbangan badan adalah kompenen yang amat penting dalam sukan bola tampar kerana pemain perlu melakukan pergerakan seperti melompat, mendarat dan menukar arah dengan pantas. Reka bentuk kajian ini adalah experimen yang melibatkan ujian pra dan ujian pasca. Kajian ini menggunakan seramai 20 orang subjek yang terdiri daripada pemain bola tampar rekreasi lelaki yang bermain sekurang-kurangnya 3 kali dalam seminggu dipilih sebagai sempel kajian dan dibahagikan kepada dua kumpulan iaitu kumpulan rawatan (n=10) dan kumpulan kawalan (n=10). Kemudian, kumpulan rawatan perlu menjalani program latihan kekuatan otot bawah badan selama empat minggu (3 kali seminggu) manakala kumpulan kawalan tidak menerima sebarang latihan tambahan. Instrumen kajian adalah menggunakan Y-Balance Test dan Four Square Step Test untuk mengukur prestasi keseimbangan badan dinamik. Data yang diperoleh dianalisis menggunakan perisian Statistical Packages for the Social Sciences (SPSS) melalui ujian t-berpasangan untuk melihat prestasi keseimbangan badan pemain bola tampar rekreasi sebelum dan selepas menjalani latihan kekuatan otot bawah badan dan ujian t-tidak bersandar digunakan bagi melihat perbezaan prestasi keseimbangan badan antara kumpulan eksperimen dan kumpulan kawalan selepas menjalani latihan kekuatan otot bawah badan pada aras signifikan $p<0.05$. Dapatan kajian menunjukkan terdapat peningkatan yang signifikan dalam keseimbangan badan bagi kumpulan rawatan selepas menjalani. Bagi ujian Y-Balance Test kaki kanan, skor min meningkat daripada 76.46 ± 8.90 cm kepada 98.95 ± 9.52 cm ($p<0.001$) manakala kaki kiri meningkat daripada 72.17 ± 9.56 cm kepada 98.69 ± 9.85 cm ($p<0.001$). Untuk ujian Four Square Step Test mencatatkan penurunan masa daripada 6.55 ± 0.95 saat kepada 4.42 ± 0.58 saat ($p<0.001$) menunjukkan peningkatan prestasi keseimbangan yang ketara. Bagi analisis perbandingan antara kumpulan turut menunjukkan peningkatan yang signifikan bagi kumpulan rawatan selepas latihan bagi kedua-dua ujian keseimbangan yang dijalankan ($p<0.001$). Kesimpulannya, latihan kekuatan otot bawah selama empat minggu menunjukkan kesan positif prestasi keseimbagan badan pemain rekreasi bola tampar lelaki. Oleh itu, program latihan kekuatan otot bawah badan ini boleh digunakan dengan sistematik dalam latiahn bola tampar bagi meningkatkan prestasi dan dapat mengurangkan risiko kecederaan.

This study was conducted to determine the effects of lower-body strength training on balance performance among male recreational volleyball players at Universiti Teknologi Malaysia. Balance is an important component in volleyball because players frequently perform movements such as jumping, landing, and changing direction quickly during play. This study used an experimental research design involving pre-test and post-test measurements. A total of 20 male recreational volleyball players who played volleyball at least three times per week were selected as participants and divided into two groups: a treatment group (n = 10) and a

control group (n = 10). The treatment group completed a four-week lower-body strength training program, conducted three times per week, while the control group did not receive any additional training. The instruments used in this study were the Y-Balance Test and the Four Square Step Test, which were employed to assess dynamic balance performance. The collected data were analysed using the Statistical Package for the Social Sciences (SPSS). A paired-samples t-test was used to examine changes in balance performance before and after the training programme, while an independent-samples t-test was used to compare balance performance between the treatment and control groups after the intervention. The level of significance was set at $p < 0.05$. The findings showed a significant improvement in balance performance among participants in the treatment group after completing the training programme. For the Y-Balance Test, the mean score for the right leg increased from 76.46 ± 8.90 cm to 98.95 ± 9.52 cm ($p < 0.001$), while the left leg increased from 72.17 ± 9.56 cm to 98.69 ± 9.85 cm ($p < 0.001$). For the Four Square Step Test, the mean completion time decreased from 6.55 ± 0.95 seconds to 4.42 ± 0.58 seconds ($p < 0.001$), indicating a clear improvement in dynamic balance performance. The comparison between groups also showed significant differences in favour of the treatment group after the training programme for both balance tests ($p < 0.001$). In conclusion, a four-week lower-body strength training programme had a positive effect on the balance performance of male recreational volleyball players. Therefore, this training programme can be incorporated into volleyball training routines to improve performance and help reduce the risk of injury.

HUBUNGAN DI ANTARA KETAGIHAN TELEFON PINTAR DENGAN TAHAP MOTIVASI BERSUKAN DALAM KALANGAN PELAJAR FAKULTI SAINS PENDIDIKAN DAN TEKNOLOGI, UNIVERSITI TEKNOLOGI MALAYSIA

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Peningkatan penggunaan telefon pintar dalam kalangan pelajar universiti menimbulkan kebimbangan mengenai kesannya terhadap gaya hidup aktif dan motivasi untuk melibatkan diri dalam aktiviti fizikal. Kajian ini bertujuan mengenal pasti hubungan antara ketagihan telefon pintar dengan motivasi bersukan dalam kalangan 216 orang pelajar di Fakulti Sains Pendidikan dan Teknologi (FEST), Universiti Teknologi Malaysia (UTM). Reka bentuk kajian bersifat kuantitatif dengan menggunakan kaedah tinjauan. Data kajian ini diperolehi menerusi soal selidik Smartphone Addiction Scale – Short Version (SAS-SV) dan Sport Motivation Scale-II (SMS-II). Analisis data dilakukan menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 31. Dapatan kajian menunjukkan bahawa tahap ketagihan telefon pintar dalam kalangan pelajar FEST adalah pada tahap sederhana dengan nilai min 4.7 ± 0.4. Dapatan kajian juga mendapati tahap motivasi bersukan berada pada tahap sederhana dengan nilai min 3.1 ± 1.0. Analisis bagi subskala SMS-II mendapati Identified Regulation mencatatkan skor tertinggi (3.2 ± 1.3), diikuti dengan Intrinsic Regulation (3.1 ± 1.4) dan Amotivation (3.1 ± 1.5). Hasil analisis korelasi Spearman menunjukkan terdapat hubungan positif yang sangat lemah dan tidak signifikan antara tahap ketagihan telefon pintar dengan tahap motivasi bersukan (r=.060, p=.380). Kesimpulannya, ketagihan telefon pintar dalam kalangan pelajar FEST berada pada tahap sederhana, tetapi ia tidak mempunyai hubungan yang signifikan dengan motivasi bersukan.

The increasing use of smartphones among university students has raised concerns regarding its impact on active lifestyles and motivation to participate in sports activities. This study aimed to examine the relationship between smartphone addiction and sports motivation among 216 students from the Faculty of Educational Sciences and Technology (FEST), Universiti Teknologi Malaysia (UTM). A quantitative research design employing a survey method was adopted. Data were collected using the Smartphone Addiction Scale – Short Version (SAS-SV) and the Sport Motivation Scale-II (SMS-II) questionnaires. Data were analysed using the Statistical Package for the Social Sciences (SPSS) Version 31. The findings revealed that the level of smartphone addiction among FEST students was moderate, with a mean score of 4.7 ± 0.4. Similarly, the level of sports motivation was found to be moderate, with a mean score of 3.1 ± 1.0. Analysis of the SMS-II subscales indicated that Identified Regulation recorded the highest mean score (3.2 ± 1.3), followed by Intrinsic Regulation (3.1 ± 1.4) and Amotivation (3.1 ± 1.5). The results of the Spearman correlation analysis showed a very weak positive and non-significant relationship between smartphone addiction and sports motivation (r = .060, p = .380). In conclusion, although smartphone addiction among FEST students was at a moderate level, it was not significantly associated with their sports motivation.

KEBERKESANAN LATIHAN IMAGERI TERHADAP PRESTASI SEPAKAN SERVIS KUDA DALAM KALANGAN ATLET SEPAK TAKRAW KELAB PERLING, JOHOR BAHRU.

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Kajian ini bertujuan untuk mengkaji keberkesanan latihan imageri terhadap prestasi sepakan servis kuda dalam kalangan atlet sepak takraw kelab Perling. Secara khususnya, kajian ini dijalankan untuk menganalisis perbezaan prestasi sepakan servis kuda antara pra dan pasca ujian serta menilai kesan latihan imageri mental terhadap keupayaan imageri atlet menggunakan sport imagery ability questionnaire (SIAQ). Kajian ini menggunakan reka bentuk pra ujian dan pasca ujian yang melibatkan dua kumpulan iaitu kumpulan eksperimen dan kawalan. Seramai 20 orang atlet sepak takraw telah dipilih dan dibahagikan kepada dua kumpulan secara rawak dengan setiap kumpulan terdiri daripada 10 orang atlet. Kumpulan eksperimen menjalani latihan imageri mental manakala kumpulan kawalan tidak menerima intervensi tersebut. Intervensi dijalankan selama 4 minggu sebanyak 12 sesi. Instrumen kajian yang digunakan ialah ujian prestasi sepakan servis kuda dan SIAQ yang mengandungi lima dimensi iaitu skills imagery ability, strategy imagery ability, goal imagery ability, affect imagery ability dan mastery imagery ability. Data dianalisis menggunakan analisis deskriptif, ujian-t berpasangan dan korelasi pearson. Dapatan kajian menunjukkan bahawa kumpulan eksperimen mencatatkan peningkatan signifikan dalam prestasi sepakan servis kuda daripada min 7.80 kepada 10.10, t (9) = -5.438, p= 0.017 manakala kumpulan kawalan tidak menunjukkan perubahan yang signifikan, t (9) = 0.758, p= 0.468. Selain itu, semua lima dimensi SIAQ menunjukkan peningkatan yang signifikan bagi kedua-dua kumpulan dengan nilai $p < 0.001$. Walau bagaimanapun, analisis korelasi pearson menunjukkan bahawa tidak terdapat hubungan yang signifikan antara skor pasca SIAQ dengan prestasi pasca sepakan servis kuda bagi kumpulan eksperimen r = -0.098, p= 0.788 dan kumpulan kawalan r= -0.514, p= 0.129. Kesimpulannya, kumpulan eksperimen menunjukkan latihan imageri mental berkesan dalam meningkatkan prestasi sepakan servis kuda berbanding kumpulan kawalan, ia memberi gambaran berkaitan dengan latihan psikologi khususnya imageri boleh dijadikan sebagai latihan sokongan selain daripada latihan fizikal dan teknikal dalam sukan sepak takraw.

This study aims to examine the effectiveness of imagery training on the performance of sepakan servis kuda among sepak takraw athletes at Perling club. Specifically, this study was conducted to analyze the difference in sepakan servis kuda performed during pre-test and post-test, as well as to evaluate the effects of mental imagery training on athletes using Sports Imagery Ability Questionnaire (SIAQ). This study used a pre-test and post-test design involving two groups, which are experimental group and the control group. A total of 20 sepak takraw athletes were selected and randomly divided into two groups with 10 athletes in each group. The experimental group underwent mental imagery training, while the control group did not receive the intervention. The instruments used in this study were the sepakan servis kuda performance test and the SIAQ, which consists of five dimensions: skill imagery ability, strategy imagery ability, goal imagery ability, affect imagery ability and mastery imagery ability. Data were analyzed using descriptive analysis, paired sample t-test and Pearson Correlations. The findings showed that the experimental group recorded a significant improvement in sepakan servis kuda performance with the mean score increasing from 7.80 to 10.10, t (9) = -5.438, p= 0.017, while the control group did not show any significant change, t (9) = 0.758, p = 0.468. In addition, all five SIAQ dimensions showed significant improvements in both groups with $p < 0.001$. However, Pearson correlations analysis showed

no significant relationship between post-test SIAQ scores and post-test sepakan servis kuda performance in the experimental group r = -0.098, p = 0.788 and the control group r = -0.514, p = 0.129. In conclusion, the experimental group showed that mental imagery training was effective in improving sepakan servis kuda compared to the control group. It can be seen that psychological training, especially imagery training, can be used as support training in addition to physical and technical training in sepak takraw.

KESAN KOMPETENSI JURULATIH TERHADAP PRESTASI PASUKAN BOLA SEPAK DI JOHOR

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Kajian ini dijalankan untuk mengenal pasti tahap kompetensi jurulatih bola sepak serta mengkaji hubungan antara kompetensi jurulatih dengan prestasi pasukan bola sepak di Negeri Johor. Kompetensi jurulatih yang dikaji melibatkan empat konstruk utama iaitu motivasi, strategi permainan, teknik dan pembinaan watak. Selain itu, kajian ini turut mengkaji hubungan antara kompetensi jurulatih dengan markah kemenangan pasukan serta pengalaman melatih bola sepak. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kajian tinjauan. Seramai 30 orang jurulatih bola sepak daripada Program Pembangunan Bola Sepak Johor Darul Ta'zim (JDT) telah dipilih sebagai responden kajian. Instrumen kajian menggunakan borang soal selidik yang diadaptasi daripada Coaching Competency Scale dan telah melalui proses kesahan oleh pakar dengan nilai kesahan 0.80 serta nilai kebolehpercayaan 0.85. Data dianalisis menggunakan statistik deskriptif iaitu min dan sisihan piawai serta statistik inferensi melalui analisis Korelasi Pearson. Dapatan kajian menunjukkan bahawa semua konstruk kompetensi jurulatih berada pada tahap yang tinggi. Konstruk pembinaan watak mencatatkan nilai min tertinggi (M = 4.29, SP = 0.60), diikuti motivasi (M = 4.20, SP = 0.60), strategi permainan (M = 4.14, SP = 0.56) dan teknik (M = 4.10, SP = 0.71). Analisis korelasi menunjukkan bahawa motivasi (r = 0.471, p = 0.009), strategi permainan (r = 0.546, p = 0.002) dan pembinaan watak (r = 0.570, p < 0.001) mempunyai hubungan positif yang signifikan dengan markah kemenangan pasukan kerana mampu meningkatkan prestasi pasukan, manakala teknik (r = 0.330, p = 0.075) tidak menunjukkan hubungan yang signifikan kerana jurulatih mendapatkan pemain melalui sesi pemilihan sebelum dibenarkan menyertai kelab bola sepak DTCJDT yang menyebabkan jurulatih tidak terlalu memikirkan pemain di dalam pasukannya sudah mempunyai kemahiran asas atau belum. Secara keseluruhannya, kajian ini membuktikan bahawa kompetensi jurulatih merupakan faktor penting yang menyumbang kepada peningkatan prestasi pasukan bola sepak. Dapatan kajian ini diharapkan dapat menjadi rujukan kepada jurulatih, organisasi sukan dan pihak berkepentingan dalam usaha memperkukuh pembangunan kejurulatihan bola sepak di Malaysia

This study was conducted to identify the level of football coaching competency and to examine the relationship between coaching competency and football team performance in Johor. The coaching competencies examined consisted of four main constructs, namely motivation, game strategy, technique, and character building. In addition, this study investigated the relationship between coaching competency and team winning scores as well as coaching experience. This study employed a quantitative approach using a survey research design. A total of 30 football coaches from the Johor Darul Ta'zim (JDT) Football Development Programme participated as respondents. The research instrument consisted of a questionnaire adapted from the Coaching Competency Scale, which achieved a content

validity index of 0.80 and a reliability coefficient of 0.85. Data were analysed using descriptive statistics, namely mean and standard deviation, as well as inferential statistics through Pearson Correlation analysis. The findings revealed that all coaching competency constructs were at a high level. Character building recorded the highest mean score (M = 4.29, SD = 0.60), followed by motivation (M = 4.20, SD = 0.60), game strategy (M = 4.14, SD = 0.56), and technique (M = 4.10, SD = 0.71). Correlation analysis showed that motivation (r = 0.471, p = 0.009), game strategy (r = 0.546, p = 0.002), and character building (r = 0.570, p < 0.001) were positively and significantly related to team winning scores, while technique (r = 0.330, p = 0.075) did not demonstrate a significant relationship. Overall, the findings indicate that coaching competency is an important factor contributing to football team performance. The findings are expected to serve as a useful reference for coaches, sports organisations, and relevant stakeholders in strengthening football coaching development in Malaysia.

KECENDERUNGAN ATLET HOKI PADANG MENJARINGKAN GOL (PILIHAN SASARAN) SEMASA PUKULAN PENENTUAN PENALTI

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Pukulan penentuan penalti (penalty shoot-out) digunakan dalam hoki padang untuk menentukan pemenang apabila perlawanan berakhir dengan keputusan seri. Kajian ini bertujuan mengenal pasti kecenderungan pemilihan zon sasaran gol, menganalisis perbezaan pemilihan mengikut posisi, serta menentukan keberkesanan jaringan mengikut zon dan bahagian gawang semasa situasi tersebut. Seramai enam atlet hoki padang (N=6) Universiti Teknologi Malaysia (UTM) berposisi penyerang dan pertahanan terlibat. Setiap pemain melakukan lima kali percubaan, menjadikan jumlah keseluruhan sebanyak 30 percubaan. Data direkiodkan melalui rakaman video dan dianalisis menggunakan perisian Kinovea berdasarkan pembahagian 9 zon sasaran gol. Hasil kajian menunjukkan Zon E paling kerap dipilih (5 percubaan / 22%), diikuti Zon F (4 percubaan / 18%), manakala Zon A, Zon B, Zon C, dan Zon D paling kurang dipilih dengan hanya 1 percubaan (4%). Dari segi posisi, pemain pertahanan mencatatkan keberkesanan jaringan yang lebih tinggi iaitu 26.7% (8 gol) berbanding pemain penyerang 23.3% (7 gol). Bagi keberkesanan jaringan mengikut zon sasaran, Zon D, Zon H, dan Zon I mencatatkan tahap keberkesanan tertinggi iaitu 100%, diikuti Zon F (75%), Zon G (66.7%), Zon A (50%), Zon E (40%), manakala Zon B dan Zon C mencatatkan keberkesanan terendah 0%. Analisis berdasarkan bahagian gawang, kawasan tengah paling kerap dipilih dengan 30.0% (9 percubaan), diikuti kawasan kanan 26.7% (8 percubaan), tersasar 23.3% (7 percubaan), dan kawasan kiri 20.0% (6 percubaan). Walau bagaimanapun, kawasan kanan merekodkan keberkesanan jaringan tertinggi (75.0%), diikuti kawasan kiri (66.7%), dan kawasan tengah terendah (55.6%). Min dan sisihan piawai prestasi keseluruhan jaringan gol dan tidak menjaringkan gol adalah seperti berikut; Jaringan gol; jaring 1.3±0.5 kali dan papan gol 1.3±0.5 kali; Tiada jaringan gol; tamat tempoh masa 8 saat 0.5±0.5 kali, tersasar keluar gol 0.7±0.5 kali, dan diselamatkan oleh penjaga gol 1.2±0.8 kali. Kesimpulannya, melalui analisis pemilihan sasaran ini, pengkaji memperolehi maklum balas berkenaan kecenderungan dan keberkesanan taktikal pemain hoki bagi membantu pemain serta jurulatih merancang strategi latihan yang lebih sistematik dan meningkatkan prestasi dalam situasi penentuan penalti.

Penalty shoot-outs are used in field hockey to determine the winner when a match ends in a

draw. This study aims to identify the tendency of goal target zone selection, analyze the difference in selection by position, and determine the effectiveness of scoring by zone and goal section during the situation. A total of six field hockey athletes (N=6) from Universiti Teknologi Malaysia (UTM) in the attacking and defensive positions were involved. Each player made five attempts, making a total of 30 attempts. The data was recorded through video recording and analyzed using Kinovea software based on the division of 9 goal target zones. The results of the study showed that Zone E was selected most often (5 attempts / 22%), followed by Zone F (4 attempts / 18%), while Zone A, Zone B, Zone C, and Zone D were selected the least with only 1 attempt (4%). In terms of position, defenders recorded a higher scoring effectiveness of 26.7% (8 goals) compared to attackers 23.3% (7 goals). For goal effectiveness by target zone, Zone D, Zone H, and Zone I recorded the highest level of effectiveness which was 100%, followed by Zone F (75%), Zone G (66.7%), Zone A (50%), Zone E (40%), while Zone B and Zone C recorded the lowest effectiveness of 0%. Analysis based on the goal area, the central area was most frequently selected with 30.0% (9 attempts), followed by the right area 26.7% (8 attempts), missed 23.3% (7 attempts), and the left area 20.0% (6 attempts). However, the right area recorded the highest goal effectiveness (75.0%), followed by the left area (66.7%), and the central area the lowest (55.6%). The mean and standard deviation of the overall performance of goal scoring and non-goal scoring are as follows; Goal scoring; net 1.3±0.5 times and goal board 1.3±0.5 times; No goal scoring; 8 seconds time limit expired 0.5±0.5 times, missed the goal 0.7±0.5 times, and was saved by the goalkeeper 1.2±0.8 times. In conclusion, through this target selection analysis, the researcher obtained feedback on the tendencies and tactical effectiveness of hockey players to help players and coaches plan more systematic training strategies and improve performance in penalty shoot-out situations.

