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Advancement of ai-tools in learning for technical vocational education and training (TVET) in Malaysia (empowering students and tutor)

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Abstract

The potential of Artificial Intelligence (AI) in Technical and Vocational Education and Training (TVET) in Malaysia, has an advantage in Education. Given the swift progress of AI technology, Malaysia's TVET sector can utilise AI-assisted learning to improve teaching and learning. Malaysia's TVET institutions can enhance skill acquisition among students by adopting advanced tools like adaptive learning algorithms, virtual simulations, and intelligent tutoring systems, which cater to diverse learning styles. Nevertheless, like any other area, Malaysia encounters obstacles such as ethical dilemmas, digital inequality, and the necessity for enhancing skills in implementing AI-supported learning in TVET. To fully capitalise on the advantages of AI in educational sector, it is imperative to tackle these challenges. By surmounting these challenges and adopting AI-assisted education, TVET sector can initiate a profound transformation aimed at enhancing educational achievements, promoting innovation, and equipping the workforce with the necessary skills for the modern economy.

Keywords: AI-TOOLS, AI-LEARNING; TVET; CHAT GPT; Teaching and learning; Student and teacher

1. Introduction

TVET is not a new thing in Malaysia, but the education system of TVET need to be updated so that our students and teacher can be more competitive and can achieve a new achievement by using a nowadays technology known as Artificial Intelligence tools.

The incorporation of Artificial Intelligence (AI) into Technical and Vocational Education and Training (TVET) in Malaysia is in line with the worldwide trend identified by Abdullah (2023) to meet the need for a proficient workforce in a fast-changing economy. The focus on AI-supported education, aligns with the objectives of improving the effectiveness of TVET programs and providing personalized learning experiences. (Lin, 2020). By integrating artificial intelligence (AI) technologies, Malaysia's Technical and Vocational Education and Training (TVET) sector can enhance the readiness of its students for success in the digital era by providing them with pertinent skills and competencies. The introduction establishes the context for examining how AI can enable individuals in Malaysia to prosper in a progressively digital and competitive environment, emphasizing the significance of embracing technological progress to address the demands of the contemporary labour market.

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The combination of AI-assisted learning and Technical and Vocational Education and Training (TVET) in Malaysia has the potential to greatly transform the educational field. (Chikoti, 2018). By incorporating artificial intelligence (AI) technologies into technical and vocational education and training (TVET) programs, educational institutions can provide customized learning experiences that cater to the varied requirements and inclinations of individual students, while also being in line with the cultural and socio-economic environment of the region. the use of adaptive learning algorithms and intelligent tutoring systems allows instructors to improve teaching methods, offer instant feedback, and create a collaborative learning environment that promotes skill development. (Vallejo Guevara, 2019). In addition, the incorporation of virtual simulations for TVET programs provides practical training opportunities, enabling students to acquire practical experience in a controlled environment and develop crucial skills pertinent to their selected disciplines. The interdependent connection between AI-supported learning and Technical and Vocational Education and Training (TVET) in Malaysia not only improves educational results but also promotes empowerment and innovation, placing the local workforce in a favorable position to succeed in a progressively digital and competitive global economy.

The incorporation of AI-driven analytics into Technical and Vocational Education and Training (TVET) programs, as emphasized by Saritha (2022), offers great potential for enhancing educational results. Through the analysis of data derived from student interactions with AI-powered educational platforms, educators in Malaysia can acquire valuable insights regarding student progress and performance (Ismawi, S. N. M., Ishar, M. I. M., & Janius, N., 2022). This enables them to customize instruction according to individual needs and implement specific interventions when required. The utilization of data in teaching methods not only improves their effectiveness but also promotes continuous improvement and innovation in Malaysia's TVET programs. The partnership between AI and TVET in Malaysia enables students to gain the necessary skills and knowledge to thrive in a dynamic employment landscape. (Shiohira, 2021). Furthermore, it provides educators with state-of-the-art resources to improve academic results and effectively equip students for upcoming obstacles. By utilizing AI-driven analytics, the TVET sector can guarantee that its educational programs adapt to the changing requirements of students and industries, thereby fostering the economic growth and well-being of the region.