KAJIAN KECEDERAAN LAZIM DAN KESEDIAAN UNTUK KEMBALI KEPADA SUKAN DALAM KALANGAN PEMAIN FUTSAL AMATUR

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Kajian ini dijalankan untuk mengenal pasti kecederaan lazim dan kesediaan untuk kembali kepada sukan dalam kalangan pemain futsal amatur. Objektif kajian ini adalah untuk mengenal pasti jenis kecederaan lazim, bahagian anggota tubuh yang lazim mengalami kecederaan, tahap kesediaan dan ketakutan untuk kembali bersukan serta hubungan antara bahagian tubuh yang cedera dengan kesediaan untuk kembali bersukan. Kajian berbentuk tinjauan ini melibatkan seramai 100 orang pemain futsal amatur sebagai responden. Instrumen kajian yang digunakan ialah soal selidik Injury-Psychological Readiness to Return to Sport (I-PRRS) dan Tampa Scale of Kinesiophobia (TSK). Data deskriptif dan data inferensi (korelasi Spearman) dianalisis dengan menggunakan perisian Statistical Package for the Social Sciences (SPSS).
Dapatan kajian menunjukkan bahawa 3 jenis kecederaan yang paling lazim dialami ialah kekejangan otot (64.0%), terseliuh (56.0%) dan lebam (48.0%). Bahagian anggota tubuh yang paling lazim mengalami kecederaan ialah buku lali (37.0%) dan lutut (35.0%). Tahap kesediaan untuk kembali bersukan berada pada tahap sederhana (M = 37.71, SP = 10.42), manakala tahap ketakutan untuk cedera semula juga berada pada tahap sederhana (M = 2.53, SP = 0.42). Analisis korelasi Spearman menunjukkan bahawa terdapat hubungan yang sangat lemah antara bahagian tubuh yang cedera dengan kesediaan untuk kembali bersukan (r = 0.084, p = 0.407). Kesimpulannya, kecederaan lazim dalam kalangan pemain futsal amatur lebih tertumpu kepada kecederaan tisu lembut dan anggota bawah badan, manakala bahagian tubuh yang cedera tidak mempunyai hubungan yang signifikan dengan tahap kesediaan untuk kembali bersukan.

This study was conducted to identify common injuries and readiness to return to sport among amateur futsal players. The objectives of this study were to identify the types of common injuries, the body parts commonly affected by injury, the level of readiness and fear of returning to sport, and the relationship between injured body parts, readiness, and fear of returning to sport. This survey study involved 100 amateur futsal players as respondents. The research instruments used were the Injury-Psychological Readiness to Return to Sport (I-PRRS) questionnaire and the Tampa Scale of Kinesiophobia (TSK). Descriptive and inferential data, using Spearman correlation, were analysed using the Statistical Package for the Social Sciences (SPSS). The findings showed that the three most common types of injuries were muscle cramp (64.0%), sprain (56.0%), and bruise (48.0%). The body parts most commonly affected by injury were the ankle (37.0%) and knee (35.0%). The level of readiness to return to sport was moderate (M = 37.71, SD = 10.42), while the level of fear of re-injury was also moderate (M = 2.53, SD = 0.42). Spearman correlation analysis showed a very weak relationship between injured body parts and readiness to return to sport (r = 0.084, p = 0.407). In conclusion, common injuries among amateur futsal players were mainly related to soft tissue injuries and lower limb injuries, while injured body parts had no significant relationship with the level of readiness to return to sport.

PERBANDINGAN KEBERKESANAN DI ANTARA LATIHAN PLIOMETRIK DAN LATIHAN KEKUATAN OTOT TERHADAP PRESTASI AEROBIK PELARI REKREASI JARAK JAUH DI UNIVERSITI TEKNOLOGI MALAYSIA.

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Prestasi aerobik merupakan komponen utama dalam menentukan kejayaan pelari jarak jauh, namun peningkatan prestasi aerobik dalam kalangan pelari rekreasi sering terhad kerana hanya menumpukan latihan larian konvensional tanpa integrasi latihan sokongan berkesan. Kajian ini bertujuan menganalisis kesan latihan pliometrik dan kekuatan otot terhadap prestasi aerobik serta membandingkan keberkesanan kedua-dua latihan dalam kalangan pelari rekreasi jarak jauh di Universiti Teknologi Malaysia (UTM). Reka bentuk kajian adalah eksperimental dengan ujian pra-pasca melibatkan dua kumpulan intervensi dan satu kumpulan kawalan. Seramai 15 pelari rekreasi (18-35 tahun) dibahagikan secara rawak kepada tiga kumpulan (n=5 setiap kumpulan). Intervensi pliometrik dan kekuatan otot dijalankan selama 4 minggu, 3 sesi/minggu. Prestasi aerobik diukur menggunakan ujian Cooper 12 minit. Data dianalisis menggunakan paired sample t-test dan one-way ANOVA. Dapatan menunjukkan peningkatan signifikan dalam kumpulan pliometrik (p=0.002) dengan peningkatan min jarak larian daripada 2446.00m kepada 2528.00m. Kesemua subjek kumpulan pliometrik menunjukkan peningkatan individu. Kumpulan kekuatan otot (p=0.116) dan kawalan (p=0.426) tidak menunjukkan perubahan signifikan, dengan seorang peserta kekuatan otot menurun 30m dan dua peserta kawalan masing-masing menurun 50m. Variasi data besar (SP=89.44 dan 136.34) menyebabkan keputusan tidak signifikan. Analisis ANOVA menunjukkan tiada perbezaan signifikan antara kumpulan (p=0.344). Kesimpulannya, latihan pliometrik 4 minggu berkesan meningkatkan prestasi aerobik pelari rekreasi, manakala latihan kekuatan otot dalam tempoh sama tidak memberi kesan signifikan. Kajian lanjutan disarankan dengan saiz sampel lebih besar dan tempoh intervensi lebih panjang.

Aerobic performance is a key component in determining the success of long-distance runners; however, improvements in aerobic performance among recreational runners are often limited as they focus solely on conventional running training without integrating effective supplementary exercises. This study aimed to analyze the effects of plyometric and strength training on aerobic performance and to compare the effectiveness of both training methods among recreational long-distance runners at Universiti Teknologi Malaysia (UTM). The study employed an experimental pre-post test design involving two intervention groups and one control group. A total of 15 recreational runners (aged 18-35 years) were randomly assigned to three groups (n=5 per group). Plyometric and strength training interventions were conducted for 4 weeks, with 3 sessions per week. Aerobic performance was measured using the 12-minute Cooper test. Data were analyzed using paired sample t-test and one-way ANOVA. Findings revealed significant improvement in the plyometric group (p=0.002), with mean running distance increasing from 2446.00m to 2528.00m. All subjects in the plyometric group showed individual improvements. The strength training group (p=0.116) and control group (p=0.426) showed no significant changes, with one strength participant decreasing by 30m and two control participants decreasing by 50m each. Large data variation (SD=89.44 and 136.34) contributed to non-significant results. ANOVA analysis showed no significant differences between groups (p=0.344). In conclusion, 4-week plyometric training effectively improves aerobic performance in recreational runners, while strength training within the same duration does not produce significant effects. Future studies are recommended with larger sample sizes and longer intervention.

PERBANDINGAN MOTIVASI AKADEMIK, MOTIVASI SUKAN DAN MOTIVASI

KERJAYA DALAM KALANGAN PELAJAR-ATLET YANG MENERIMA BIASISWA DAN TIDAK MENERIMA BIASISWA

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Biasiswa merupakan satu bentuk insentif kewangan yang mungkin memberi motivasi kepada pelajar untuk cemerlang dalam akademik, sukan, dan kerjaya. Oleh itu, kajian ini dijalankan dengan tujuan untuk mengkaji kesan biasiswa terhadap ketiga-tiga aspek motivasi tersebut dalam kalangan pelajar-atlet di Universiti Teknologi Malaysia (UTM). Kajian berbentuk tinjauan ini dijalankan dengan menggunakan instrumen Student-Athletes' Motivation toward Sports and Academics Questionnaire (SAMSAQ). Seramai 71 orang responden terlibat dalam kajian ini yang terdiri daripada kumpulan penerima biasiswa dan kumpulan bukan penerima biasiswa. Daripada bilangan responden tersebut, 34 orang pelajar-atlet merupakan penerima biasiswa manakala selebihnya bukan penerima biasiswa. Kajian mendapati tahap motivasi akademik dan motivasi sukan bagi kedua-dua kumpulan adalah sederhana. Bagi motivasi kerjaya, tahap motivasi yang diperolehi bagi kedua-dua kumpulan adalah rendah. Analisis statistik Independent t-test mendapati bahawa tidak terdapat perbezaan yang signifikan antara kedua-dua kumpulan berdasarkan motivasi akademik, motivasi sukan dan motivasi kerjaya. Dapatan ini membuktikan bahawa penerimaan biasiswa tidak semestinya memberi kelebihan kepada pelajar-atlet dalam aspek motivasi akademik, motivasi sukan dan motivasi kerjaya.

Scholarships are a form of financial incentive that may motivate students to excel in academic, sports, and career domains. Therefore, this study was conducted to examine the effect of scholarships on these three dimensions of motivation among student-athletes at Universiti Teknologi Malaysia (UTM). This study employed a survey design using the Student-Athletes' Motivation toward Sports and Academics Questionnaire (SAMSAQ). A total of 71 respondents participated in this study, consisting of scholarship recipients and non-recipients. Out of these, 34 student-athletes were scholarship recipients, while the remainder were non-recipients. The findings indicated that both scholarship recipients and non-recipients demonstrated a moderate level of academic motivation and sports motivation. However, career motivation for both groups was found to be low. An Independent Samples t-test analysis revealed that there were no statistically significant differences between the two groups in terms of academic motivation, sports motivation, and career motivation. These results suggest that receiving a scholarship does not necessarily provide a significant advantage in enhancing student-athletes' academic, sports, and career motivation. Scholarships are a form of financial incentive that may motivate students to excel in academic, sports, and career domains. Therefore, this study was conducted to examine the effect of scholarships on these three dimensions of motivation among student-athletes at Universiti Teknologi Malaysia (UTM). This study employed a survey design using the Student-Athletes' Motivation toward Sports and Academics Questionnaire (SAMSAQ). A total of 71 respondents participated in this study, consisting of scholarship recipients and non-recipients. Out of these, 34 student-athletes were scholarship recipients, while the remainder were non-recipients. The findings indicated that both scholarship recipients and non-recipients demonstrated a moderate level of academic motivation and sports motivation. However, career motivation for both groups was found to be low. An Independent Samples t-test analysis revealed that there were no statistically significant differences between the two groups in terms of academic motivation, sports motivation, and career motivation. These results suggest that receiving a scholarship does not necessarily provide a significant advantage in enhancing student-athletes' academic, sports, and career motivation.

ANALISIS SIMTERI OTOT RECTUS FEMORIS KAKI KIRI DAN KANAN DALAM KALANGAN ATLET EQUESTRIAN DI MALAYSIA

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Sukan ekuestrian memerlukan tahap kestabilan postur, koordinasi pergerakan dan kawalan neuromuskular yang tinggi bagi memastikan interaksi yang berkesan antara penunggang dan kuda. Simetri otot merupakan komponen penting dalam prestasi sukan di mana ketidakseimbangan biomekanikal antara anggota bawah boleh menjejaskan kecekapan pergerakan serta meningkatkan risiko kecederaan. Walau bagaimanapun, kajian berkaitan sifat mekanikal otot dan tahap simetri biomekanikal dalam kalangan atlet ekuestrian masih terhad, khususnya di Malaysia. Oleh itu, kajian ini bertujuan mengenal pasti nilai sifat mekanikal otot rectus femoris serta membandingkan tahap simetri antara kaki kiri dan kaki kanan menggunakan peranti MyotonPro. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk deskriptif dan perbandingan yang melibatkan 10 orang atlet aktif ekuestrian. Pengukuran dilakukan pada otot rectus femoris sebelum Pre dan selepas Post aktiviti menunggang selama 40 minit di Equine Park, Universiti Teknologi Malaysia. Lima parameter mekanikal otot yang dianalisis ialah frequency, stiffness, decrement, relaxation dan creep. Data dianalisis menggunakan statistik deskriptif, Paired Sample t-test, Symmetry Index (SI) dan One Sample t-test. Dapatan kajian menunjukkan bahawa nilai Paired Sample t-test menunjukkan tiada perbezaan yang signifikan antara kaki kiri dan kaki kanan bagi semua parameter mekanikal otot pada fasa Pre dan Post ($p > 0.05$). Analisis SI turut menunjukkan nilai yang hampir kepada sifar, dengan julat antara −4.37% hingga 2.37%, manakala keputusan One Sample t-test mengesahkan bahawa semua nilai SI tidak berbeza secara signifikan daripada sifar ($p > 0.05$). Dapatan ini menunjukkan bahawa atlet ekuestrian yang terlibat mempunyai sifat mekanikal otot rectus femoris yang seimbang serta tahap simetri biomekanikal yang baik antara kedua-dua anggota bawah. Kesimpulannya, aktiviti menunggang selama 40 minit berintensiti sederhana tidak menghasilkan perbezaan yang signifikan terhadap sifat mekanikal otot rectus femoris antara kaki kiri dan kaki kanan. Kajian ini menyumbang kepada data biomekanik dalam sukan ekuestrian di Malaysia dan menyokong penggunaan MyotonPro sebagai instrumen yang objektif dan boleh dipercayai untuk menilai sifat mekanikal otot dan memantau simetri biomekanikal atlet.

Equestrian sport requires a high level of postural stability, movement coordination, and neuromuscular control to ensure effective interaction between the rider and the horse. Muscle symmetry is a key component of sport performance, as biomechanical imbalances between the lower limbs can reduce movement efficiency and increase the risk of injury. However, studies related to the muscle mechanical properties and level of biomechanical symmetry among equestrian athletes remain limited, particularly in Malaysia. Therefore, this study aimed to identify the value of the mechanical properties of the rectus femoris muscle and compare the level of symmetry between the left and right lower limbs using the MyotonPro device. This study employed a quantitative approach with a descriptive and comparative research design involving ten active equestrian athletes. Measurements conducted on the rectus femoris muscle were conducted before Pre and after Post a 40-minute horseback riding activity at the Equine Park, Universiti Teknologi Malaysia. Five muscle mechanical parameters assessed were frequency, stiffness, decrement, relaxation, and creep. Data were analysed using descriptive statistics, the Paired Sample t-test value the Symmetry Index (SI), and the One-Sample t-test. The findings revealed that the Paired Sample t-test value showed no significant differences between the left and right lower limbs for all muscle mechanical parameters for both Pre and Post phases ($p > 0.05$). The Symmetry Index values were also shown close to zero, with range from −4.37% to 2.37%, while the One-Sample t-test confirmed that all SI values were not significantly different from zero ($p > 0.05$). These findings indicate that the equestrian athletes involved were having balanced mechanical

properties of the rectus femoris muscle and good biomechanical symmetry value between the left and right lower limbs. In conclusion, 40-minutes moderate-intensity horseback riding session did not produce significant differences in the mechanical properties of the rectus femoris muscle between the left and right lower limbs. This study contributes to the biomechanical data in the equestrian sport in Malaysia and supports the use of MyotonPro as an objective and reliable tool to assess muscle mechanical properties and monitoring biomechanical symmetry.

MOTIVASI PENYERTAAN SUKAN DALAM KALANGAN PELAJAR FAKULTI SAINS PENDIDIKAN DAN TEKNOLOGI DI UNIVERSITI TEKNOLOGI MALAYSIA

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Penyertaan dalam aktiviti fizikal memainkan peranan penting dalam membentuk kesejahteraan fizikal, sosial dan keperibadian mahasiswa pendidikan. Terdapat kajian yang menyatakan bahawa penglibatan aktiviti fizikal dalam kalangan mahasiswa adalah rendah. Oleh itu, kajian ini dijalankan untuk mengenal pasti tahap setiap dimensi motivasi penyertaan sukan serta membandingkan perbezaannya mengikut program pengajian dan jantina dalam kalangan pelajar Fakulti Sains Pendidikan dan Teknologi (FEST) di Universiti Teknologi Malaysia (UTM). Kajian kuantitatif ini menggunakan kaedah tinjauan bagi mendapatkan maklum balas daripada 200 orang pelajar yang terpilih sebagai responden menerusi persampelan rawak berstrata. Pengumpulan data kajian ini menggunakan soal selidik Participation Motivation Questionnaire (PMQ). Soal selidik ini merangkumi 8 dimensi motivasi penyertaan sukan iaitu kekal aktif, semangat berpasukan, persahabatan, pencapaian, keseronokan, kecergasan fizikal, persaingan dan pembangunan kemahiran. Data deskriptif diterjemahkan dalam bentuk min dan sisihan piawai. Bagi analisis inferensi, ujian ANOVA sehala digunakan bagi membandingkan motivasi penyertaan sukan dalam kalangan pelajar FEST, manakala perbandingan motivasi penyertaan sukan antara jantina dilakukan menerusi analisis ujian Independent T-test. Dapatan kajian menunjukkan program pengajian SHPSH memperoleh skor paling dominan bagi 4 dimensi motivasi penyertaan iaitu semangat berpasukan, keseronokan, kecergasan fizikal dan persaingan. Program SHPEH pula mendominasi 2 dimensi iaitu kekal aktif dan pencapaian. Analisis ANOVA menunjukkan semua dimensi motivasi penyertaan sukan menunjukkan perbezaan yang signifikan antara setiap program kecuali dimensi persahabatan. Analisis Independent T-test menunjukkan terdapat perbezaan yang signifikan berdasarkan jantina, khususnya bagi dimensi kekal aktif, pencapaian dan persaingan. Secara keseluruhannya, kajian ini memberikan gambaran yang jelas tentang variasi motivasi penyertaan sukan dalam kalangan mahasiswa pendidikan berdasarkan program pengajian dan jantina. Dapatan ini menyumbang kepada pengembangan pengetahuan dalam bidang motivasi penyertaan sukan, khususnya dalam konteks mahasiswa pendidikan di Malaysia.

Participation in physical activity plays an important role in promoting the physical, social, and personal well-being of education students. Previous studies have reported that the level of physical activity participation among university students remains low. Therefore, this study was conducted to identify the level of each dimension of sport participation motivation and to compare differences according to academic programme and gender among students of the Faculty of Educational Sciences and Technology (FEST) at Universiti Teknologi Malaysia

(UTM). This quantitative study employed a survey method to obtain responses from 200 students selected through stratified random sampling. Data were collected using the Participation Motivation Questionnaire (PMQ), which comprises eight dimensions of sport participation motivation: staying active, team affiliation, friendship, achievement, enjoyment, physical fitness, competition, and skill development. Descriptive statistics were analysed using the mean and standard deviation. For inferential analysis, a one-way Analysis of Variance (ANOVA) was conducted to compare sport participation motivation across academic programmes, while an Independent Samples t-test was used to examine gender differences. The findings revealed that students from the SHPSH programme recorded the highest scores in four dimensions of sport participation motivation, namely team affiliation, enjoyment, physical fitness, and competition. Meanwhile, students from the SHPEH programme achieved the highest scores in the dimensions of staying active and achievement. The one-way ANOVA indicated significant differences across academic programmes for all dimensions of sport participation motivation except friendship. The Independent Samples t-test also revealed significant gender differences, particularly in the dimensions of staying active, achievement, and competition. Overall, this study identifies variations in sport participation motivation among education students according to academic programme and gender. The findings contribute to the advancement of knowledge in the field of sport participation motivation, particularly within the context of education students in Malaysia.