Abdullah (2023) highlights that the incorporation of Artificial Intelligence (AI) into Technical and Vocational Education and Training (TVET) in Malaysia is a significant advancement that addresses the needs of a swiftly changing economy. This integration is in line with the worldwide movement to meet the demand for a proficient workforce that can effectively navigate the digital age. Malaysia's TVET sector aims to improve program efficiency and offer personalized learning experiences tailored to individual student needs through AI-assisted learning, as described by Lin (2020). The focus on AI technologies aligns with the objective of equipping students with pertinent skills and competencies to thrive in the contemporary labour market. The combination of AI advancements and TVET, as emphasized by Chikoti (2018) and Vallejo Guevara (2019), has the potential to completely transform the educational environment in Malaysia. Malaysia's TVET institutions can cultivate a cooperative learning atmosphere that promotes skill enhancement and innovation by incorporating adaptive learning algorithms, intelligent tutoring systems, and virtual simulations. Incorporating AI-powered analytics, as highlighted by Saritha (2022) and Shiohira (2021), allows educators to obtain valuable insights into student progress and performance. This leads to ongoing enhancement and innovation in TVET programs. The symbiotic alliance between artificial intelligence (AI) and technical and vocational education and training (TVET) in Malaysia not only improves educational results but also empowers students to excel in a swiftly evolving job market, while positioning the region's workforce for triumph in a digital and fiercely competitive global economy (Fadel, N. S. M., Ishar, M. I. M., Jabor, M. K., Ahyan, N. A. M., & Janius, N., 2022). Through the utilization of artificial intelligence technologies and data-driven methodologies, the Technical and Vocational Education and Training (TVET) sector has the potential to significantly contribute to the advancement of economic growth and prosperity in the area.

1.1. Problem Statement

- **Bias in AI algorithms**: Ensuring fair assessments and grading are crucial for the success of Bali's Technical and Vocational Education and Training (TVET) programmes. The presence of bias in AI algorithms has the capacity to compromise the credibility of assessments and impede the prospects of students in Malaysia's job market. (H Iqbal Hussain, 2019)
- **Lack of access to technology**: In Malaysia TVET institutions, the presence of high-speed bandwidth and additional facilities like virtual reality hardware and computers is crucial for the successful implementation of AI-enabled learning. The absence of access may exacerbate the digital divide and restrict the efficacy of AI integration in Malaysia's TVET programmes. (C Cantrell, 2020)
- **Overreliance on AI**: There is a potential risk for students and educators in Malaysia Technical and Vocational Education and Training (TVET) programmes, which could result in a deficiency in critical thinking and problem-solving abilities. (Ahmad, J. B, 2022). Ensuring the comprehensive development of students in Bali requires a

careful balance between utilising AI as a means of enhancing learning and maintaining human interaction and decision-making. (MH Jarrahi, 2018)

- 4.**Lack of training and support**. The implementation of AI technology in TVET sector is particularly difficult due to its novelty and the limited resources available for training initiatives. Ensuring educators and students receive sufficient training and support is essential for empowering them to effectively utilise AI-enabled systems and optimise the advantages of AI integration in TVET programmes. (LD Valencia, 2020)