ANALISIS PERBANDINGAN UJIAN KECERGASAN FIZIKAL DALAM KALANGAN ATLET SILAT WANITA DI MALAYSIA

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Kajian ini bertujuan untuk membandingkan komponen kecergasan fizikal, ciri antropometri dan komposisi badan dalam kalangan individu sedentari, atlet Silat Seni dan atlet Silat Olahraga wanita di Malaysia. Seramai 30 orang peserta wanita berumur antara 15 hingga 20 tahun terlibat dalam kajian ini dan dibahagikan kepada tiga kumpulan, iaitu kumpulan sedentari, atlet Silat Seni dan atlet Silat Olahraga, dengan 10 orang peserta bagi setiap kumpulan. Semua peserta menjalani pengukuran antropometri dan komposisi badan, manakala kapasiti aerobik dianggarkan berdasarkan penggunaan oksigen maksimum VO2max melalui ujian beep test. Kapasiti anaerobik pula diukur menggunakan ujian Running-based Anaerobic Sprint Test (RAST), serta kuasa eksplosif otot anggota bawah badan diukur melalui ujian lompat jauh berdiri. Data dianalisis menggunakan ujian Analisis Varians Sehala (One- Way Analysis of Variance, ANOVA) bagi menentukan perbezaan antara ketiga-tiga kumpulan. Hasil kajian menunjukkan bahawa hanya peratusan lemak badan mempunyai perbezaan yang signifikan antara atlet Silat Olahraga dan Silat Seni. Dari aspek kapasiti aerobik, atlet Silat Olahraga dan Silat Seni mencatat nilai VO2max yang signifikan lebih tinggi berbanding kumpulan sedentari, manakala atlet Silat Olahraga turut mencatatkan nilai VO2max yang signifikan lebih tinggi berbanding atlet Silat Seni. Bagi kapasiti anaerobik, kedua-dua kumpulan atlet Silat Seni dan Silat Olahraga menunjukkan nilai Mean Power dan Peak Power yang signifikan lebih tinggi berbanding kumpulan sedentari, namun tiada perbezaan signifikan antara kedua-dua kumpulan atlet. Bagi kuasa eksplosif, atlet Silat Olahraga menunjukkan prestasi yang signifikan lebih baik dalam ujian lompat jauh berdiri berbanding kumpulan sedentari, manakala prestasi atlet Silat Seni tidak menunjukkan perbezaan yang signifikan berbanding kedua-dua kumpulan yang lain. Kesimpulannya, penglibatan dalam sukan silat dikaitkan dengan tahap kecergasan fizikal yang lebih baik berbanding gaya hidup sedentari, khususnya dari aspek kapasiti aerobik dan kapasiti anaerobik. Dapatan kajian ini diharapkan dapat dijadikan rujukan dalam merancang program latihan yang lebih sistematik bagi meningkatkan prestasi atlet silat serta menyokong penyertaan dan pembangunan sukan silat dalam kalangan wanita muda di Malaysia.

This study aimed to compare physical fitness components, anthropometric characteristics, and body composition among sedentary individuals, female Silat Seni athletes, and female Silat Olahraga athletes in Malaysia. A total of 30 female participants aged between 15 and 20 years were involved in this study and divided into three groups, sedentary individuals, Silat Seni athletes, and Silat Olahraga athletes, with 10 participants in each group. All participants underwent anthropometric and body composition measurements. Aerobic capacity was estimated based on maximal oxygen consumption VO2max using the beep test, while anaerobic capacity was assessed using the Running-based Anaerobic Sprint Test (RAST). Explosive power of the lower limb muscles was measured using the standing broad jump test. The data were analysed using a One-Way Analysis of Variance (ANOVA) to determine differences among the three groups. The findings showed that only body fat percentage differed significantly between Silat Olahraga and Silat Seni athletes. In terms of aerobic capacity, both Silat Olahraga and Silat Seni athletes recorded significantly higher VO2max values compared to the sedentary group, while Silat Olahraga athletes also recorded significantly higher VO2max values than Silat Seni athletes. For anaerobic capacity, both Silat Seni and Silat Olahraga athletes demonstrated significantly higher Mean Power and Peak Power values compared to the sedentary group, with no significant difference between

the two athlete groups. In terms of explosive power, Silat Olahraga athletes demonstrated significantly better performance in the standing long jump test compared to the sedentary group, whereas the performance of Silat Seni athletes did not differ significantly from the other two groups. In conclusion, participation in Silat is associated with better physical fitness levels compared to a sedentary lifestyle, particularly in terms of aerobic and anaerobic capacity. The findings of this study are expected to serve as a reference for planning more systematic training programmes to enhance the performance of Silat athletes and support the participation and development of Silat among young women in Malaysia.

PERBANDINGAN KESAN FOAM ROLLING DAN REHAT AKTIF TERHADAP TAHAP KESAKITAN DAN JULAT PERGERAKAN SELEPAS PROTOKOL DELAYED ONSET MUSCLE SORENESS (DOMS)

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Delayed Onset Muscle Soreness (DOMS) merupakan keadaan yang berlaku selepas melakukan aktiviti fizikal berintensiti tinggi sehingga menyebabkan peningkatan tahap kesakitan otot dan pengurangan julat pergerakan (Range of Motion, ROM). Pelbagai kaedah pemulihan telah digunakan bagi mengurangkan gejala DOMS, antaranya foam rolling dan rehat aktif. Walau bagaimanapun, keberkesanan kedua-dua kaedah tersebut dalam tempoh 24 jam sehingga 72 jam masih belum jelas. Oleh itu, kajian ini bertujuan membandingkan kesan penggunaan foam rolling dan rehat aktif terhadap tahap kesakitan menggunakan Skala Analog Visual (VAS) dan ROM selepas protokol DOMS. Kajian eksperimental ini melibatkan 14 orang pelajar perempuan berumur 20 hingga 25 tahun yang dibahagikan secara rawak kepada kumpulan foam rolling dan kumpulan rehat aktif. Kesemua peserta menjalani protokol DOMS menggunakan Counter Movement Jump sebanyak 10 set. Aktiviti tersebut dilaksanakan sebanyak 10 ulangan bagi setiap set. Selepas protokol DOMS, kumpulan foam rolling menjalani intervensi foam rolling selama dua minit, manakala kumpulan rehat aktif menjalani aktiviti standing calf raises sebanyak 50 ulangan. Tahap kesakitan (VAS) dan ROM yang diukur menggunakan universal goniometer direkodkan pada pra, 24 jam, 48 jam dan 72 jam. Data dianalisis secara deskriptif menggunakan min dan sisihan piawai serta Ujian Paired Samples t-Test melalui perisian Statistical Package for the Social Sciences (SPSS) versi 31. Hasil kajian menunjukkan kumpulan foam rolling mengalami perubahan signifikan bagi VAS antara pra hingga 24 jam ($p < 0.001$), 48 hingga 72 jam ($p = 0.006$) dan pra hingga 72 jam ($p = 0.002$). Kumpulan rehat aktif pula menunjukkan perubahan signifikan antara 48 hingga 72 jam ($p = 0.006$). Bagi ROM, kumpulan foam rolling tidak menunjukkan perbezaan signifikan pada semua tempoh pengukuran ($p > 0.05$), manakala kumpulan rehat aktif menunjukkan peningkatan signifikan antara 24 hingga 48 jam ($p = 0.014$). Secara keseluruhannya, kedua-dua intervensi menunjukkan keberkesanan yang hampir setara dalam pemulihan DOMS, namun tiada satu kaedah yang terbukti lebih berkesan. Kajian lanjutan dengan saiz sampel yang lebih besar disarankan bagi meningkatkan kebolehpercayaan dapatan kajian.

Delayed Onset Muscle Soreness (DOMS) is a condition that occurs following high-intensity physical activities, resulting in increased muscle soreness and reduced Range of Motion (ROM). Various recovery methods have been applied to alleviate DOMS symptoms, including foam rolling and active recovery. However, the effectiveness of these two methods within the period of 24 to 72 hours remains unclear. Therefore, this study aimed to compare the effects of foam rolling and active recovery on pain intensity measured using the Visual Analogue Scale (VAS) and ROM following a DOMS protocol. This experimental study involved 14

female students aged between 20 and 25 years, who were randomly assigned into the foam rolling group and active recovery group. All participants underwent a DOMS induction protocol using Counter Movement Jump consisting of 10 sets. The activity was performed with 10 repetitions for each set. Following the DOMS protocol, the foam rolling group performed a two-minute foam rolling intervention, while the active recovery group performed standing calf raises for 50 repetitions. Pain intensity (VAS) and ROM, measured using a universal goniometer, were recorded at pre, 24 hours, 48 hours, and 72 hours post-DOMS protocol. Data were analysed descriptively using mean and standard deviation, as well as the Paired Samples t-Test through the Statistical Package for the Social Sciences (SPSS) version 31. The results showed that the foam rolling group demonstrated significant changes in VAS between pre to 24 hours ($p < 0.001$), 48 to 72 hours ($p = 0.006$), and pre to 72 hours ($p = 0.002$). The active recovery group showed a significant change in VAS between 48 to 72 hours ($p = 0.006$). For ROM, the foam rolling group showed no significant differences across all measurement periods ($p > 0.05$), whereas the active recovery group demonstrated a significant improvement between 24 and 48 hours ($p = 0.014$). Overall, both interventions demonstrated comparable effectiveness in DOMS recovery; however, neither method was proven to be superior. Future studies involving larger sample sizes are recommended to enhance the reliability of the findings.

PERBANDINGAN ANTARA AKTIVITI OTOT TANGAN SEMASA MENGGUNAKAN DUMBBELL DAN RESISTANCE BAND DALAM KALANGAN ATLET HOKI UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini bertujuan untuk membandingkan aktiviti otot biceps brachii semasa melakukan ujian biceps curl menggunakan dumbbell dan resistance band dalam kalangan atlet hoki wanita Universiti Teknologi Malaysia (UTM). Kajian ini membandingkan pengaktifan otot antara dumbbell dan resistance band yang menggunakan eksperimen dengan perbandingan dalam subjek yang sama melibatkan 10 orang atlet hoki wanita UTM berumur 19 tahun hingga 25 tahun. Semua subjek menjalani Ujian One-Repetition Maximum (1RM) bagi menentukan intensiti beban sebelum menjalani ujian biceps curl menggunakan dumbbell dan resistance band pada hari yang berbeza dengan tempoh pemulihan selama 72 jam. Pergerakan subjek diseragamkan menggunakan 60 beats per minute (BPM) bagi memastikan ritma pergerakan konsisten. Aktiviti otot biceps brachii direkodkan menggunakan Electromyography (EMG) dan dianalisis berdasarkan nilai Root Mean Square (RMS). Data dianalisis menggunakan statistik deskriptif dan Data dianalisis menggunakan statistik deskriptif dan Independent Samples t-test melalui perisian SPSS. Dapatan kajian menunjukkan nilai min RMS bagi penggunaan dumbbell ialah 3.569 ± 1.387 manakala penggunaan resistance band ialah 3.100 ± 1.111. Keputusan Independent Sample t-test menunjukkan bahawa tiada perbezaan yang signifikan dalam aktiviti otot biceps brachii antara dumbbell dan resistance Band ($t(18) = 0.834$, $p = 0.415$; $p > 0.05$). Kesimpulannya, penggunaa resistance band mampu menghasilkan tahap pengaktifan otot biceps brachii yang hampir sama dengan dumbbell semasa melakukan biceps curl. Oleh itu, resistance band boleh dijadikan sebagai alternatif kepada dumbbell dalam program latihan apabila berhadapan dengan kekurangan kos, kemudahan atau peralatan.

This study aims to compare the biceps brachii muscle activity during the biceps curl exercise using dumbbells and resistance bands among female field hockey athletes at Universiti Technology Malaysia (UTM). An experimental within-subject design was employed, involving 10 female UTM field hockey athletes aged between 19 and 25 years. All participants underwent a One-Repetition Maximum (1RM) test to determine the appropriate exercise intensity before performing the biceps curl exercise using dumbbells and resistance bands on separate days with a 72-hour recovery period between testing sessions. Movement tempo was standardized at 60 beats per minute (BPM) to ensure consistent exercise execution. Biceps brachii muscle activity was recorded using surface electromyography (EMG) and analysed based on the Root Mean Square (RMS) values. Data were analysed using descriptive statistics and an Independent Samples t-test in SPSS software. The results showed that the mean RMS value for the dumbbell condition was 3.569 ± 1.387 whereas the mean RMS value for the resistance band condition was 3.100 ± 1.111. The Independent Samples t-test revealed no significant difference in biceps brachii muscle activity between the dumbbell and resistance band conditions ($t(18) = 0.834$, $p = 0.415$; $p > 0.05$). In conclusion, resistance bands produced a level of biceps brachii muscle activation comparable to that of dumbbells during the biceps curl exercise. Therefore, resistance bands may be considered a practical alternative to dumbbells in resistance training programmes, particularly when cost, equipment availability or training facilities are limited.

KEBERKESANAN VOLUME LATIHAN PLIOMETRIK TERHADAP JARINGAN LOMPATAN DALAM KALANGAN ATLET BOLA KERANJANG REMAJA LELAKI

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Kajian eksperimen kuantitatif ini bertujuan untuk mengenal pasti keberkesanan volume latihan pliometrik yang berbeza terhadap prestasi jaringan lompatan dalam kalangan atlet bola keranjang remaja lelaki. Seramai 20 orang atlet bola keranjang remaja lelaki berumur antara 13 hingga 15 tahun dari daerah Kubang Pasu, Kedah, dipilih sebagai sampel kajian menggunakan teknik persampelan rawak sistematik dan dibahagikan kepada dua kumpulan intervensi: Kumpulan Volume Rendah (n = 10) dan Kumpulan Volume Tinggi (n = 10). Kedua-dua kumpulan menjalani program latihan pliometrik yang serupa kombinasi Drop Box Jump dan Countermovement Jump selama empat minggu dengan kekerapan tiga kali seminggu, di mana manipulasinya dibezakan melalui jumlah sentuhan kaki (40–80 sentuhan bagi volume rendah dan 80– 160 sentuhan bagi volume tinggi). Instrumen kajian yang digunakan untuk menilai pemboleh ubah bersandar ialah Ujian Jaringan Lompatan 5 Sudut 2 Mata dan Ujian Jaringan Lompatan Mengelecek yang ditadbir pada fasa pra dan pasca intervensi. Data dianalisis secara deskriptif iaitu min dan sisihan piawai serta inferensi menggunakan perisian SPSS versi 27 melalui ujian-t berpasangan (Paired Samples T-test) dan ujian- t sampel bebas (Independent-Samples T-test) pada aras signifikan $p < 0.05$. Dapatan ujian-t berpasangan bagi Ujian Jaringan Lompatan 5 Sudut menunjukkan bahawa Kumpulan Volume Rendah mengalami peningkatan min prestasi yang signifikan secara statistik daripada fasa pra (2.9 ± 1.59) ke fasa pasca (5.1 ± 1.25) dengan nilai $p = 0.01$. Sebaliknya, Kumpulan Volume Tinggi tidak menunjukkan peningkatan yang signifikan (pra: 3.3 ± 1.59, pasca: 4.2 ± 1.39; $p = 0.147$). Bagi Ujian Jaringan Lompatan Mengelecek, kedua-dua kumpulan tidak menunjukkan sebarang perubahan atau peningkatan prestasi yang signifikan ($p > 0.05$). Seterusnya, hasil ujian-t sampel bebas membuktikan tidak terdapat perbezaan yang signifikan dalam pencapaian pasca intervensi antara kedua-dua kumpulan bagi kedua-dua jenis ujian jaringan ($p > 0.05$). Kesimpulannya, intervensi latihan pliometrik volume rendah terbukti lebih efektif dan efisien untuk meningkatkan ketepatan jaringan lompatan statik (5 sudut) dalam kalangan atlet remaja kerana mampu mengoptimumkan adaptasi saraf tanpa mencetuskan kelesuan neuromuskular yang melampau. Bagaimanapun, latihan pliometrik linear yang tidak diintegrasikan dengan komponen ketangkasan pelbagai arah dan manipulasi bola didapati gagal meningkatkan prestasi jaringan kompleks seperti jaringan lompatan selepas mengelecek.

This quantitative experimental study aimed to determine the effectiveness of different plyometric training volumes on jump shooting performance among male adolescent basketball athletes. A total of 20 male adolescent basketball athletes aged 13 to 15 years from the Kubang Pasu district, Kedah, were selected using systematic random sampling and divided into two intervention groups: the Low-Volume Group (n = 10) and the High-Volume Group (n = 10). Both groups underwent a similar four- week plyometric training program (a combination of Drop Box Jump and Countermovement Jump) with a frequency of three time a week, where the training volume was manipulated based on the total number of foot contacts (40–80 contacts for low volume and 80–160 contacts for high volume). The research instruments utilized to measure the dependent variables were the 2-Point 5-Angle Jump Shot Test and the Dribble Jump Shot Test, administered during pre- and post-intervention phases. Data were analyzed descriptively (mean and standard deviation) and inferentially using SPSS version 27 via Paired Samples T-test and Independent- Samples T-test at a significance level

of p < 0.05. The paired t-test results for the 5- Angle Jump Shot Test indicated that the Low-Volume Group experienced a statistically significant increase in mean performance from pre-test (2.9 ± 1.59) to post- test (5.1 ± 1.25) with p = 0.01. Conversely, the High-Volume Group showed no significant improvement (pre-test: 3.3 ± 1.59, post-test: 4.2 ± 1.39; p = 0.147). For the Dribble Jump Shot Test, neither group demonstrated any significant change or performance enhancement (p > 0.05). Furthermore, the independent-samples t-test revealed no significant difference in post-intervention outcomes between the two groups for both shooting tests (p > 0.05). In conclusion, a low-volume plyometric training intervention is proven to be more effective and efficient in enhancing static (5-angle) jump shooting accuracy among adolescent athletes, as it optimizes neural adaptation without inducing excessive neuromuscular fatigue. However, linear plyometric training that lacks integration with multidirectional agility components and ball manipulation failed to improve complex shooting skills, such as jump shooting post-dribbling.

TAHAP KEKUATAN MENTAL PENGADIL KEBANGSAAN NEGERI JOHOR DALAM MENGADILI PERLAWANAN BOLA SEPAK DI PERINGKAT KEBANGSAAN

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Kajian ini dijalankan untuk mengenal pasti tahap kekuatan mental dalam kalangan pengadil kebangsaan Negeri Johor serta mengkaji perbezaan tahap kekuatan mental berdasarkan status pengadil dan kategori pengadil. Kekuatan mental merupakan elemen penting dalam bidang kepengadilan kerana pengadil sering berhadapan dengan tekanan, kritikan serta keperluan membuat keputusan yang tepat dalam situasi yang mencabar. Kajian ini menggunakan reka bentuk tinjauan kuantitatif berbentuk deskriptif. Seramai 36 orang pengadil kebangsaan Negeri Johor yang bernaung di bawah Persatuan Bola Sepak Negeri Johor (PBNJ) telah dipilih sebagai sampel kajian menggunakan kaedah persampelan bertujuan. Instrumen kajian yang digunakan ialah soal selidik yang diadaptasi daripada Mental Toughness Questionnaire (MTQ) yang mengandungi lima subkonstruk iaitu bangkit semula daripada kesilapan (reboundability), pengurusan tekanan (pressure), fokus (concentration), keyakinan (confidence) dan motivasi (motivation). Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui analisis deskriptif, ujian-t tidak bersandar dan analisis varians sehala (ANOVA). Dapatan kajian menunjukkan bahawa tahap kekuatan mental pengadil kebangsaan Negeri Johor berada pada tahap yang baik bagi semua subkonstruk yang dikaji. Subkonstruk motivasi mencatatkan nilai min tertinggi (M = 7.36, SP = 0.76), diikuti fokus (M = 6.97, SP = 0.88), keyakinan (M = 6.83, SP = 0.94), pengurusan tekanan (M = 6.81, SP = 1.69) dan bangkit semula daripada kesilapan (M = 6.33, SP = 1.26). Hasil ujian-t tidak bersandar menunjukkan tidak terdapat perbezaan yang signifikan terhadap tahap kekuatan mental berdasarkan status pengadil (pengadil dan penolong pengadil). Analisis ANOVA pula menunjukkan tidak terdapat perbezaan yang signifikan bagi kebanyakan subkonstruk berdasarkan kategori pengadil (A,A1- Liga Super), (B,B1- Liga Perdana) dan (C,C1-Piala Presiden, Belia dan Piala KPM) kecuali subkonstruk fokus yang menunjukkan perbezaan signifikan. Secara keseluruhannya, kajian ini membuktikan bahawa pengadil kebangsaan Negeri Johor mempunyai tahap kekuatan mental yang baik dan mampu membantu mereka melaksanakan tugas pengadilan dengan lebih berkesan. Dapatan kajian ini diharapkan dapat dijadikan rujukan oleh pihak pengurusan kepengadilan dalam merancang

program pembangunan psikologi dan latihan mental pengadil pada masa hadapan.

This study was conducted to identify the level of mental toughness among national-level referees from Johor and to examine differences in mental toughness based on referee status and category. Mental toughness is a crucial element in officiating, as referees frequently encounter pressure, criticism, and the need to make accurate decisions in challenging situations. A quantitative descriptive survey design was employed. A total of 36 national-level referees from Johor, affiliated with the Johor Football Association (PBNJ), were selected as the study sample using purposive sampling. The research instrument was a questionnaire adapted from the Mental Toughness Questionnaire (MTQ), comprising five sub-constructs: reboundability, pressure, concentration, confidence, and motivation. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software through descriptive analysis, independent samples t-tests, and one-way analysis of variance (ANOVA). The findings indicate that the mental toughness level of Johor's national-level referees was good across all studied sub-constructs. The motivation sub-construct recorded the highest mean value (M = 7.36, SD = 0.76), followed by focus (M = 6.97, SD = 0.88), confidence (M = 6.83, SD = 0.94), pressure management (M = 6.81, SD = 1.69), and rebounding from mistakes (M = 6.33, SD = 1.26). Independent samples t-test results showed no significant difference in mental toughness levels based on referee status (referees and assistant referees). ANOVA analysis revealed no significant differences across most sub-constructs based on referee categories (A, A1 – Super League; B, B1 – Premier League; and C, C1 – President's Cup, Youth Cup, and MOE Cup), with the exception of the "focus" sub-construct, which showed a significant difference. Overall, the study demonstrates that national referees from Johor possess a good level of mental strength, which enables them to perform their officiating duties more effectively. It is hoped that these findings will serve as a reference for refereeing management in planning future psychological development and mental training programs for referees.