Research objectives

- Evaluate the current state of AI-assisted learning in Technical and Vocational Education and Training (TVET) programmes in Malaysia: This objective entails evaluating the existing degree of integration of artificial intelligence (AI) technology in Technical and Vocational Education and Training (TVET) programmes within educational institutions in Malaysia. It would offer valuable information about the degree to which AI is being employed and its impact on educational approaches in the area.
- Examine the effectiveness of AI-driven tools in enhancing individualised learning experiences for Technical and Vocational Education and Training (TVET) students in Malaysia: The purpose of this objective is to assess the efficacy of AI technologies, such as adaptive learning algorithms and virtual simulations, in improving the educational experiences of students enrolled in Malaysia's TVET programmes. It would illuminate the tangible advantages of incorporating AI into personalised learning initiatives.
- Assess the influence of AI-assisted learning on enhancing the capabilities of instructors: This objective aims to evaluate the impact of AI-supported learning on instructors, specifically by analysing its ability to provide valuable insights into student progress and performance. The study would investigate how AI technologies enable focused interventions and individualised instruction, thereby improving the efficacy of teaching in TVET programmes.
- Evaluate the potential of integrating AI into TVET to enhance skill acquisition among students in Malaysia: This goal aims to assess the degree to which the integration of AI into TVET programmes in Malaysia improves students' ability to acquire skills, thereby enhancing their employability and readiness for the requirements of the contemporary labour market. The text would emphasise the tangible advantages of AI-assisted education in improving students' skill acquisition in the area.
- Identify the barriers and benefits associated with the implementation of AI-assisted education in Technical and Vocational Education and Training (TVET) in Malaysia: This objective aims to analyse the challenges and opportunities that arise from implementing AI-supported learning in TVET programmes in Malaysia. The study would investigate ethical considerations, matters pertaining to equal access to digital resources, and the necessity for educators to improve their skills. This research would offer valuable perspectives for future approaches to implementing strategies and making policy decisions in the region.

To summarize, the stated research objectives offer a thorough structure for examining the incorporation of Artificial Intelligence (AI) into Technical and Vocational Education and Training (TVET) programs. The research aims to uncover the practical benefits and challenges of integrating artificial intelligence (AI) into technical and vocational education and training (TVET). This will be done by examining the current state of AI-supported learning, evaluating the effectiveness of AI-powered tools in enhancing personalized learning experiences, and assessing the impact on instructors and students. Moreover, the research aims to investigate how AI can improve students' skill acquisition in TVET sector. It also aims to identify the obstacles and advantages associated with deploying AI in this context (Janius, N., Ishar, M. I. M., Bang, P., Sid, R., & Wong, G., 2023). The findings of this research will provide valuable insights for informing future strategies and policy decisions regarding the implementation of AI in TVET sector. In conclusion, tackling these research goals can help optimize the capabilities of AI-assisted learning in TVET programs, thus empowering students, improving educational results, and equipping them for success in the contemporary labour market.

2. Literature of the Research

The global growth of Technical and Vocational Education and Training (TVET), as seen in regions such as Malaysia, reflects a significant increase in the need for technical and engineering experts, particularly in areas like technology and engineering. Ismail Affero's research in 2015 highlights Malaysia's substantial increase in the quantity of engineers and engineer assistants, indicating the growing demand for proficient workers in these industries. Likewise, in Malaysia, where Technical and Vocational Education and Training (TVET) is also undergoing swift progress, it is probable that these statistics align with the trend observed in Malaysia (Janius, N., Ishar, M. I. M., Yusof, Y., Bang, P., Sid, R., & Wong, G., 2023). Historically, TVET courses have presented difficulties for educators and students alike because of restricted resources and time limitations. Nevertheless, the advent of Artificial Intelligence (AI) has made TVET education in

Malaysia more accessible and efficient. In their study, Adamopoulou and Moussiades (2020) investigate the incorporation of artificial intelligence (AI) in educational settings, emphasizing its capacity to improve the quality of teaching and learning. The 21st International Conference on Artificial Intelligence in Education (AIED) highlighted the growing significance of AI in educational technology, providing valuable insights into its use in higher education. Jungwirth & Haluza (2023) explore the influence of artificial intelligence (AI) on the process of teaching and learning, highlighting both its advantages and difficulties. The possible consequences of incorporating artificial intelligence (AI) in the classroom and its significance in technical and vocational education and training (TVET), considering both theoretical and practical aspects. (Boateng and Tindi, 2022). In Malaysia, Artificial Intelligence (AI) shows potential for enhancing learning outcomes in Technical and Vocational Education and Training (TVET) through the provision of customized learning experiences and the implementation of cutting-edge teaching techniques. In general, AI offers several benefits for TVET pedagogy, aiding students and educators in accomplishing learning goals more efficiently and supporting the ongoing expansion and advancement of the TVET industry