SENARAI ABSTRAK
PROJEK SARJANA MUDA (PSM)

SARJANA MUDA TEKNOLOGI DENGAN PENDIDIKAN (REKA BENTUK DAN TEKNOLOGI) DENGAN KEPUJIAN [SHPVH]

PENERIMAAN PELANGGAN RESTORAN TERHADAP PENGGUNAAN MENU DIGITAL BERDASARKAN MODEL PENERIMAAN TEKNOLOGI (TAM)

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Kajian ini bertujuan untuk mengenal pasti tahap penerimaan pelanggan restoran terhadap penggunaan menu digital berdasarkan Model Penerimaan Teknologi atau Technology Acceptance Model (TAM). Kajian ini memberi tumpuan kepada pelanggan generasi Baby Boomers di negeri Johor kerana golongan ini sering dikaitkan dengan tahap literasi digital dan keyakinan teknologi yang berbeza berbanding generasi lebih muda. Empat konstruk utama telah digunakan dalam kajian ini iaitu kebolehgunaan menu digital, kemudahgunaan menu digital, sikap penggunaan menu digital dan niat untuk menggunakan semula sistem menu digital. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan. Seramai 180 orang responden dipilih melalui kaedah persampelan mudah. Responden terdiri daripada pelanggan generasi Baby Boomers yang menetap di negeri Johor serta mempunyai pengalaman atau pendedahan terhadap penggunaan menu digital di restoran Data dikumpulkan melalui borang soal selidik digital yang menggunakan skala Likert lima mata. Responden kajian terdiri daripada pelanggan generasi Baby Boomers yang mempunyai pengalaman atau pendedahan terhadap penggunaan menu digital di restoran. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 31.0 melalui statistik deskriptif yang melibatkan kekerapan, peratusan, min dan sisihan piawai. Dapatan kajian menunjukkan bahawa konstruk kemudahgunaan menu digital berada pada tahap tinggi. Konstruk kebolehgunaan menu digital, sikap penggunaan menu digital dan niat untuk menggunakan semula sistem menu digital pula berada pada tahap sederhana. Hal ini menunjukkan bahawa pelanggan Baby Boomers menerima penggunaan menu digital sebagai satu kemudahan yang berpotensi membantu proses pesanan makanan. Namun begitu, penerimaan tersebut masih belum sepenuhnya kukuh kerana sebahagian responden masih memerlukan sistem yang lebih mudah difahami, jelas dan mesra pengguna. Kajian ini mencadangkan agar pengusaha restoran dan pembangun sistem menu digital menambah baik aspek reka bentuk antaramuka, saiz tulisan, kejelasan arahan, susun atur menu dan sokongan staf bagi meningkatkan keselesaan pelanggan berumur. Secara keseluruhannya, kajian ini menyumbang kepada kefahaman tentang penerimaan teknologi digital dalam industri perkhidmatan makanan serta kepentingan pelaksanaan menu digital yang lebih inklusif.

This study aims to identify the level of restaurant customers' acceptance of digital menus based on the Technology Acceptance Model (TAM). The study focuses on Baby Boomer customers in Johor because this group may have different levels of digital literacy and confidence in using technology compared with younger generations. Four main constructs were examined in this study. These constructs were digital menu usefulness, digital menu ease of use, attitude towards digital menu use and intention to reuse digital menu systems. This study employed a quantitative approach using a cross-sectional survey design. A total of 180 respondents were selected through convenience sampling. The respondents consisted of Baby Boomer customers residing in Johor who had experience or exposure to using digital menus in restaurants. Data were collected through a digital questionnaire using a five-point Likert scale. The data were analysed using the Statistical Package for the Social Sciences (SPSS) version 31.0. Descriptive statistics involving frequency, percentage, mean and standard deviation were used. The findings showed that digital menu ease of use was at a high level. Digital menu usefulness, attitude towards digital menu use and intention to reuse digital menu systems were at a moderate level. These findings indicate that Baby Boomer customers generally found digital menus easy to learn and operate. However, the perceived benefits,

attitude towards use and intention to continue using the systems were not yet fully established. Some respondents still preferred printed menus or required assistance when using digital systems. This study recommends that restaurant operators and digital menu developers improve interface design, font size, clarity of instructions and menu layout. Staff assistance should also be provided to support older customers. Overall, this study contributes to the understanding of digital technology acceptance in the food service industry. It also highlights the importance of implementing digital menus in an inclusive and user-friendly manner.

SISTEM AKUAPONIK PINTAR MENGGUNAKAN KAWALAN MIKRO ARDUINO DAN ESP32-CAM

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Sistem akuaponik merupakan satu kaedah pertanian moden yang menggabungkan akuakultur dan hidroponik dalam satu ekosistem yang saling melengkapi. Walau bagaimanapun, pemantauan sistem akuaponik secara manual memerlukan kehadiran pengguna secara berterusan bagi memeriksa parameter penting seperti nilai pH, suhu air dan paras air, selain menyukarkan pemantauan keadaan fizikal tanaman dari jarak jauh. Oleh itu, projek ini bertujuan membangunkan Sistem Akuaponik Pintar Menggunakan Arduino UNO dan ESP32-CAM bagi membantu pengguna memantau keadaan sistem secara automatik melalui teknologi Internet of Things (IoT). Pembangunan projek ini menggunakan Model ADDIE yang melibatkan lima fasa, iaitu analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Fasa analisis dijalankan melalui soal selidik terhadap 50 orang responden bagi mengenal pasti keperluan pengguna sebelum sistem dibangunkan. Sistem yang dibangunkan mengintegrasikan penderia pH, penderia suhu DS18B20, penderia paras air, Arduino UNO, modul ESP32-CAM dan aplikasi Telegram bagi membolehkan pemantauan parameter air serta penghantaran imej tanaman secara automatik kepada pengguna. Pengujian kefungsian dilaksanakan secara berasingan terhadap setiap komponen sebelum sistem diintegrasikan sepenuhnya. Hasil pengujian menunjukkan bahawa semua penderia berjaya berfungsi dengan baik, manakala sistem berjaya menghantar bacaan parameter serta imej tanaman kepada pengguna melalui Telegram mengikut fungsi yang telah ditetapkan. Secara keseluruhannya, projek ini berjaya mencapai semua objektif yang telah ditetapkan dan berpotensi membantu meningkatkan kecekapan pemantauan sistem akuaponik melalui penggunaan teknologi IoT yang praktikal, mudah digunakan dan berkos rendah.

Aquaponics is a modern farming method that integrates aquaculture and hydroponics into a mutually beneficial ecosystem. However, manual monitoring of an aquaponics system requires continuous physical supervision to inspect essential water quality parameters such as pH, water temperature, and water level, while also making remote observation of plant conditions difficult. Therefore, this project aims to develop a Smart Aquaponics System Using Arduino UNO and ESP32-CAM to enable automatic monitoring through Internet of Things (IoT) technology. The project was developed using the ADDIE model, which consists of five phases: analysis, design, development, implementation, and evaluation. During the analysis phase, a questionnaire involving 50 respondents was conducted to identify user requirements prior to system development. The developed system integrates a pH sensor, DS18B20 temperature sensor, water level sensor, Arduino UNO, ESP32-CAM module, and the Telegram application to monitor water quality parameters and automatically transmit plant images to users. Functional testing was carried out individually on each component before full system integration. The testing results demonstrated that all sensors operated successfully, and the system was able to transmit sensor readings and plant images to users via Telegram according to the intended functionality. Overall, the project successfully achieved all the specified objectives and demonstrates the potential of IoT technology in improving the efficiency of aquaponics monitoring through a practical, user-friendly, and low-cost smart monitoring system.

PENERIMAAN GENERASI MUDA DI JOHOR BAHRU TERHADAP MAKANAN TRADISIONAL DALAM ERA MODENISASI

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Kajian ini mengkaji tahap pengetahuan, pengaruh sosial dan penerimaan generasi muda terhadap makanan tradisional di Johor Bahru dalam era modenisasi, di mana makanan tradisional merupakan elemen penting dalam warisan budaya yang mencerminkan identiti, sejarah dan nilai sosial masyarakat, namun semakin terkesan dengan perubahan gaya hidup moden serta perkembangan teknologi digital yang mempengaruhi corak pemilihan makanan dalam kalangan generasi muda. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan dengan instrumen soal selidik berstruktur sebagai kaedah pengumpulan data, melibatkan responden dalam kalangan generasi muda di Johor Bahru termasuk individu yang bekerja dan menetap di kawasan tersebut, dan data yang diperoleh dianalisis menggunakan perisian SPSS melalui analisis deskriptif serta inferensi iaitu korelasi Pearson bagi mengenal pasti hubungan antara pemboleh ubah kajian. Hasil kajian menunjukkan bahawa tahap pengetahuan dan pengaruh sosial mempunyai hubungan dengan penerimaan generasi muda terhadap makanan tradisional, di samping dapatan yang turut menunjukkan bahawa tahap penerimaan berada pada tahap sederhana dengan pengaruh utama datang daripada rakan sebaya, keluarga dan pendedahan media sosial. Kesimpulannya, kajian ini menegaskan bahawa usaha pemeliharaan makanan tradisional perlu diperkukuhkan melalui pendidikan budaya, pendedahan berterusan dan sokongan persekitaran sosial agar warisan kulinari ini tidak terus terpinggir dalam kalangan generasi muda di era globalisasi.

This study investigates the level of knowledge, social influence, and acceptance of traditional foods among the younger generation in Johor Bahru in the era of modernization. Traditional food is an important component of cultural heritage that reflects the identity, history, and social values of society. However, it is increasingly affected by changes in modern lifestyles and the rapid advancement of digital technology, which influence the food preferences of the younger generation. This study employed a quantitative survey design using a structured questionnaire as the data collection instrument. The respondents consisted of young people living and working in Johor Bahru. The data collected were analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive statistics and inferential analysis, specifically Pearson correlation, to determine the relationships among the variables. The findings indicated that both the level of knowledge and social influence were significantly related to the acceptance of traditional foods among the younger generation. Furthermore, the results showed that the level of acceptance was moderate, with peers, family, and social media exposure identified as the main factors influencing acceptance. In conclusion, this study emphasises the need to strengthen efforts to preserve traditional foods through cultural education, continuous exposure, and support from the social environment to ensure that this culinary heritage continues to be appreciated by the younger generation in the era of globalization.

PEMBANGUNAN BBM BERTERASKAN TEKNOLOGI AI BERDASARKAN MODEL ADDIE: SATU TINJAUAN TERHADAP GURU KOLEJ VOKASIONAL DI MELAKA

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Perkembangan pesat teknologi Artificial Intelligence (AI) telah membawa perubahan yang signifikan dalam bidang pendidikan, khususnya dalam pembangunan Bahan Bantu Mengajar (BBM). Penggunaan AI berupaya membantu guru menghasilkan bahan pengajaran yang lebih interaktif, kreatif dan berkesan. Walau bagaimanapun, kajian berkaitan pembangunan BBM berteraskan AI berdasarkan Model ADDIE dalam konteks Pendidikan dan Latihan Teknikal dan Vokasional (TVET) masih terhad, khususnya dalam kalangan guru Kolej Vokasional di Negeri Melaka. Oleh itu, kajian ini bertujuan untuk mengenal pasti pembangunan Bahan Bantu Mengajar (BBM) berteraskan Artificial Intelligence (AI) berdasarkan Model ADDIE dalam kalangan guru Kolej Vokasional di Negeri Melaka. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kajian tinjauan. Instrumen kajian yang digunakan ialah soal selidik yang dibangunkan berdasarkan Model ADDIE dan diedarkan kepada 137 orang guru Kolej Vokasional di Negeri Melaka yang dipilih menggunakan kaedah persampelan rawak mudah. Data yang diperoleh dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 29.0 dengan menggunakan statistik deskriptif seperti kekerapan, peratusan, min dan sisihan piawai. Hasil kajian menunjukkan bahawa tahap pembangunan BBM berteraskan AI berdasarkan Model ADDIE berada pada tahap yang tinggi. Dapatan menunjukkan bahawa guru-guru Kolej Vokasional mengaplikasikan AI dalam setiap fasa Model ADDIE iaitu Analisis, Reka Bentuk, Pembangunan, Pelaksanaan dan Penilaian. Penggunaan AI didapati membantu guru meningkatkan kecekapan dalam menghasilkan BBM yang lebih sistematik, kreatif, interaktif dan bersesuaian dengan keperluan pembelajaran pelajar. Secara keseluruhannya, pembangunan BBM berteraskan Artificial Intelligence (AI) berdasarkan Model ADDIE dalam kalangan guru Kolej Vokasional di Negeri Melaka berada pada tahap yang tinggi dan diterima secara positif oleh responden. Penggunaan AI didapati berupaya menyokong proses pembangunan bahan pengajaran yang lebih berkualiti, menjimatkan masa dan meningkatkan keberkesanan pengajaran dan pembelajaran.

The rapid advancement of Artificial Intelligence (AI) technology has brought significant changes to the field of education, particularly in the development of Teaching and Learning Materials (TLM). The integration of AI enables educators to produce more interactive, creative, and effective instructional materials. However, studies focusing on AI-based TLM development using the ADDIE Model within the context of Technical and Vocational Education and Training (TVET), particularly among Vocational College teachers in Melaka, remain limited. Therefore, this study aims to identify the development of Artificial Intelligence (AI)-based Teaching and Learning Materials (TLM) according to the ADDIE Model among teachers in Vocational Colleges in Melaka. This study employed a quantitative approach using a survey research design. A questionnaire developed based on the ADDIE Model was used as the research instrument and distributed to 137 Vocational College teachers in Melaka selected through simple random sampling. The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 29.0. Descriptive statistics including frequency, percentage, mean, and standard deviation were utilized to analyze the data. The findings revealed that the level of AI-based TLM development according to the ADDIE Model was high. The results indicated that Vocational College teachers applied AI across all ADDIE phases, namely Analysis, Design, Development, Implementation, and

Evaluation. The use of AI was found to enhance teachers' efficiency in producing more systematic, creative, interactive, and learner-centered teaching materials. In conclusion, the development of Artificial Intelligence (AI)-based Teaching and Learning Materials (TLM) according to the ADDIE Model among Vocational College teachers in Melaka was found to be at a high level and positively accepted by the respondents. The integration of AI supports the development of higher-quality instructional materials, saves time, and enhances the effectiveness of teaching and learning processes. Therefore, the implementation of AI in teaching material development should be strengthened through professional training, adequate technological infrastructure, and continuous integration within the TVET education system.

PENERIMAAN PELAJAR KULINARI TERHADAP PENGGUNAAN KECERDASAN BUATAN GENERATIF (GEN AI) DALAM KURSUS AMALI MASAKAN

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Perkembangan Kecerdasan Buatan Generatif (Gen AI) telah membawa transformasi dalam bidang pendidikan, termasuk Pendidikan dan Latihan Teknikal dan Vokasional (TVET). Walau bagaimanapun, kajian berkaitan penerimaan penggunaan Gen AI dalam kursus amali masakan masih terhad. Kekurangan bukti empirikal mengenai jenis Gen AI yang digunakan serta tahap penerimaan pelajar dari aspek kebolehgunaan, kemudahgunaan, sikap terhadap penggunaan dan niat untuk menggunakan menyukarkan institusi merancang strategi pengintegrasian teknologi yang lebih berkesan dalam pembelajaran amali. Oleh itu, kajian ini bertujuan mengenal pasti jenis Gen AI yang digunakan oleh pelajar kulinari serta menilai tahap penerimaan mereka terhadap penggunaan Gen AI dalam kursus amali masakan berdasarkan aspek kebolehgunaan, kemudahgunaan, sikap terhadap penggunaan dan niat untuk menggunakan. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan yang melibatkan seramai 92 orang pelajar diploma tahun akhir daripada UiTM Cawangan Pulau Pinang Kampus Permatang Pauh dan UiTM Cawangan Terengganu Kampus Dungun. Data dikumpulkan menggunakan soal selidik diadaptasi daripada Model Penerimaan Teknologi (TAM) dan dianalisis menggunakan statistik deskriptif melalui perisian SPSS V31.0. Dapatan kajian menunjukkan bahawa ChatGPT dan Google Gemini merupakan aplikasi Gen AI yang paling banyak digunakan oleh pelajar. Selain itu, tahap penerimaan pelajar terhadap penggunaan Gen AI dari aspek kebolehgunaan, kemudahgunaan, sikap terhadap penggunaan dan niat untuk menggunakan berada pada tahap yang tinggi, sekali gus membuktikan bahawa Gen AI diterima dengan baik sebagai alat sokongan pembelajaran dalam kursus amali masakan. Kajian ini mencadangkan agar institusi pengajian tinggi memperkukuh garis panduan penggunaan Gen AI, menyediakan latihan kepada pensyarah dan pelajar serta menambah baik kurikulum, infrastruktur dan sumber pembelajaran digital bagi memastikan pengintegrasian Gen AI dapat dilaksanakan secara sistematik, berkesan dan mampan dalam pendidikan TVET.

The development of Generative Artificial Intelligence (Gen AI) has brought about transformation in the field of education, including Technical and Vocational Education and Training (TVET). However, studies related to the acceptance of the use of Gen AI in culinary practical courses are still limited. The lack of empirical evidence on the types of Gen AI used and the level of student acceptance in terms of usability, ease of use, attitudes towards use

and intention to use make it difficult for institutions to plan more effective technology integration strategies in practical learning. Therefore, this study aims to identify the types of Gen AI used by culinary students and assess their level of acceptance of the use of Gen AI in culinary practical courses based on the aspects of usability, ease of use, attitudes towards use and intention to use. This study uses a quantitative approach with a survey design involving 92 final year diploma students from UiTM Penang Branch Permatang Pauh Campus and UiTM Terengganu Branch Dungun Campus. Data were collected using a questionnaire adapted from Technology Acceptance Model (TAM) and analyzed using descriptive statistics through SPSS V31.0 software. The findings of the study show that ChatGPT and Google Gemini are the Gen AI applications most widely used by students. In addition, the level of student acceptance of the use of Gen AI in terms of usability, ease of use, attitude towards use and intention to use is at a high level, thus proving that Gen AI is well received as a learning support tool in practical cooking courses. This study recommends that higher education institutions strengthen guidelines for the use of Gen AI, provide training to lecturers and students and improve the curriculum, infrastructure and digital learning resources to ensure that the integration of Gen AI can be implemented systematically, effectively and sustainably in TVET education.

PEMBANGUNAN MODUL PEMBELAJARAN BERASASKAN PROJEK (PJBL) BAGI SUBJEK OPERASI PENGELUARAN TANAMAN PROGRAM PENDIDIKAN KHAS INTEGRASI (PPKI)

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Kajian ini dijalankan bagi membangunkan Modul Pembelajaran Berasaskan Projek (PjBL) bagi subjek Operasi Pengeluaran Tanaman untuk murid Program Pendidikan Khas Integrasi (PPKI). Kajian ini dilaksanakan berikutan kekurangan bahan pembelajaran yang sistematik dan bersesuaian dengan tahap pembelajaran murid PPKI serta keperluan mengintegrasikan pendekatan Pembelajaran Berasaskan Projek (PjBL) dalam pengajaran dan pembelajaran. Objektif kajian ini ialah mengenal pasti keperluan kandungan modul berdasarkan perspektif guru PPKI, membangunkan Modul Pembelajaran Berasaskan Projek (PjBL) berdasarkan Model ADDIE, serta menilai kesahan modul berdasarkan penilaian pakar. Kajian ini menggunakan reka bentuk kajian pembangunan (Developmental Research) dengan mengaplikasikan Model ADDIE yang melibatkan fasa analisis, reka bentuk, pembangunan dan penilaian. Fasa pelaksanaan tidak dijalankan kerana berada di luar skop kajian. Kaedah temu bual separa berstruktur digunakan dalam fasa analisis yang melibatkan tiga orang guru PPKI, manakala proses penilaian kesahan modul melibatkan tiga orang pakar dalam bidang berkaitan. Data temu bual dianalisis menggunakan analisis tematik, manakala data penilaian pakar dianalisis secara analisis dokumen. Dapatan kajian menunjukkan bahawa kandungan modul perlu dibangunkan berdasarkan National Occupational Skills Standard (NOSS) dan Written Instructional Material (WIM), disusun secara sistematik mengikut urutan proses kerja serta menerapkan elemen Pembelajaran Berasaskan Projek (PjBL) yang sesuai dengan tahap murid PPKI. Penilaian pakar turut menunjukkan bahawa modul yang dibangunkan mempunyai tahap kesahan yang baik dari aspek kandungan, reka bentuk dan pentaksiran, dengan beberapa cadangan penambahbaikan dari aspek visual, susun atur kandungan dan instrumen pentaksiran. Kesimpulannya, Modul Pembelajaran Berasaskan Projek (PjBL) yang dibangunkan berpotensi dijadikan sebagai bahan sokongan pengajaran dan pembelajaran bagi membantu guru meningkatkan pengetahuan dan kemahiran murid PPKI dalam subjek Operasi

Pengeluaran Tanaman.

This study was conducted to develop a Project-Based Learning (PjBL) Module for the Crop Production Operations subject for students in the Integrated Special Education Programme (PPKI). The study was carried out due to the lack of systematic learning materials that are suitable for the learning needs of PPKI students, as well as the need to integrate the Project-Based Learning (PjBL) approach into the teaching and learning process. The objectives of this study were to identify the content requirements of the module based on the perspectives of PPKI teachers, to develop a Project-Based Learning (PjBL) Module based on the ADDIE Model, and to evaluate the module's validity through expert validation. This study employed a developmental research design using the ADDIE Model, which consisted of the Analysis, Design, Development and Evaluation phases. The Implementation phase was excluded as it was beyond the scope of the study. Semi-structured interviews were conducted during the analysis phase involving three PPKI teachers, while the module validation process involved three experts in the related field. The interview data were analysed using thematic analysis, whereas the expert validation data were analysed through document analysis. The findings revealed that the module content should be developed based on the National Occupational Skills Standard (NOSS) and the Written Instructional Material (WIM), organised systematically according to the work process sequence, and incorporate Project-Based Learning (PjBL) elements that are appropriate to the learning abilities of PPKI students. The expert evaluation also indicated that the developed module demonstrated good validity in terms of content, design and assessment, with several recommendations for improvement related to visual elements, content organisation and assessment instruments. In conclusion, the developed Project-Based Learning (PjBL) Module has the potential to serve as a teaching and learning resource to assist teachers in enhancing the knowledge and practical skills of PPKI students in the Crop Production Operations subject.

PERSEPSI GURU PELATIH TVET TERHADAP KEBERKESANAN SIMULASI MAYA SEBAGAI ALTERNATIF LATIHAN AMALI BERKOS EFEKTIF

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Kajian ini bertujuan menilai persepsi guru pelatih Pendidikan dan Latihan Teknikal dan Vokasional (TVET) terhadap keberkesanan simulasi maya (Virtual Lab) sebagai alternatif latihan amali yang berkos efektif. Tiga objektif digariskan, iaitu mengenal pasti tahap pengetahuan dan literasi digital guru pelatih, mengkaji persepsi mereka terhadap keberkesanan kos dan keselamatan, serta menganalisis hubungan antara literasi digital dengan penerimaan terhadap simulasi maya. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan deskriptif dan korelasi, dengan Model Penerimaan Teknologi (TAM) oleh Davis (1989) sebagai landasan teori. Seramai 178 orang pelajar tahun 3 dan 4 Program Sarjana Muda Teknologi dengan Pendidikan (TVET) di Universiti Teknologi Malaysia (UTM) dipilih melalui persampelan rawak mudah, melepasi saiz sampel minimum 169 orang menurut Krejcie dan Morgan (1970). Data dikumpul menerusi soal selidik berskala Likert 5 mata dan dianalisis menggunakan perisian SPSS Versi 27.0 melibatkan statistik deskriptif (min dan sisihan piawai) serta statistik inferensi (Korelasi Pearson). Dapatan menunjukkan tahap literasi digital (Min = 3.90), persepsi keberkesanan kos dan keselamatan (Min = 3.92), serta penerimaan keseluruhan terhadap simulasi maya (Min = 3.96) kesemuanya berada pada tahap tinggi. Walau bagaimanapun, analisis item mendedahkan corak "penerimaan bersyarat", di mana guru pelatih meragui keupayaan simulasi maya menggantikan latihan psikomotor fizikal secara mutlak. Ujian Korelasi Pearson mengesahkan hubungan positif yang kuat dan signifikan antara literasi digital dengan penerimaan teknologi ($r = 0.662$, $p < 0.01$), dengan literasi digital menjelaskan 43.9% varians penerimaan. Kesimpulannya, simulasi maya wajar diposisikan sebagai komponen pelengkap dalam model latihan hibrid, dan usaha pemerkasaan integrasinya perlu dilaksanakan secara bersepadu merangkumi peringkat guru pelatih, institusi latihan guru dan dasar Kementerian Pendidikan Malaysia (KPM).

This study aims to evaluate the perceptions of Technical and Vocational Education and Training (TVET) trainee teachers towards the effectiveness of virtual simulation (Virtual Lab) as a cost-effective alternative to hands-on practical training. Three objectives were outlined: to identify the level of trainee teachers' knowledge and digital literacy, to examine their perceptions of cost-effectiveness and safety, and to analyse the relationship between digital literacy and acceptance of virtual simulation. A quantitative approach employing a descriptive and correlational survey design was adopted, grounded in the Technology Acceptance Model (TAM) by Davis (1989). A total of 178 third- and fourth-year students of the Bachelor of Technology with Education (TVET) programme at Universiti Teknologi Malaysia (UTM) were selected through simple random sampling, exceeding the minimum sample size of 169 recommended by Krejcie and Morgan (1970). Data were collected using a 5-point Likert scale questionnaire and analysed using SPSS Version 27.0, involving descriptive statistics (mean and standard deviation) and inferential statistics (Pearson Correlation). The findings revealed that digital literacy (Mean = 3.90), perceptions of cost-effectiveness and safety (Mean = 3.92), and overall acceptance of virtual simulation (Mean = 3.96) were all at a high level. However, item analysis uncovered a pattern of "conditional acceptance", in which trainee teachers doubted the capability of virtual simulation to fully replace physical psychomotor training. The Pearson Correlation test confirmed a strong and significant positive relationship between digital literacy and technology acceptance ($r = 0.662$, $p < 0.01$), with digital literacy explaining 43.9% of the variance in acceptance. In conclusion, virtual simulation should be positioned as a complementary component within a

hybrid training model, and efforts to strengthen its integration should be carried out holistically across the levels of trainee teachers, teacher training institutions, and the policies of the Ministry of Education Malaysia (MOE).

ANALISIS KEPERLUAN PEMBANGUNAN APLIKASI DIAGNOSTIK BERASASKAN KECERDASAN BUATAN (AI) BAGI MEMBANTU PELAJAR RBT MENGESAN RALAT LITAR MEKATRONIK DI UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini bertujuan untuk menganalisis keperluan pembangunan aplikasi diagnostik berasaskan Kecerdasan Buatan (AI) bagi membantu pelajar Reka Bentuk dan Teknologi (RBT) di Universiti Teknologi Malaysia (UTM) dalam mengesan ralat litar fizikal mekatronik secara kendiri. Isu utama yang mendorong kajian ini ialah kekangan tenaga pengajar semasa sesi amali yang menyebabkan pelajar terbeban dengan proses troubleshooting manual yang tidak efisien. Melalui pendekatan kuantitatif yang melibatkan 84 orang responden daripada program Ijazah Sarjana Muda Teknologi dengan Pendidikan (RBT), kajian ini berjaya mengenal pasti profil masalah teknikal yang dominan dalam kalangan pelajar. Analisis data menunjukkan bahawa kesemua item masalah mencatatkan skor min yang tinggi, iaitu: beban emosi akibat troubleshooting manual yang memakan masa (mean = 4.73), isu kerosakan atau ketidakstabilan komponen penderia (mean = 4.65), ralat kelonggaran sambungan wayar pelompat pada papan reka (mean = 4.62), kesalahan padanan antara pin fizikal dengan deklarasi kod Arduino IDE (mean = 4.62), serta kesukaran membezakan kekutuban komponen (mean = 4.49). Keseluruhan data empirikal ini telah disepadukan ke dalam Dokumen Spesifikasi Keperluan Pengguna bagi memastikan blueprint aplikasi yang dihasilkan benar-benar menepati keperluan teknikal dan emosi pelajar. Rumusannya, kajian ini menyediakan asas pembangunan aplikasi AI yang praktikal dan berupaya mengurangkan beban kognitif pelajar, sekali gus menyokong agenda transformasi digital dalam pendidikan teknikal dan vokasional

This study analyzes the requirements for developing an Artificial Intelligence (AI)-based diagnostic application to assist Design and Technology (RBT) students at Universiti Teknologi Malaysia (UTM) in identifying mechatronic circuit faults independently. The research addresses the challenge of limited instructional support during practical sessions, which forces students to rely on inefficient manual troubleshooting. Utilizing a quantitative survey involving 84 students from the Bachelor of Technology with Education (RBT) program, this study comprehensively maps the dominant technical challenges encountered by students. The findings reveal high mean scores across all assessed areas: the emotional burden caused by time-consuming manual troubleshooting (mean = 4.73), issues with unstable or faulty sensors (mean = 4.65), loose jumper wire connections on breadboards (mean = 4.62), errors in mapping physical pins to Arduino IDE code declarations (mean = 4.62), and difficulties in identifying component polarity (mean = 4.49). These empirical findings were integrated into the User Requirement Specification document to ensure that the proposed application blueprint is aligned with both the technical and emotional needs of the users. In conclusion, this study provides a robust foundation for developing a practical AI diagnostic tool that effectively reduces students' cognitive load and supports digital transformation in technical and vocational education.

HUBUNGAN ANTARA PENGGUNAAN TEKNOLOGI DIGITAL DAN PENGAJARAN GURU PELATIH TVET SEMASA PRAKTIKUM (RBT)

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Kajian ini dijalankan untuk mengenal pasti tahap penggunaan teknologi digital, mengenal pasti tahap pengajaran guru pelatih Pendidikan dan Latihan Teknikal dan Vokasional (TVET), serta menentukan hubungan antara penggunaan teknologi digital dan pengajaran guru pelatih TVET semasa praktikum. Kajian ini menggunakan pendekatan kuantitatif melalui reka bentuk tinjauan deskriptif dan korelasi. Populasi kajian terdiri daripada 90 orang guru pelatih TVET Tahun 4 di Universiti Teknologi Malaysia yang telah menjalani praktikum. Berdasarkan Jadual Penentuan Saiz Sampel Krejcie dan Morgan, seramai 73 orang responden dipilih melalui teknik persampelan rawak mudah. Borang soal selidik digunakan sebagai instrumen utama bagi mengumpulkan data berkaitan latar belakang responden, penggunaan teknologi digital dan pengajaran guru pelatih TVET. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS). Statistik deskriptif yang melibatkan kekerapan, peratusan, min dan sisihan piawai digunakan untuk menjawab objektif kajian pertama dan kedua. Analisis Korelasi Pearson pula digunakan untuk menentukan hubungan antara penggunaan teknologi digital dan pengajaran guru pelatih TVET semasa praktikum. Kajian ini diharapkan dapat memberikan gambaran tentang penggunaan teknologi digital dalam pengajaran guru pelatih TVET serta menjadi rujukan kepada guru pelatih, pensyarah, institusi pendidikan dan pihak sekolah dalam merancang latihan, sokongan serta kemudahan teknologi yang bersesuaian. Kajian ini juga diharapkan dapat menyokong usaha memperkukuh penggunaan teknologi digital dalam proses pengajaran dan pembelajaran bagi memenuhi keperluan pendidikan abad ke-21.

This study was conducted to identify the level of digital technology use, determine the level of teaching among Technical and Vocational Education and Training (TVET) trainee teachers, and examine the relationship between digital technology use and the teaching of TVET trainee teachers during practicum. This study employed a quantitative approach using descriptive survey and correlational research designs. The study population consisted of 90 fourth-year TVET trainee teachers at Universiti Teknologi Malaysia who had completed their practicum. Based on the Krejcie and Morgan Sample Size Determination Table, 73 respondents were selected through simple random sampling. A questionnaire was used as the main instrument to collect data concerning the respondents' backgrounds, digital technology use and the teaching of TVET trainee teachers. The data were analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics involving frequency, percentage, mean and standard deviation were used to address the first and second research objectives. Pearson's correlation analysis was used to determine the relationship between digital technology use and the teaching of TVET trainee teachers during practicum. This study is expected to provide an overview of digital technology use in the teaching of TVET trainee teachers and serve as a reference for trainee teachers, lecturers, educational institutions and schools in planning appropriate training, support and technological facilities. The study is also expected to support efforts to strengthen the use of digital technology in teaching and learning to meet the demands of twenty-first-century education.

KEPERLUAN SOKONGAN DAN PEMBANGUNAN KEMAHIRAN BAGI KELESTARIAN PEKERJAAN DALAM KALANGAN KOMUNITI NELAYAN KERANG DI AYER BALOI

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Kajian ini dijalankan untuk meneroka keperluan sokongan dan pembangunan kemahiran bagi kelestarian pekerjaan dalam kalangan komuniti nelayan kerang di Ayer Baloi, Pontian, Johor. Kajian ini memberi tumpuan kepada tiga aspek utama, iaitu cabaran operasi harian, pengurusan hasil dan pemasaran; keperluan pendidikan dan latihan kemahiran; serta bentuk sokongan institusi, modal dan teknologi yang diperlukan oleh nelayan kerang. Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk kajian kes. Data diperoleh melalui temu bual berkumpulan separa berstruktur bersama lima orang nelayan kerang yang mempunyai pengalaman langsung dalam aktiviti penuaian, pengurusan hasil dan pemasaran kerang. Data temu bual dianalisis menggunakan kaedah analisis tematik bagi mengenal pasti tema, subtema dan pola dapatan kajian. Dapatan kajian menunjukkan bahawa nelayan kerang berhadapan dengan cabaran seperti penuaian berdasarkan pesanan, risiko hasil mudah rosak, gangguan cuaca, kos operasi, pengurusan saiz dan gred kerang, kebergantungan kepada orang tengah serta ketiadaan produk nilai tambah. Dari aspek pendidikan dan latihan, nelayan memerlukan pendedahan berkaitan keselamatan makanan, pensijilan halal, tarikh luput, pengurusan hasil, pemprosesan asas, teknologi moden, pemasaran dan keusahawanan. Kajian ini juga mendapati bahawa sokongan institusi, bantuan modal, geran, peralatan pemprosesan, kerjasama universiti, sokongan teknikal dan ujian makmal diperlukan bagi membantu nelayan meningkatkan nilai hasil serta memperluas peluang pasaran. Secara keseluruhannya, kajian ini menunjukkan bahawa kelestarian pekerjaan nelayan kerang tidak hanya bergantung kepada hasil penuaian, tetapi turut dipengaruhi oleh kemahiran, sokongan, teknologi, modal dan keupayaan mengembangkan produk nilai tambah. Kajian ini mencadangkan supaya latihan praktikal, bantuan peralatan berskala komuniti, sokongan pensijilan, ujian makmal dan program pemasaran dilaksanakan secara bersepadu bagi memperkukuh daya saing dan kelestarian pekerjaan nelayan kerang di Ayer Baloi.

This study was conducted to explore the support and skill development needs for job sustainability among the cockle fishing community in Ayer Baloi, Pontian, Johor. The study focused on three main aspects: daily operational challenges, post-harvest management and marketing; education and skill training needs; and the forms of institutional, financial and technological support required by cockle fishermen. This study employed a qualitative approach using a case study design. Data were collected through a semi-structured group interview with five cockle fishermen who had direct experience in cockle harvesting, post harvest handling and marketing. The interview data were analysed using thematic analysis to identify themes, sub-themes and patterns in the findings. The findings revealed that cockle fishermen faced several challenges, including order-based harvesting, the risk of highly perishable harvests, weather disruptions, operational costs, size and grade management, dependence on middlemen and the absence of systematic value-added products. In terms of education and training, the fishermen required exposure to food safety, halal certification, expiry date determination, post-harvest management, basic processing, modern technology, marketing and entrepreneurship. The study also found that institutional support, financial assistance, grants, processing equipment, university collaboration, technical guidance and laboratory testing were needed to help fishermen improve product value and expand market opportunities. Overall, the study shows that the sustainability of cockle fishing livelihoods does not depend solely on harvesting activities, but is also influenced by skills, support,

technology, financial resources and the ability to develop value-added products. This study recommends that practical training, community-scale equipment assistance, certification support, laboratory testing and marketing programmes be implemented in an integrated manner to strengthen the competitiveness and job sustainability of cockle fishermen in Ayer Baloi.

ANALISIS KEPERLUAN PEMBANGUNAN RESEPI VISUAL INKLUSIF BAGI PEMBELAJARAN PEMBUATAN PASTRI DALAM PROGRAM KEMAHIRAN VOKASIONAL SPESIFIK UNTUK MURID BERKEPERLUAN PENDIDIKAN KHAS

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Pembelajaran pembuatan pastri dalam Program Kemahiran Vokasional Spesifik melibatkan prosedur berurutan, penggunaan istilah teknikal serta pengendalian bahan dan peralatan yang memerlukan arahan yang jelas. Bahan yang terlalu bergantung pada teks boleh menimbulkan kesukaran kepada Murid Berkeperluan Pendidikan Khas yang mempunyai tahap kefungsian, penguasaan literasi dan keperluan sokongan yang berbeza. Kajian ini bertujuan mengenal pasti keperluan dan elemen reka bentuk resipi visual inklusif serta merumuskan cadangan spesifikasi reka bentuk bagi pembelajaran pembuatan pastri. Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk deskriptif kualitatif. Dua orang guru pendidikan khas yang mempunyai pengalaman mengajar dalam Program Pendidikan Khas Integrasi dan bidang Kemahiran Vokasional Spesifik dipilih melalui persampelan bertujuan. Data dikumpulkan menggunakan temu bual separa berstruktur yang mengandungi 16 soalan dan dianalisis melalui analisis tematik. Selain itu, dua dokumen sokongan, iaitu bahan rasmi pendidikan khas tempatan dan sebuah resipi visual antarabangsa, dianalisis menggunakan senarai semak elemen reka bentuk sebagai perbandingan luaran terhadap dapatan temu bual. Analisis tematik menghasilkan empat tema utama, iaitu bahan berteks sahaja tidak mencukupi sebagai panduan amali, hierarki teks yang jelas membantu murid mengenal pasti tindakan, visual yang konkrit perlu menunjukkan objek dan tindakan secara tepat, serta struktur berurutan dan format praktikal menyokong penggunaan kendiri. Analisis dokumen menunjukkan bahawa kedua-dua bahan menggunakan langkah bernombor dan arahan yang ringkas, tetapi tidak menonjolkan kata kerja tindakan secara konsisten. Dokumen antarabangsa menunjukkan pemecahan tugasan yang lebih terperinci, manakala aspek format fizikal tidak dapat ditentukan sepenuhnya daripada dokumen yang dianalisis. Berdasarkan kedua-dua analisis, cadangan spesifikasi dirumuskan meliputi penggunaan arahan ringkas, satu tindakan bagi setiap langkah, penonjolan kata kerja, foto sebenar, ilustrasi pergerakan, sudut gambar yang jelas, latar belakang terkawal, susunan langkah yang konsisten, penanda kemajuan dan format bahan yang sesuai digunakan di bengkel. Kajian ini tidak membangunkan atau menguji prototaip, sebaliknya menyediakan asas bagi pembangunan dan pengujian resipi visual bersama Murid Berkeperluan Pendidikan Khas pada masa hadapan.

Pastry-making lessons in the Specific Vocational Skills Programme involve sequential procedures, technical terminology, and the handling of ingredients and equipment, all of which require clear instructions. Materials that rely heavily on written text may present difficulties for Students with Special Educational Needs who have different functional abilities, literacy levels, and support requirements. This study aimed to identify the needs and appropriate design elements of an inclusive visual recipe and to formulate proposed design

specifications for pastry-making instruction. A qualitative approach with a qualitative descriptive design was employed. Two special education teachers with experience teaching in the Special Education Integration Programme and Specific Vocational Skills were selected through purposive sampling. Data were collected using semi-structured interviews consisting of 16 questions and analysed through thematic analysis. In addition, two supporting documents, comprising a local official special education resource and an international visual recipe, were analysed using a design-element checklist as an external comparison with the interview findings. The thematic analysis generated four main themes: text-based materials alone are insufficient as practical guides; a clear text hierarchy helps students identify required actions; concrete visuals should accurately represent objects and actions; and a sequential structure and practical format support independent use. The document analysis showed that both materials used numbered steps and concise instructions but did not consistently emphasise action verbs. The international document demonstrated a more detailed breakdown of tasks, while the physical format of both documents could not be fully determined from the accessible versions. Based on both analyses, the proposed design specifications included concise instructions, one action per step, emphasised action verbs, real photographs, illustrations of movements, clear viewing angles, controlled backgrounds, consistent sequencing, progress indicators, and a format suitable for use in a pastry workshop. This study did not develop or test a prototype; instead, it provides a foundation for the future development and evaluation of visual recipes involving Students with Special Educational Needs.

KESAN PERBELANJAAN ATAS TALIAN TERHADAP PENGURUSAN KEWANGAN PELAJAR UNIVERSITI TEKNOLOGI MALAYSIA

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Kajian ini bertujuan menilai kesan perbelanjaan atas talian terhadap pengurusan kewangan pelajar universiti, memandangkan ledakan e-dagang dikhuatiri memanipulasi corak perbelanjaan mahasiswa yang bergantung kepada sumber kewangan terhad seperti pinjaman pendidikan dan elaun. Tiga objektif utama kajian adalah mengenal pasti tahap faktor pendorong perbelanjaan digital, menilai tahap amalan serta implikasinya, dan menganalisis hubungan antara faktor pendorong tersebut dengan pengurusan kewangan pelajar. Penyelidikan kuantitatif ini menggunakan kaedah tinjauan hirisan lintang menerusi borang soal selidik atas talian berskala Likert Lima-Mata. Seramai 239 mahasiswa Universiti Teknologi Malaysia (UTM) dipilih melalui teknik pensampelan rawak mudah. Data dianalisis secara deskriptif dan inferensi (Korelasi Pearson) menggunakan perisian Statistical Package Ffor the Social Sciences (SPSS). Dapatan kajian menunjukkan tahap faktor pendorong e-dagang berada pada paras tinggi, terutamanya disebabkan tawaran "Penghantaran Percuma" dan skim "Beli Sekarang Bayar Kemudian" (BNPL). Walau bagaimanapun, analisis membuktikan kewujudan "Paradoks Tingkah Laku Kewangan Digital", di mana pelajar secara rasionalnya mengimbangi perbelanjaan impulsif dengan literasi kewangan yang utuh. Majoriti responden konsisten merangka bajet bertulis dan mengekalkan dana kecemasan di kampus. Ujian Korelasi Pearson mengesahkan hubungan positif yang kuat (r = 0.772) antara faktor pendorong dengan amalan pengurusan kewangan positif, serta hubungan negatif yang kuat (r = -0.633) dengan tekanan emosi kewangan. Kesimpulannya, godaan e-dagang tidak melumpuhkan akal rasional mahasiswa, sebaliknya bertindak sebagai pemangkin yang mendisiplinkan perancangan aliran tunai mereka. Kajian ini mencadangkan agar pihak universiti memperkasakan modul Literasi Kewangan Digital yang lebih kontemporari bagi menyokong kesejahteraan pelajar.

This study aims to evaluate the impact of online spending on the financial management of university students, as the boom of e-commerce is feared to manipulate the spending patterns of students who rely on limited financial resources such as educational loans and allowances. The three main objectives of this study are to identify the level of driving factors of digital spending, to assess the level of its practices and implications, and to analyze the relationship between these driving factors and the students' financial management. This quantitative research utilized a cross-sectional survey method through an online questionnaire using a Five-Point Likert scale. A total of 239 students from Universiti Teknologi Malaysia (UTM) were selected via a simple random sampling technique. The data were analyzed descriptively and inferentially (Pearson Correlation) using the Statistical Package for the Social Sciences (SPSS) software. The findings indicated that the level of e-commerce driving factors was high, primarily driven by "Free Shipping" offers and the "Buy Now, Pay Later" (BNPL) schemes. However, the analysis proved the existence of a "Digital Financial Behavior Paradox," where students rationally balance impulsive spending tendencies with solid financial literacy. The majority of respondents consistently outline written budgets and maintain emergency funds on campus. The Pearson Correlation test confirmed a strong positive relationship (r = 0.772) between the driving factors and positive financial management practices, along with a strong negative relationship (r = -0.633) with financial emotional stress. In conclusion, e-commerce temptations do not paralyze the rational minds of university students; instead, they act as a catalyst that disciplines their cash flow planning. This study suggests that universities should empower more contemporary Digital Financial Literacy modules to support student well-being.

PEMBANGUNAN PRODUK INOVASI SERBUK KERANG DARAH (ANADARA GRANOSA) SEBAGAI SERBUK MIKRONUTRIEN BERPOTENSI SEBAGAI SUMBER ZAT BESI UNTUK PELAJAR UNIVERSITI BERISIKO ANEMIA

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Anemia kekurangan zat besi merupakan isu kesihatan yang signifikan dalam kalangan pelajar universiti akibat pengambilan nutrisi tidak seimbang dan kekurangan mikronutrien penting. Oleh itu, kajian ini dijalankan untuk membangunkan serbuk perasa berasaskan kerang darah (Anadara granosa) sebagai produk mikronutrien yang berpotensi menyokong pengambilan zat besi dan pencegahan anemia dalam kalangan pelajar Universiti Teknologi Malaysia (UTM), di samping meningkatkan nilai tambah industri kerang tempatan. Kajian ini dilaksanakan melalui beberapa fasa. Fasa pertama melibatkan pemilihan bahan mentah dan pemprosesan kerang darah sebagai asas pembangunan produk. Fasa kedua merangkumi pembangunan formulasi serbuk perasa serta penghasilan prototaip produk. Fasa ketiga melibatkan penilaian penerimaan deria terhadap produk yang dibangunkan dalam kalangan pelajar universiti menggunakan ujian sensori dengan skala hedonik sembilan mata. Seterusnya, fasa keempat melibatkan analisis kandungan mikronutrien asas seperti zat besi dan mineral berkaitan yang dijalankan oleh makmal analisis makanan bertauliah bagi mengesahkan potensi nutrisi produk. Selain itu, kajian ini turut melibatkan temu bual separa berstruktur bersama komuniti nelayan di Ayer Baloi, Pontian, Johor bagi menilai potensi inovasi produk terhadap nilai tambah industri kerang dan kelestarian ekonomi nelayan tempatan. Dapatan kajian menunjukkan serbuk perasa berasaskan kerang darah mempunyai penerimaan yang baik serta berpotensi menjadi medium penambah mikronutrien yang praktikal, menyokong pencegahan anemia dan pembangunan ekonomi komuniti nelayan secara mampan.

Iron-deficiency anemia is a significant health issue among university students due to unbalanced nutritional intake and a lack of essential micronutrients. Therefore, this study is conducted to develop a seasoning powder based on blood cockles (Anadara granosa) as a micronutrient product that has the potential to support iron intake and anemia prevention among Universiti Teknologi Malaysia (UTM) students, while also increasing the added value of the local cockle industry. This study is carried out through several phases. The first phase involves the selection of raw materials and the processing of blood cockles as the basis for product development. The second phase includes the development of the seasoning powder formulation and the production of the product prototype. The third phase involves the sensory acceptance evaluation of the developed product among university students using a sensory test with a nine-point hedonic scale. Next, the fourth phase involves the analysis of basic micronutrient content such as iron and related minerals, which is conducted by an accredited food analysis laboratory to verify the nutritional potential of the product. In addition, this study also involves semi-structured interviews with the fishing community in Ayer Baloi, Pontian, Johor to evaluate the potential of product innovation in enhancing the added value of the cockle industry and the economic sustainability of local fishermen. The findings of the study show that blood cockle-based seasoning powder has good acceptance and has the potential to become a practical micronutrient enhancement medium, supporting anemia prevention and the sustainable economic development of the fishing community.

HUBUNGAN PENGETAHUAN DAN PENGGUNAAN BAHAN LESTARI DALAM MATA PELAJARAN REKA BENTUK DAN TEKNOLOGI DI SEKOLAH MENENGAH

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Kajian ini dijalankan untuk mengkaji hubungan antara pengetahuan guru dengan penggunaan bahan lestari dalam mata pelajaran Reka Bentuk dan Teknologi (RBT) di sekolah menengah. Kajian ini menggunakan pendekatan kuantitatif melalui kaedah tinjauan dengan menggunakan instrumen soal selidik bagi mengumpul data. Responden kajian terdiri daripada 74 orang guru RBT Tingkatan 1, Tingkatan 2 dan Tingkatan 3 di sekolah menengah Daerah Kluang. Data yang diperoleh daripada soal selidik dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) secara deskriptif dan inferensi bagi menentukan tahap pengetahuan guru, tahap penggunaan bahan lestari serta hubungan antara pengetahuan dengan penggunaan bahan lestari. Dapatan kajian menunjukkan bahawa tahap pengetahuan guru terhadap bahan lestari berada pada tahap tinggi dengan nilai min 4.48, manakala tahap penggunaan bahan lestari dalam mata pelajaran RBT juga berada pada tahap tinggi dengan nilai min 4.53. Analisis Korelasi Pearson menunjukkan terdapat hubungan positif yang signifikan antara pengetahuan guru dengan penggunaan bahan lestari dalam mata pelajaran RBT, iaitu $r = 0.597$, $p < 0.001$. Dapatan ini menunjukkan bahawa guru yang mempunyai tahap pengetahuan yang lebih tinggi cenderung untuk menggunakan bahan lestari dengan lebih kerap dalam pengajaran dan pembelajaran RBT. Secara keseluruhannya, pengetahuan guru memainkan peranan penting dalam menggalakkan penggunaan bahan lestari. Berdasarkan dapatan kajian, beberapa cadangan dikemukakan kepada guru, sekolah dan pihak berkaitan bagi meningkatkan pelaksanaan pendidikan lestari melalui mata pelajaran RBT. Kata kunci: pengetahuan, penggunaan bahan lestari, Reka Bentuk dan Teknologi, guru RBT, pendidikan lestari, sekolah menengah.

This study was conducted to examine the relationship between teachers' knowledge and the use of sustainable materials in the Design and Technology (RBT) subject in secondary schools. This study employed a quantitative approach using a survey method, with a questionnaire as the research instrument for data collection. The respondents consisted of 74 RBT teachers teaching Form 1, Form 2 and Form 3 in secondary schools in the Kluang District. The data obtained from the questionnaires were analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive and inferential statistics to determine the level of teachers' knowledge, the level of use of sustainable materials, and the relationship between both variables. The findings showed that the level of teachers' knowledge of sustainable materials was high, with a mean score of 4.48. The level of use of sustainable materials in the RBT subject was also high, with a mean score of 4.53. Pearson correlation analysis showed a positive and significant relationship between teachers' knowledge and the use of sustainable materials in RBT, with $r = 0.597$, $p < 0.001$. This finding indicates that teachers with higher levels of knowledge tend to use sustainable materials more frequently in RBT teaching and learning. Overall, teachers' knowledge plays an important role in promoting the use of sustainable materials. Based on the findings, several recommendations are proposed for teachers, schools and relevant authorities to improve the implementation of sustainability education through the RBT subject. Keywords: knowledge, use of sustainable materials, Design and Technology, RBT teachers, sustainability education, secondary schools.

KESEDIAAN GURU DALAM MENGINTEGRASIKAN TEKNOLOGI INTERNET PELBAGAI BENDA (IOT) KE DALAM PENGAJARAN DAN PROJEK REKA BENTUK DAN TEKNOLOGI (RBT)

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Kajian ini dijalankan berikutan transformasi sistem pendidikan negara dalam menghadapi gelombang Revolusi Industri 4.0 yang menuntut pengintegrasian teknologi Internet Pelbagai Benda (IoT) secara komprehensif ke dalam mata pelajaran Reka Bentuk dan Teknologi (RBT), namun realitinya wujud jurang yang ketara antara mandat kurikulum dalam Dokumen Standard Kurikulum dan Pentaksiran (DSKP) dengan kualiti pelaksanaan di dalam bilik darjah disebabkan oleh tahap kesediaan guru yang masih belum mencapai tahap optimum. Bertitik tolak daripada permasalahan tersebut, kajian ini bertujuan secara khusus untuk mengenal pasti tahap pengetahuan, kemahiran teknikal dan sikap penerimaan guru RBT terhadap integrasi teknologi IoT, analisis ini bertujuan untuk meninjau kaitan diantara pengetahuan dengan kemahiran teknikal dalam kalangan guru RBT. Kajian ini menggunakan pendekatan kuantitatif melalui reka bentuk tinjauan yang melibatkan seramai 57 orang guru RBT di daerah Johor Bahru yang dipilih menggunakan teknik pensampelan rawak mudah, di mana data dikumpul melalui instrumen soal selidik dan dianalisis menggunakan perisian SPSS untuk mendapatkan statistik deskriptif bagi melihat min dan sisihan piawai serta statistik inferensi melalui ujian korelasi Pearson. Hasil dapatan kajian menunjukkan bahawa tahap pengetahuan guru berada pada tahap sederhana tinggi, manakala tahap kemahiran teknikal mereka didapati berada pada tahap sederhana rendah; walau bagaimanapun, sikap penerimaan guru terhadap teknologi IoT adalah sangat positif dan tinggi, dan analisis korelasi Pearson mendedahkan wujudnya hubungan positif yang sangat kuat serta signifikan antara tahap pengetahuan dengan kemahiran teknikal guru ($r = 0.796$, $p < 0.01$). Secara keseluruhannya, kajian ini merumuskan bahawa defisit dalam kemahiran teknikal praktikal merupakan halangan utama yang menyekat keberkesanan pengajaran, justeru pihak Kementerian Pendidikan Malaysia disyorkan untuk merancang serta melaksanakan kursus peningkatan profesionalisme dan bengkel teknikal yang lebih sistematik dan berfokus kepada penyelesaian masalah praktikal bagi memperkasakan keupayaan guru dalam mendepani cabaran pendidikan berteraskan IoT pada masa hadapan

This study was conducted in response to the national education system's transformation toward the Fourth Industrial Revolution (IR 4.0), which necessitates the comprehensive integration of Internet of Things (IoT) technology into the Design and Technology (RBT) curriculum, despite a notable gap between the Curriculum and Assessment Standard Document (DSKP) mandates and actual classroom implementation due to suboptimal teacher readiness. Aiming to assess the knowledge, technical skills, and acceptance levels of 57 RBT teachers in the Johor Bahru district, this quantitative survey study utilized simple random sampling and analyzed data via SPSS to compute descriptive statistics and Pearson correlation coefficients. The findings reveal that while teachers possess a moderately high level of knowledge and demonstrate a very positive attitude toward IoT integration, their practical technical skills remain at a moderately low level, with a very strong, significant positive correlation observed between their knowledge and technical competence ($r = 0.796$, $p < 0.01$). Consequently, the study identifies a deficit in practical technical skills as the primary barrier to effective instruction, leading to the recommendation that the Ministry of Education Malaysia implement more systematic, practice-oriented professional development and technical workshops to better empower educators to meet the demands of IoT-based education.

PENGARUH REKA BENTUK PEMBUNGKUSAN MAKANAN TERHADAP PEMBELIAN PENGGUNA DI UTM SKUDAI

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Kajian ini dijalankan bagi mengkaji pengaruh reka bentuk pembungkusan makanan dan minuman terhadap keputusan pembelian pengguna di UTM Skudai. Objektif kajian ini adalah untuk mengenal pasti elemen reka bentuk pembungkusan makanan dan minuman yang paling mempengaruhi keputusan pembelian pengguna, menganalisis hubungan antara reka bentuk pembungkusan dengan persepsi kualiti produk, serta mengkaji faktor demografi yang mempengaruhi penilaian pengguna terhadap reka bentuk pembungkusan. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan melalui borang soal selidik sebagai instrumen kajian. Seramai 204 orang responden telah terlibat dalam kajian ini. Data yang diperoleh dianalisis menggunakan statistik deskriptif seperti kekerapan, peratusan, min dan sisihan piawai, serta analisis Korelasi Pearson bagi mengenal pasti hubungan antara pemboleh ubah kajian. Dapatan kajian menunjukkan bahawa elemen warna pembungkusan mencatatkan nilai min tertinggi dalam mempengaruhi minat pengguna untuk membeli produk makanan dan minuman berbungkus. Selain itu, pembungkusan yang menarik juga didapati dapat membentuk persepsi pengguna bahawa sesuatu produk lebih berkualiti. Analisis Korelasi Pearson menunjukkan terdapat hubungan positif yang signifikan antara reka bentuk pembungkusan dengan persepsi kualiti produk dan keputusan pembelian pengguna. Dapatan kajian turut menunjukkan bahawa faktor demografi seperti latar belakang budaya, umur, pendapatan, jantina dan gaya hidup mempengaruhi penilaian pengguna terhadap reka bentuk pembungkusan. Kesimpulannya, reka bentuk pembungkusan makanan dan minuman memainkan peranan penting dalam menarik perhatian pengguna, membentuk persepsi kualiti produk dan mempengaruhi keputusan pembelian. Kajian ini memberi implikasi kepada pengeluar produk, pereka pembungkusan dan pemasar supaya memberi perhatian terhadap elemen reka bentuk pembungkusan bagi meningkatkan daya tarikan dan keyakinan pengguna terhadap produk.

This study was conducted to examine the influence of food and beverage packaging design on consumers' purchasing decisions at UTM Skudai. The objectives of this study were to identify the packaging design elements that most influence consumers' purchasing decisions, to analyse the relationship between packaging design and perceived product quality, and to examine the demographic factors that influence consumers' evaluation of packaging design. This study employed a quantitative survey approach using a questionnaire as the research instrument. A total of 204 respondents participated in this study. The data collected were analysed using descriptive statistics such as frequency, percentage, mean and standard deviation, as well as Pearson correlation analysis to determine the relationships between the research variables. The findings showed that packaging colour recorded the highest mean score in influencing consumers' interest in purchasing packaged food and beverage products. In addition, attractive packaging was found to shape consumers' perception that a product is of higher quality. The Pearson correlation analysis revealed a significant positive relationship between packaging design, perceived product quality and consumers' purchasing decisions. The findings also indicated that demographic factors such as cultural background, age, income, gender and lifestyle influence consumers' evaluation of packaging design. In conclusion, food and beverage packaging design plays an important role in attracting consumers' attention, shaping perceived product quality and influencing purchasing decisions. This study provides implications for product manufacturers, packaging designers and marketers to give greater attention to packaging design elements in order to enhance product attractiveness and consumers' confidence.

PENGGUNAAN TEKNOLOGI IOT DALAM KALANGAN PEKEBUN FERTIGASI KECIL BERASASKAN SAYUR BERBUAH DI KAWASAN KULAI

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Kajian ini dijalankan untuk mengenal pasti tahap penggunaan teknologi Internet of Things (IoT) dalam kalangan pekebun fertigasi kecil berasaskan sayur berbuah di daerah Kulai. Penggunaan teknologi IoT dalam sektor pertanian dilihat mampu meningkatkan kecekapan pengurusan tanaman, mengoptimumkan penggunaan sumber serta meningkatkan hasil pengeluaran. Namun begitu, tahap penggunaan teknologi tersebut dalam kalangan pekebun fertigasi kecil masih kurang diketahui. Oleh itu, kajian ini bertujuan untuk mengenal pasti tahap penggunaan teknologi sensor pintar, teknologi kawalan automatik dan teknologi kawalan jarak jauh dalam kalangan pekebun fertigasi kecil di daerah Kulai. Kajian ini menggunakan reka bentuk kajian tinjauan dengan pendekatan kuantitatif. Instrumen soal selidik digunakan untuk mengumpul data daripada seramai 50 orang responden daripada jumlah populasi seramai 55 orang pekebun fertigasi kecil di daerah Kulai. Data kajian dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) versi 32.0 dengan melibatkan analisis deskriptif seperti kekerapan, peratusan, min dan sisihan piawai. Dapatan kajian menunjukkan bahawa tahap penggunaan teknologi sensor pintar berada pada tahap sederhana dengan nilai min 2.88. Seterusnya, tahap penggunaan teknologi kawalan automatik berada pada tahap tinggi dengan nilai min 4.22. Manakala, tahap penggunaan teknologi kawalan jarak jauh berada pada tahap sederhana dengan nilai min 2.82. Secara keseluruhannya, kajian mendapati bahawa penggunaan teknologi IoT dalam kalangan pekebun fertigasi kecil di daerah Kulai berada pada tahap sederhana. Kajian ini diharapkan dapat membantu pihak berkepentingan seperti Jabatan Pertanian dalam merancang program latihan, bantuan teknologi serta strategi pembangunan pertanian pintar bagi meningkatkan penggunaan teknologi IoT dalam kalangan pekebun fertigasi kecil.

This study was conducted to identify the level of Internet of Things (IoT) technology usage among small-scale fertigation farmers cultivating fruit vegetables in Kulai district. The application of IoT technology in the agricultural sector has the potential to improve crop management efficiency, optimize resource utilization, and enhance agricultural productivity. However, the level of IoT technology usage among small-scale fertigation farmers remains unclear. Therefore, this study aimed to identify the level of usage of smart sensor technology, automatic control technology, and remote control technology among small-scale fertigation farmers in Kulai district. This study employed a survey research design using a quantitative approach. A questionnaire was used as the research instrument to collect data from 50 respondents selected from a population of 55 small-scale fertigation farmers in Kulai district. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 32.0. Descriptive statistical analyses, including frequency, percentage, mean, and standard deviation, were employed to analyze the data. The findings revealed that the level of smart sensor technology usage was at a moderate level, with a mean score of 2.88. The level of automatic control technology usage was found to be high, with a mean score of 4.22. Meanwhile, the level of remote control technology usage was at a moderate level, with a mean score of 2.82. Overall, the study found that the usage of IoT technology among small-scale fertigation farmers in Kulai district was at a moderate level. It is hoped that the findings of this study will assist relevant stakeholders, such as the Department of Agriculture, in planning training programs, technological assistance, and smart agriculture development strategies to enhance the adoption of IoT technology among small-scale fertigation farmers.

TAHAP PENGUASAAN AI DALAM PEMERKASAAN PENDIDIKAN REKA BENTUK DAN TEKNOLOGI DALAM KALANGAN GURU REKA BENTUK DAN TEKNOLOGI.

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Perkembangan teknologi kecerdasan buatan (AI) telah membawa perubahan signifikan dalam bidang pendidikan, khususnya dalam meningkatkan keberkesanan proses pengajaran dan pembelajaran (PdP). Dalam konteks mata pelajaran Reka Bentuk dan Teknologi (RBT), penggunaan AI berpotensi membantu guru menghasilkan pengajaran yang lebih kreatif, interaktif dan selaras dengan keperluan pendidikan abad ke-21. Namun demikian, tahap penguasaan AI dalam kalangan guru RBT masih menjadi isu yang perlu diberi perhatian bagi memastikan teknologi tersebut dapat dimanfaatkan secara optimum dalam PdP. Kajian ini bertujuan untuk menilai tahap penguasaan AI dalam kalangan guru RBT dari aspek pengetahuan, kemahiran dan kesediaan serta menganalisis hubungan antara tahap penguasaan AI dengan pemerkasaan pendidikan RBT. Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan keratan rentas. Seramai 80 orang guru RBT di Johor dipilih sebagai responden melalui kaedah persampelan rawak mudah. Data dikumpulkan menggunakan soal selidik berstruktur yang mengandungi lima bahagian utama dan dianalisis menggunakan statistik deskriptif serta inferensi. Dapatan kajian menunjukkan bahawa tahap penguasaan AI dalam kalangan guru RBT berada pada tahap yang tinggi bagi aspek pengetahuan, kemahiran dan kesediaan. Selain itu, analisis korelasi menunjukkan terdapat hubungan positif yang signifikan antara tahap penguasaan AI dengan pemerkasaan pendidikan RBT. Guru yang mempunyai tahap penguasaan AI yang lebih tinggi didapati lebih berupaya mengintegrasikan teknologi dalam PdP, meningkatkan kreativiti pengajaran serta melaksanakan pembelajaran yang lebih interaktif dan berpusatkan pelajar. Kesimpulannya, penguasaan AI memainkan peranan penting dalam memperkasa pendidikan RBT. Oleh itu, latihan profesional, pembangunan kompetensi digital dan sokongan berterusan daripada pihak berkepentingan perlu dipertingkatkan bagi memastikan guru RBT bersedia mengadaptasi teknologi AI secara berkesan dalam proses PdP.

The rapid advancement of Artificial Intelligence (AI) technology has significantly transformed the educational landscape, particularly in enhancing the effectiveness of teaching and learning processes. In the context of Design and Technology (D&T) education, AI has the potential to support teachers in delivering more creative, interactive, and student-centred learning experiences that align with the demands of 21st-century education. However, the level of AI mastery among D&T teachers remains a concern that requires attention to ensure the effective integration of AI into teaching practices. This study aimed to assess the level of AI mastery among Design and Technology teachers in terms of knowledge, skills, and readiness, as well as to examine the relationship between AI mastery and the empowerment of Design and Technology education. A quantitative cross-sectional survey design was employed in this study. A total of 80 Design and Technology teachers in Johor were selected through simple random sampling. Data were collected using a structured questionnaire consisting of five main sections and were analysed using descriptive and inferential statistics. The findings revealed that the level of AI mastery among Design and Technology teachers was high across the dimensions of knowledge, skills, and readiness. Furthermore, correlation analysis indicated a significant positive relationship between AI mastery and the empowerment of Design and Technology education. Teachers with higher levels of AI mastery demonstrated greater capability in integrating technology into teaching practices, enhancing instructional creativity, and implementing more interactive and student-

centred learning experiences. In conclusion, AI mastery plays a crucial role in empowering Design and Technology education. Therefore, professional training, digital competency development, and continuous support from relevant stakeholders should be strengthened to ensure that teachers are well-prepared to effectively integrate AI into teaching and learning processes.

KEMENJADIAN MURID SEKOLAH MENENGAH KEBANGSAAN (SMK) BERDASARKAN FALSAFAH PENDIDIKAN KEBANGSAAN (FPK)

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Kajian ini dijalankan untuk mengenal pasti tahap keseimbangan pembelajaran murid Sekolah Menengah Kebangsaan berdasarkan aspek Jasmani, Emosi, Rohani, Intelek dan Sosial (JERIS), mengenal pasti faktor luaran yang menyokong keseimbangan pembelajaran murid serta mengenal pasti faktor dalaman yang menjadi cabaran kepada keseimbangan pembelajaran murid. Kajian ini menggunakan pendekatan kuantitatif berbentuk kajian tinjauan. Populasi kajian terdiri daripada 419 orang murid Tingkatan 4 di Sekolah Menengah Kebangsaan Kangkar Pulai, Johor, manakala seramai 100 orang murid dipilih sebagai sampel kajian menggunakan kaedah persampelan rawak mudah. Instrumen kajian yang digunakan ialah soal selidik yang mengandungi lapan bahagian. Kajian rintis yang dijalankan melibatkan 10 orang responden menunjukkan nilai kebolehpercayaan Cronbach's Alpha sebanyak 0.936, yang menandakan instrumen mempunyai tahap kebolehpercayaan yang sangat tinggi. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS) melalui analisis deskriptif yang melibatkan kekerapan, peratusan, min dan sisihan piawai. Dapatan kajian menunjukkan bahawa secara keseluruhannya tahap keseimbangan pembelajaran murid berdasarkan aspek JERIS berada pada tahap sederhana dengan nilai min keseluruhan sebanyak 3.90 (SD = 0.56). Dari aspek faktor luaran, guru dikenal pasti sebagai faktor yang paling dominan dalam membantu pembelajaran murid, diikuti oleh kemudahan internet sebagai sokongan pembelajaran. Selain itu, sokongan daripada pihak sekolah, rakan sebaya dan keluarga turut menyumbang kepada perkembangan murid dari aspek intelek, emosi dan sosial. Bagi faktor dalaman pula, majoriti murid menunjukkan tahap yang positif dari segi cita-cita, disiplin belajar, minat terhadap pembelajaran dan pengurusan tekanan. Walau bagaimanapun, masih terdapat sebahagian murid yang menghadapi cabaran dalam pengurusan tugasan, tahap minat terhadap pembelajaran dan pengendalian tekanan. Secara keseluruhannya, kajian ini menunjukkan bahawa keseimbangan pembelajaran murid dipengaruhi oleh gabungan faktor luaran dan faktor dalaman. Oleh itu, kerjasama antara guru, sekolah, keluarga dan murid sendiri perlu diperkukuhkan bagi memastikan keseimbangan pembelajaran dapat dicapai secara menyeluruh selaras dengan aspirasi Falsafah Pendidikan Kebangsaan.

This study was conducted to identify the level of balanced learning among secondary school students based on the Physical, Emotional, Spiritual, Intellectual, and Social (JERIS) aspects, to identify the external factors that support students' balanced learning, and to identify the internal factors that pose challenges to students' balanced learning. The study employed a quantitative approach using a survey research design. The population consisted of 419 Form Four students from Sekolah Menengah Kebangsaan Kangkar Pulai, while 100 students were selected as the study sample through simple random sampling. A questionnaire consisting of eight sections was used as the research instrument. A pilot study involving 10 respondents was

conducted, and the instrument achieved a Cronbach's Alpha value of 0.936, indicating a very high level of reliability. Data were analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive statistics, including frequency, percentage, mean, and standard deviation. The findings revealed that the overall level of students' balanced learning based on the JERIS aspects was moderate, with an overall mean score of 3.90 (SD = 0.56). In terms of external factors, teachers were identified as the most dominant factor in supporting students' balanced learning, followed by internet accessibility as a learning support resource. In addition, support from the school, peers, and family also contributed to students' intellectual, emotional, and social development. Regarding internal factors, the majority of students demonstrated positive levels of ambition, study discipline, interest in learning, and stress management. However, some students still faced challenges in task management, learning interest, and stress handling. Overall, the study indicates that students' balanced learning is influenced by a combination of external and internal factors. Therefore, collaboration among teachers, schools, families, and students should be strengthened to ensure holistic student development in line with the aspirations of the National Philosophy of Education (NPE).

PEMBANGUNAN MODUL JAHITAN BAJU KURUNG TRADISIONAL BERPUSATKAN PELAJAR BAGI TAHUN SATU KURSUS SENI REKA FESYEN DI KOLEJ VOKASIONAL

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Bidang jahitan memerlukan penguasaan kemahiran praktikal yang tinggi serta bahan pembelajaran yang sistematik bagi membantu pelajar memahami setiap proses pembelajaran dengan lebih berkesan. Walau bagaimanapun, kekurangan bahan rujukan yang khusus bagi topik jahitan baju kurung tradisional menyebabkan proses pengajaran dan pembelajaran kurang menarik serta menyukarkan pelajar untuk menjalankan pembelajaran kendiri. Oleh itu, kajian ini bertujuan untuk mengenal pasti elemen dan ciri modul pengajaran yang sesuai bagi pembangunan modul jahitan baju kurung tradisional berdasarkan pandangan pakar, membangunkan modul jahitan baju kurung tradisional menggunakan pembelajaran berpusatkan pelajar berdasarkan Model Pengajaran ADDIE, serta menilai persepsi guru pakar dan pelajar terhadap kesesuaian modul yang dibangunkan. Kajian ini menggunakan pendekatan kaedah campuran yang melibatkan kaedah kualitatif dan kuantitatif. Seramai tiga orang guru pakar Kursus Seni Reka Fesyen terlibat dalam temu bual dan pengesahan modul, manakala seramai 94 orang pelajar Tahun Satu Kursus Seni Reka Fesyen di Kolej Vokasional ERT Azizah terlibat dalam soal selidik. Instrumen kajian terdiri daripada borang temu bual, borang senarai semak dan borang soal selidik skala Likert empat mata. Kajian rintis telah dijalankan melibatkan 18 orang responden dan memperoleh nilai kebolehpercayaan Cronbach Alpha sebanyak 0.855 yang menunjukkan tahap kebolehpercayaan yang tinggi. Data dianalisis menggunakan analisis tematik serta analisis deskriptif melibatkan frekuensi, peratusan, min dan sisihan piawai. Hasil kajian menunjukkan bahawa guru pakar bersetuju elemen utama yang perlu dimasukkan dalam modul ialah penggunaan bahasa yang mudah difahami, reka bentuk yang menarik, kandungan yang sistematik, penggunaan visual yang jelas serta penyediaan latihan dan aktiviti amali yang bersesuaian. Modul berjaya dibangunkan mengikut lima fasa Model ADDIE iaitu analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian. Selain itu, persepsi pelajar terhadap modul yang dibangunkan berada pada tahap tinggi dengan nilai min keseluruhan 3.43 dan sisihan piawai 0.44. Secara keseluruhannya, modul jahitan baju kurung tradisional berpusatkan pelajar yang dibangunkan

didapati sesuai digunakan sebagai bahan bantu mengajar dan bahan pembelajaran kendiri bagi pelajar Tahun Satu Kursus Seni Reka Fesyen di Kolej Vokasional. Kajian ini diharapkan dapat menyumbang kepada pembangunan bahan pengajaran yang lebih sistematik dan inovatif dalam bidang Pendidikan dan Latihan Teknikal dan Vokasional (TVET).

The field of sewing requires a high level of practical skills and systematic learning materials to help students understand each learning process effectively. However, the lack of specific reference materials on traditional Baju Kurung sewing has made the teaching and learning process less engaging and has limited students' opportunities for self-directed learning. Therefore, this study aimed to identify the appropriate elements and characteristics for the development of a traditional Baju Kurung sewing module based on experts' views, to develop a student-centred traditional Baju Kurung sewing module using the ADDIE instructional model, and to evaluate the perceptions of experts and students towards the suitability of the developed module. This study employed a mixed-method approach involving both qualitative and quantitative methods. Three Fashion Design expert teachers participated in the interviews and module validation process, while 94 first-year Fashion Design students from Kolej Vokasional ERT Azizah participated in the questionnaire survey. The research instruments consisted of interview forms, checklist forms and a four-point Likert scale questionnaire. A pilot study involving 18 respondents was conducted and obtained a Cronbach Alpha value of 0.855, indicating a high level of reliability. The data were analysed using thematic analysis and descriptive statistics involving frequency, percentage, mean and standard deviation. The findings revealed that the experts agreed that the main elements required in the module include the use of simple language, attractive design, systematic content, clear visuals and suitable practical exercises and activities. The module was successfully developed based on the five phases of the ADDIE model, namely analysis, design, development, implementation and evaluation. Furthermore, students' perceptions towards the developed module were at a high level with an overall mean score of 3.43 and a standard deviation of 0.44. Overall, the student-centred traditional Baju Kurung sewing module developed in this study is suitable to be used as a teaching aid and self-learning material for first-year Fashion Design students in Vocational Colleges. This study is expected to contribute towards the development of more systematic and innovative instructional materials in the field of Technical and Vocational Education and Training (TVET).

CABARAN MENGINTEGRASIKAN TEKNOLOGI DIGITAL DALAM PENGAJARAN DAN PEMBELAJARAN DI KOLEJ VOKASIONAL DI CABARAN MENGINTEGRASIKAN TEKNOLOGI DIGITAL DALAM PENGAJARAN DAN PEMBELAJARAN DI KOLEJ VOKASIONAL DI JOHOR BHARU

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Pengintegrasian teknologi digital dalam bidang Pendidikan Teknikal dan Vokasional (TVET) amat kritikal bagi melahirkan modal insan yang berkemahiran tinggi dan kalis masa hadapan selaras dengan arus Revolusi Industri 4.0. Walau bagaimanapun, proses transisi digital ini mendepani pelbagai hambatan sistemik dan psikologi di peringkat lapangan. Kajian kes kualitatif ini dijalankan bertujuan untuk meneroka ekosistem pengintegrasian teknologi digital dalam konteks pengajaran dan pembelajaran (PdP) yang melibatkan para guru Kolej Vokasional di daerah Johor Bahru. Secara khusus, kajian ini dipandu oleh tiga objektif utama: mengenal pasti kekangan dan cabaran guru, menilai profil penguasaan kemahiran digital, serta memperincikan bentuk sokongan sistemik yang diperlukan oleh pendidik. Data primer dikumpul menerusi sesi temu bual mendalam yang berstruktur bersama lima orang informan (TB1 hingga TB5) yang terdiri daripada guru aktif di Kolej Vokasional, sebelum ditranskrip secara verbatim dan dianalisis menggunakan kaedah analisis kandungan. Hasil penemuan kajian menunjukkan bahawa kekangan infrastruktur (ketidakstabilan capaian internet dan makmal komputer usang) serta kekangan pengurusan masa (lambakan tugas perkeranian dan audit pensijilan) menjadi benteng terbesar yang menghalang kelancaran PdP digital guru. Dari segi penguasaan, majoriti guru mempunyai literasi yang sangat baik dalam mengendalikan aplikasi digital asas dan kuiz interaktif, namun wujud jurang kemahiran yang besar dalam aspek pengendalian perisian multimedia kompleks dan simulasi industri khusus. Rentetan itu, kajian mendesak keperluan pakej sokongan bersepadu yang merangkumi penganjuran program latihan kompetensi ICT yang berfokus mengikut bidang vokasional secara berkala, pengurangan birokrasi fail fizikal oleh pihak pengurusan, serta menaik taraf fasiliti fizikal kepada "bengkel pintar digital". Implikasi kajian ini memberikan rujukan dinamik kepada pihak Bahagian Pendidikan dan Latihan Teknik Vokasional (BPLTV) untuk menstrukturkan semula agihan tugas guru dan pembiayaan modal prasarana demi kelestarian digitalisasi TVET nasional.

The integration of digital technology in Technical and Vocational Education and Training (TVET) is highly critical to produce a highly skilled and future-proof workforce in line with the Fourth Industrial Revolution. However, this digital transition faces various systemic and psychological hurdles at the ground level. This qualitative case study was conducted to explore the ecosystem of digital technology integration within the context of teaching and learning (PdP) involving Vocational College teachers in the district of Johor Bahru. Specifically, this study was guided by three main objectives: to identify the constraints and challenges faced by teachers, to assess their profile of digital skill mastery, and to detail the forms of systemic support required by educators. Primary data were gathered through structured, in-depth interviews with five informants (R1 to R5) comprising active Vocational College teachers, which were then transcribed verbatim and analyzed using content analysis. The findings indicate that infrastructural constraints (unstable internet access and outdated computer labs) along with time management constraints (heavy clerical burdens and certification audits) serve as the biggest barriers disrupting smooth digital teaching. In terms of mastery, the majority of teachers exhibit excellent literacy in handling basic digital applications and interactive quizzes, yet a significant skill gap remains in operating complex multimedia software and specialized industrial simulations. Consequently, this study

highlights the urgent need for an integrated support package, including the implementation of periodic ICT competency workshops customized to specific vocational fields, the reduction of physical documentation bureaucracy by management, and the upgrading of physical facilities into "digital smart workshops". The implications of this study provide a dynamic reference for the Technical and Vocational Education and Training Division (BPLTV) to restructure teachers' workload distribution and infrastructure capital funding for the sustainability of national TVET digitalization.

PEMBANGUNAN MODUL KENDIRI ASAS POLA BLAUS BAGI MENILAI TAHAP PEMBELAJARAN KENDIRI PELAJAR SAINS RUMAH TANGGA TINGKATAN 4 DI DAERAH KULAI

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Kajian ini bertujuan untuk membangunkan Modul Kendiri Asas Pola Blaus bagi menilai tahap pembelajaran kendiri murid Sains Rumah Tangga Tingkatan 4 di daerah Kulai. Kajian ini dijalankan bagi mengatasi masalah murid yang menghadapi kesukaran dalam menguasai kemahiran asas mendraf pola blaus disebabkan oleh penggunaan kaedah pengajaran tradisional serta kekurangan bahan bantu mengajar yang bersifat kendiri, interaktif dan sistematik. Kajian ini mempunyai tiga objektif utama iaitu mengenal pasti elemen pembelajaran kendiri bagi pembangunan modul berdasarkan pandangan guru pakar, membangunkan Modul Kendiri Asas Pola Blaus berasaskan Model ADDIE, serta mengenal pasti persepsi guru pakar dan murid terhadap keberkesanan modul yang dibangunkan. Reka bentuk kajian deskriptif dengan gabungan pendekatan kuantitatif dan kualitatif telah digunakan. Seramai 180 orang murid Tingkatan 4 Sains Rumah Tangga daripada lima buah sekolah menengah di daerah Kulai dipilih sebagai responden melalui kaedah persampelan rawak mudah, manakala dua orang guru pakar terlibat dalam proses penilaian modul. Instrumen kajian yang digunakan terdiri daripada borang senarai semak, borang temu bual separa berstruktur dan borang soal selidik skala Likert empat mata. Data kuantitatif dianalisis menggunakan statistik deskriptif seperti min dan peratusan, manakala data kualitatif dianalisis secara analisis kandungan. Dapatan kajian dijangka menunjukkan bahawa Modul Kendiri Asas Pola Blaus yang dibangunkan mempunyai tahap kesesuaian dan kebolehgunaan yang tinggi serta berupaya menyokong pembelajaran kendiri murid dalam topik asas pola blaus. Kesimpulannya, modul yang dibangunkan dapat dijadikan sebagai bahan bantu mengajar yang berkesan bagi meningkatkan kefahaman, kemahiran praktikal dan pembelajaran kendiri murid dalam mata pelajaran Sains Rumah Tangga.

This study aimed to develop a Self-Learning Basic Blouse Pattern Module to evaluate the level of self-directed learning among Form Four Home Science students in the Kulai district. The study was conducted to address students' difficulties in mastering basic blouse pattern drafting skills due to the use of traditional teaching methods and the lack of interactive and systematic teaching materials. The study had three main objectives: to identify the elements of self-directed learning required for the development of the module based on expert teachers' views, to develop the Self□Learning Basic Blouse Pattern Module based on the ADDIE Model, and to identify the perceptions of expert teachers and students regarding the effectiveness of the developed module. A descriptive research design employing both quantitative and qualitative approaches was adopted. A total of 180 Form Four Home Science students from five secondary schools in the Kulai district were selected as respondents through simple random sampling, while two expert teachers were involved in the module evaluation process. The research instruments consisted of a checklist form, a semi□structured interview form, and a four-point Likert scale questionnaire. Quantitative data were analysed using descriptive statistics such as mean and percentage, whereas qualitative data were analysed using content analysis. The findings are expected to indicate that the Self-Learning Basic Blouse Pattern Module possesses a high level of suitability and usability and is capable of supporting students' self-directed learning in the topic of basic blouse patterns. In conclusion, the developed module can serve as an effective teaching aid in enhancing students' understanding, practical skills, and self□directed learning in the Home Science subject.

PEMBANGUNAN MODUL PEMBELAJARAN BERASASKAN PROJEK BAGI TOPIK HIDROPONIK DALAM KURIKULUM REKA BENTUK DAN TEKNOLOGI (RBT) SEKOLAH MENENGAH

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Kajian ini bertujuan untuk membangunkan dan menilai Modul Pembelajaran Berasaskan Projek bagi Topik Hidroponik dalam Kurikulum Reka Bentuk dan Teknologi (RBT) Sekolah Menengah. Kajian ini dijalankan bagi menyediakan bahan pengajaran dan pembelajaran yang lebih sistematik kepada guru untuk melaksanakan pendekatan Pembelajaran Berasaskan Projek dengan lebih berkesan. Pembangunan modul ini melibatkan penggunaan Model ADDIE yang mempunyai lima fasa iaitu fasa analisis, reka bentuk, pembangunan, pelaksanaan serta penilaian. Tambahan juga, penyusunan isi kandungan modul yang dibangunkan juga berteraskan Kerangka Pembelajaran Berasaskan Projek yang telah diperkenalkan oleh Kementerian Pendidikan Malaysia. Kajian ini menggunakan pendekatan kualitatif melalui analisis dokumen kurikulum RBT, temu bual bersama guru RBT serta analisis dokumen borang penilaian kesahan dan kesesuaian modul. Kesahan modul melibatkan tiga Ketua Panitia RBT manakala penilaian kandungan modul pula melibatkan empat guru mata pelajaran RBT dari beberapa sekolah menengah di daerah Johor Bahru dan Kulai. Dapatan telah menunjukkan bahawa modul yang dibangunkan mempunyai kesahan dan kesesuaian kandungan yang baik, sesuai, mudah digunakan dan memenuhi keperluan pengajaran. Dapatan ini menjadikan modul yang dibangunkan berpotensi untuk menjadi bahan sokongan pengajaran yang membantu guru melaksanakan aktiviti pengajaran dengan lebih sistematik dan berkesan. Sehubungan dengan itu, terdapat beberapa cadangan telah dibincangkan berdasarkan hasil dapatan kajian yang telah diperoleh.

This study aims to develop and evaluate a Project Based Learning Module for the Hydroponics Topic in the Design and Technology (RBT) Curriculum for Secondary Schools. This study was conducted to provide more systematic teaching and learning materials for teachers to implement the Project-Based Learning approach more effectively. This module development involved the use of the ADDIE Model which has five phases which are analysis, design, development, implementation and evaluation phases. In addition, the content of the developed module was also based on the Project-Based Learning Framework of the Ministry of Education Malaysia. This study uses a qualitative approach through a document analysis of RBT curriculum, interviews with RBT teachers and document analysis of validity and suitability forms. The validity of the module involved three RBT Committee Heads while the content assessment of the module involved four RBT subject teachers from several secondary schools in the Johor Bahru and Kulai districts. The findings have shown that the developed module has good validity and suitability of content, appropriate, easy to use and meets teaching needs. These findings make the developed module potential to be a teaching support material that helps teachers implement teaching activities more systematically and effectively. Thus, there are several suggestions that have been discussed based on the study findings that have been obtained.

CABARAN GURU PROGRAM PENDIDIKAN KHAS INTEGRASI (PPKI) PENDENGARAN DALAM PENGGUNAAN ISTILAH TEKNIKAL TVET

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Kekurangan kod isyarat piawai bagi istilah teknikal Pendidikan dan Latihan Teknikal dan Vokasional (TVET) dalam Kod Tangan Bahasa Melayu (KTBM) atau Bahasa Isyarat Malaysia (BIM) menyukarkan proses pengajaran dan pembelajaran (PdP) bagi Murid Berkeperluan Pendidikan Khas (MBPK) Pendengaran. Akibatnya, guru terpaksa menggunakan ejaan jari (fingerspelling) yang memakan masa atau mencipta isyarat improvisasi sendiri, yang boleh menyebabkan salah faham terhadap konsep teknikal dalam kalangan MBPK Pendengaran dan menjejaskan pencapaian amali mereka. Kajian ini bertujuan untuk meneroka cabaran guru Program Pendidikan Khas Integrasi (PPKI) Pendengaran dalam penggunaan istilah teknikal TVET semasa proses PdP. Kajian ini turut meneroka penggunaan istilah teknikal TVET serta strategi pengajaran yang diaplikasikan oleh guru. Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk penerokaan. Seramai tiga orang guru PPKI Pendengaran di sebuah sekolah menengah di Johor dipilih sebagai peserta kajian menggunakan persampelan bertujuan. Data dikumpulkan melalui temu bual separa berstruktur dan dianalisis menggunakan analisis tematik dengan bantuan perisian NVivo. Dapatan kajian menunjukkan bahawa guru menghadapi pelbagai cabaran dalam penggunaan istilah teknikal TVET, termasuk kekurangan istilah bahasa isyarat yang standard, keterbatasan sumber pengajaran, kekangan masa serta perbezaan tahap kefahaman MBPK kategori pendengaran. Bagi mengatasi cabaran tersebut, guru menggunakan pelbagai strategi seperti penggunaan Kod Tangan Bahasa Melayu (KTBM), Bahasa Isyarat Malaysia (BIM), bahan visual, demonstrasi amali, pengulangan istilah teknikal serta pengubahsuaian pengajaran mengikut keperluan MBPK. Kajian ini turut mengenal pasti keperluan pembangunan glosari istilah teknikal TVET dan latihan profesional bagi menyokong pengajaran guru. Dapatan kajian diharapkan dapat menjadi rujukan kepada guru, pihak sekolah dan Pejabat Pendidikan Daerah (PPD) dalam memperkukuh pelaksanaan pengajaran TVET yang lebih berkesan kepada MBPK kategori pendengaran.

The lack of standardized signs for technical terms in Technical and Vocational Education and Training (TVET) within Kod Tangan Bahasa Melayu (KTBM) or Bahasa Isyarat Malaysia (BIM) poses challenges to the teaching and learning process for students with hearing disabilities. Consequently, teachers often resort to fingerspelling, which can be time-consuming, or create improvised signs, which may lead to misunderstandings of technical concepts among students with hearing disabilities and affect their practical performance. This study aims to explore the challenges faced by teachers in the Hearing Impairment Special Education Integration Programme (PPKI) when using technical TVET terms during the teaching and learning process. It also explores the use of technical TVET terms, and the teaching strategies employed by teachers. This study adopts a qualitative approach with an exploratory research design. Three PPKI teachers for students with hearing disabilities from a secondary school in Johor were selected as participants using purposive sampling. Data were collected through semi-structured interviews and analysed using thematic analysis with the assistance of NVivo software. The findings reveal that teachers face various challenges in using technical TVET terms, including the lack of standardized sign language terms, limited teaching resources, time constraints, and differences in students' levels of understanding. To address these challenges, teachers employ various strategies, including Kod Tangan Bahasa Melayu (KTBM), Malaysian Sign Language (BIM), visual materials, practical demonstrations, repetition of technical terms, and instructional adaptations based on

students' needs. The study also identifies the need to develop a glossary of technical TVET terms and provide professional training to support teachers' instructional practices. The findings are expected to serve as a reference for teachers, schools, and District Education Offices (PPD) in strengthening the implementation of more effective TVET instruction for students with hearing disabilities.

HUBUNGAN PELAKSANAAN PEMBELAJARAN BERASASKAN PROJEK DENGAN TAHAP MOTIVASI DAN MINAT MURID DALAM MATA PELAJARAN REKA BENTUK DAN TEKNOLOGI (RBT)

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Kajian ini dijalankan bagi mengkaji hubungan pelaksanaan Pembelajaran Berasaskan Projek (PBP) dengan tahap motivasi dan minat murid dalam mata pelajaran Reka Bentuk dan Teknologi (RBT) di sekolah menengah. Pendekatan PBP merupakan salah satu strategi pembelajaran yang memberi penekanan kepada penglibatan aktif murid melalui pelaksanaan projek bagi membolehkan mereka mengaplikasikan pengetahuan, kemahiran dan nilai secara bermakna. Walau bagaimanapun, pelaksanaan PBP dalam mata pelajaran RBT masih berhadapan dengan beberapa cabaran seperti kesukaran murid menghubungkaitkan teori dengan amali, kekurangan kemudahan dan bahan bantu mengajar, serta perbezaan tahap pelaksanaan PBP oleh guru yang secara tidak langsung mempengaruhi motivasi dan minat murid terhadap pembelajaran. Sehubungan itu, kajian ini dijalankan bagi mengenal pasti tahap pelaksanaan Pembelajaran Berasaskan Projek (PBP) dalam kalangan guru RBT, menentukan tahap motivasi dan minat murid selepas pelaksanaan PBP serta menganalisis hubungan antara pelaksanaan PBP dengan tahap motivasi dan minat murid dalam mata pelajaran Reka Bentuk dan Teknologi (RBT). Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan dengan melibatkan seramai 40 orang guru mata pelajaran RBT daripada tiga buah sekolah menengah di kawasan Bandar Chukai, Kemaman, Terengganu yang dipilih melalui kaedah pensampelan rawak mudah berdasarkan Jadual Krejcie dan Morgan (1970). Instrumen kajian yang digunakan ialah borang soal selidik yang dibangunkan oleh pengkaji dan data dianalisis menggunakan perisian IBM Statistical Package for the Social Sciences (SPSS) versi 31 melalui analisis statistik deskriptif yang melibatkan min, sisihan piawai, frekuensi dan peratusan serta analisis statistik inferensi menggunakan ujian korelasi Pearson. Dapatan kajian menunjukkan bahawa tahap pelaksanaan Pembelajaran Berasaskan Projek (PBP) berada pada tahap tinggi dengan nilai min 4.17, manakala persepsi guru terhadap tahap motivasi dan minat murid selepas pelaksanaan PBP juga berada pada tahap tinggi dengan nilai min 3.95. Selain itu, maklum balas responden melalui soalan terbuka menunjukkan bahawa pelaksanaan PBP berupaya meningkatkan penglibatan, kreativiti, keyakinan dan kemahiran penyelesaian masalah murid, namun masih memerlukan penambahbaikan dari aspek kemudahan, peralatan, pengurusan masa dan latihan profesional kepada guru. Kajian ini memberi implikasi bahawa pelaksanaan PBP yang dirancang dan dilaksanakan secara sistematik mampu meningkatkan keberkesanan pengajaran dan pembelajaran RBT serta membantu meningkatkan motivasi dan minat murid terhadap mata pelajaran tersebut. Oleh itu, dapatan kajian ini diharapkan dapat dijadikan sebagai rujukan kepada guru, pihak sekolah, Kementerian Pendidikan Malaysia dan penyelidik akan datang dalam memperkukuh pelaksanaan Pembelajaran Berasaskan Projek di sekolah. Kesimpulannya, pendekatan Pembelajaran Berasaskan Projek merupakan satu pendekatan pedagogi yang berkesan dalam menyokong pelaksanaan Kurikulum Standard Sekolah Menengah (KSSM) serta berpotensi

melahirkan murid yang lebih bermotivasi, kreatif, inovatif dan bersedia menghadapi cabaran pendidikan abad ke-21.

This study was conducted to examine the relationship between the implementation of Project-Based Learning (PBL) and students' motivation and interest in the Design and Technology (D&T) subject at the secondary school level. Project-Based Learning (PBL) is a student-centred instructional approach that emphasizes active student engagement through project implementation, enabling students to apply their knowledge, skills, and values in meaningful learning experiences. However, the implementation of PBL in the Design and Technology (D&T) subject continues to face several challenges, including students' difficulties in relating theoretical knowledge to practical applications, inadequate facilities and teaching aids, and variations in teachers' implementation of PBL, which indirectly affect students' motivation and interest in learning. Therefore, this study aimed to identify the level of Project-Based Learning (PBL) implementation among Design and Technology (D&T) teachers, determine students' motivation and interest after participating in PBL, and analyse the relationship between the implementation of PBL and students' motivation and interest in the Design and Technology (D&T) subject. This study employed a quantitative survey research design involving 40 Design and Technology (D&T) teachers from three secondary schools in Bandar Chukai, Kemaman, Terengganu, who were selected using a simple random sampling technique based on the Krejcie and Morgan (1970) sampling table. The research instrument consisted of a questionnaire developed by the researcher, and the data were analysed using IBM Statistical Package for the Social Sciences (SPSS) Version 31. Descriptive statistical analyses, including mean, standard deviation, frequency, and percentage, as well as inferential statistical analysis using the Pearson correlation test, were employed. The findings revealed that the implementation of Project-Based Learning (PBL) was at a high level, with a mean score of 4.17, while teachers' perceptions of students' motivation and interest following the implementation of PBL were also at a high level, with a mean score of 3.95. Furthermore, responses to the open-ended questions indicated that PBL enhances students' engagement, creativity, self-confidence, and problem-solving skills. Nevertheless, improvements are still required in terms of facilities, equipment, time management, and professional training for teachers. The findings of this study imply that well-planned and systematically implemented PBL can enhance the effectiveness of teaching and learning in the Design and Technology (D&T) subject while simultaneously improving students' motivation and interest. Therefore, the findings are expected to serve as a valuable reference for teachers, schools, the Ministry of Education Malaysia, and future researchers in strengthening the implementation of Project-Based Learning in schools. In conclusion, Project-Based Learning is an effective pedagogical approach that supports the implementation of the Secondary School Standard Curriculum (KSSM) and has the potential to produce students who are more motivated, creative, innovative, and well-prepared to meet the challenges of 21st-century education.

PENERAPAN ELEMEN KELESTARIAN DALAM SILIBUS REKA BENTUK DAN TEKNOLOGI

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Kajian ini dijalankan untuk meneroka amalan penerapan elemen kelestarian alam sekitar, ekonomi dan sosial melalui aktiviti projek dalam silibus mata pelajaran Reka Bentuk dan Teknologi (RBT) di sekolah menengah. Kajian ini memfokuskan cara guru mengintegrasikan ketiga-tiga elemen kelestarian tersebut dalam konteks sebenar pengajaran dan pembelajaran. Pendekatan kualitatif deskriptif digunakan dengan melibatkan guru-guru RBT dari lima buah sekolah menengah di sekitar Johor Bahru dan Kulai yang dipilih melalui persampelan bertujuan. Data kajian dikumpulkan menggunakan temu bual separa berstruktur dan dianalisis melalui kaedah analisis tematik bagi mengenal pasti tema serta subtema yang selaras dengan objektif dan persoalan kajian. Dapatan kajian menunjukkan bahawa elemen kelestarian alam sekitar diterapkan melalui penggunaan bahan kitar semula, penggunaan semula bahan terpakai dan pengurangan pembaziran semasa pelaksanaan projek. Elemen kelestarian ekonomi pula diterapkan melalui perancangan kos, pengurusan perbelanjaan, perkongsian bahan dan pengoptimuman penggunaan sumber. Seterusnya, elemen kelestarian sosial diterapkan melalui kerja berkumpulan, pembahagian tugas, komunikasi, keselamatan, etika, tanggungjawab serta aktiviti pembentangan yang membina keyakinan diri murid. Dapatan turut menunjukkan bahawa aktiviti projek merupakan medium utama yang membolehkan ketiga-tiga elemen kelestarian diterapkan secara praktikal dan saling berkaitan. Walau bagaimanapun, pelaksanaannya dipengaruhi oleh kekangan masa, tahap kefahaman murid, ketersediaan bahan, peruntukan dan kemudahan sekolah.Berdasarkan sintesis dapatan kajian dan sorotan literatur, Kerangka Awal 3P yang merangkumi peringkat perancangan, pelaksanaan serta penilaian dan refleksi dicadangkan sebagai panduan awal kepada guru. Kajian ini diharapkan dapat membantu guru dan penggubal kurikulum memperkukuh penerapan elemen kelestarian secara lebih terancang, sistematik dan sesuai dengan konteks pelaksanaan projek RBT.

This study was conducted to explore the practices of integrating environmental, economic, and social sustainability elements through project activities in the Design and Technology (RBT) syllabus at the secondary school level. The study focused on how teachers integrated these three sustainability elements within the actual context of teaching and learning. A qualitative descriptive approach was employed, involving RBT teachers from five secondary schools in the Johor Bahru and Kulai areas who were selected through purposive sampling. Data were collected through semistructured interviews and analysed using thematic analysis to identify themes and subthemes aligned with the research objectives and research questions. The findings revealed that environmental sustainability was integrated through the use of recycled materials, the reuse of discarded materials, and the reduction of waste during project implementation. Economic sustainability was integrated through cost planning, expenditure management, material sharing, and the optimisation of resource use. Social sustainability was integrated through group work, task allocation, communication, safety, ethics, responsibility, and presentation activities that enhanced students' self-confidence. The findings also indicated that project activities served as the main medium through which the three sustainability elements could be integrated practically and interdependently. However, their implementation was influenced by time constraints, students' levels of understanding, the availability of materials, financial allocation, and school facilities. Based on a synthesis of the findings and the literature review, a Preliminary 3P Framework comprising the stages of planning, implementation, and assessment and reflection was proposed as an initial guide for

teachers. This study is expected to assist teachers and curriculum developers in strengthening the integration of sustainability elements in a more structured, systematic, and contextually appropriate manner within RBT project implementation.

TAHAP PENGETAHUAN PELAJAR UNIVERSITI MENGENAI SPESIES TUMBUHAN HIASAN BERACUN YANG POPULAR SEBAGAI HIASAN DALAMAN

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Tumbuhan hiasan dalaman merupakan elemen dekorasi popular yang mampu meningkatkan estetika dan kualiti udara, namun terdapat spesies tertentu yang mempunyai sifat toksik dan berisiko kepada kesihatan pengguna. Kajian tinjauan ini bertujuan untuk mengenal pasti tahap pengetahuan pelajar universiti terhadap spesies tumbuhan hiasan beracun yang popular digunakan sebagai hiasan dalaman. Fokus utama kajian merangkumi aspek keupayaan pelajar dalam mengecam spesies tumbuhan, tahap pengetahuan kesan toksisiti bahan kimia, serta kesedaran amalan pengendalian selamat. Data dikumpul melalui borang soal selidik daripada 146 orang responden dalam kalangan pelajar Tahun Akhir Fakulti Sains Pendidikan dan Teknologi (FEST) dan dianalisis secara deskriptif menggunakan perisian Statistical Package for the Social Sciences (SPSS). Dapatan kajian menunjukkan hasil yang membimbangkan di mana majoriti besar pelajar iaitu sebanyak 81.5% berada pada aras pengetahuan yang Rendah, manakala sifar peratus (0.0%) pelajar mencatkan aras pengetahuan yang Tinggi dalam mengecam taksonomi dan profil toksisiti tumbuhan. Dari sudut kesedaran risiko (Skala Likert), pelajar mempamerkan skor min yang tinggi terhadap kesedaran simptom klinikal luaran seperti keradangan kulit (min = 4.76), namun wujud paradoks tingkah laku yang nyata di mana amalan proaktif untuk menyemak profil keselamatan botani sebelum pembelian mencatatkan nilai min terendah iaitu 3.82. Kemelut pengetahuan ini dipacu oleh pola rujukan maklumat yang sangat berat sebelah, dengan 80.1% pelajar bergantung sepenuhnya kepada media sosial berbanding rujukan ilmiah (10.3%). Implikasi kajian ini membuktikan kewujudan fenomena "buta tumbuhan" (plant blindness) yang kritikal dalam kalangan bakal pendidik. Dapatan ini secara langsung menjadi asas rujukan konkrit bagi mendesak pihak pengurusan universiti dan kolej kediaman untuk menggubal polisi "Hijau dan Selamat" serta garis panduan keselamatan landskap asrama bagi mengelakkan insiden keracunan dalam kampus.

Indoor ornamental plants are popular decorative elements capable of enhancing aesthetics and air quality; however, certain species possess toxic properties and pose risks to human health. This survey study aims to identify the level of knowledge among university students regarding popular poisonous ornamental plant species used as indoor decor. The primary focus encompasses students' capability in identifying plant species, their knowledge of toxic chemical effects, and awareness of safe handling practices. Data were collected via questionnaires from 146 final-year students at the Faculty of Educational Sciences and Technology (FEST) and descriptively analyzed using the Statistical Package for the Social Sciences (SPSS) software. The findings revealed a concerning reality where the vast majority of students (81.5%) scored at a Low knowledge level, while zero percent (0.0%) of the students managed to attain a High knowledge level in identifying plant taxonomy and toxicity profiles. In terms of risk perception (Likert Scale), students demonstrated high mean scores regarding awareness of external clinical symptoms like skin dermatitis (mean = 4.76);

however, a significant behavioral contradiction occurred as proactive practices to check the botanical safety profile prior to purchase recorded the lowest mean score at 3.82. This knowledge deficit is driven by heavily biased information-seeking patterns, with 80.1% of students relying entirely on social media compared to academic literature (10.3%). The implications of this study highlight the critical existence of "plant blindness" among future educators. These findings directly serve as a concrete reference urging university management and residential colleges to formulate "Green and Safe" policies and official campus landscape safety guidelines to mitigate accidental poisoning incidents.

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BUKU ABSTRAK
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