3. The advantage of ai in education (Artificial Intelligence)

- **Personalized Leaning**: The incorporation of Artificial Intelligence (AI) into Technical and Vocational Education and Training (TVET) programmes has the potential to provide customised learning experiences that cater to the specific requirements of students. Artificial intelligence can be employed to customise the content and tempo of education to align with the specific abilities of individual students, thereby improving their acquisition of theoretical knowledge and practical skills in Technical and Vocational Education and Training (TVET) courses. (Pat pataranutaporn,2021). TVET sector is experiencing rapid growth to meet the needs of an expanding economy. AI-powered educational materials can be instrumental in delivering captivating and efficient learning experiences. Through the utilisation of AI characters, TVET programmes can provide educational content in classrooms and interactive environments (Janius, N., Hassan, Z. B., Atan, N. A., & Idris, M. D. B., 2018). This approach allows for the customisation of instruction to meet the unique requirements of students across different age groups. Consequently, students receive individualised attention and assistance, which is crucial for achieving success in their educational pursuits. Therefore, the implementation of AI in TVET education in Malaysia not only improves learning results but also aids the region's endeavours to cultivate a proficient workforce capable of tackling the demands of the contemporary economy. (Pat pataranutaporn,2021)
- **Skill Assessment and Monitoring**: The integration of Artificial Intelligence (AI) technologies in Technical and Vocational Education and Training (TVET) programs offers numerous benefits for both instructors and students. These AI-driven tools enable quick responses and provide real-time feedback, enhancing the learning process in TVET fields. By utilizing AI for evaluating student achievement and growth, instructors can maintain performance standards while identifying areas for improvement. AI-powered technologies can track students' progress in learning practical skills, offering immediate feedback and facilitating timely interventions to enhance learning outcomes. Moreover, AI enables educators to customize the curriculum and learning experiences to meet the unique requirements and skill levels of each student, promoting individualized learning experiences. By tracking learning preferences, detecting skill gaps, and measuring performance, AI contributes to optimizing the learning environment in TVET classrooms. According to Janius, N., Ishar, M. I. M., Yusof, Y., Bang, P., Sid, R., & Wong, G. (2023), AI-powered solutions can collect data, assess performance, verify answers, and provide precise outcomes, enhancing the efficiency and accuracy of assessments. Chatbots and virtual assistants with AI capabilities further complement the learning process by providing individualized, real-time assistance to students. Overall, the integration of AI in TVET education in Malaysia empowers both instructors and students, fostering a dynamic and personalized learning environment conducive to skill development and academic success.
- **Virtual Reality and simulation**: The incorporation of AI-driven virtual reality (VR) and simulation technologies into Technical and Vocational Education and Training (TVET) programmes has significant potential to transform vocational education. These cutting-edge tools offer students practical and interactive educational experiences, allowing for hands-on teaching and learning opportunities. VR and simulation technologies enable students to engage with 3D models of technical components and systems, replicating real-world environments. This facilitates immersive learning in subjects such as automotive, HVAC, electronics, and renewable energy. Additionally, the use of virtual reality (VR) and simulation learning can effectively decrease educational costs by offering a digital substitute for conventional practical training, while simultaneously improving competence in contemporary skills relevant to the 21st century. By incorporating virtual reality (VR) and simulation learning into Learning Management Systems (LMS), educational institutions in Malaysia can effectively track students' advancement and guarantee their attainment of the designated learning goals. By integrating virtual reality (VR) and simulation-based learning into technical and vocational education and training (TVET), educational institutions in Malaysia can provide substantial learning prospects while

enhancing student involvement. The future of TVET training in Bali is anticipated to be a blend of in-person sessions and virtual reality (VR) components. This approach acknowledges the significant impact that VR and simulation technologies can have on vocational education and training, especially in technical subjects. By utilising virtual reality (VR) and simulation learning, students in Malaysia can gain hands-on skills in a controlled and secure setting, effectively addressing the issues arising from inadequate resources and materials for both students and teachers. Therefore, the implementation of virtual reality (VR) and simulation technologies in Technical and Vocational Education and Training (TVET) programmes in Malaysia holds the potential to improve the standard and availability of vocational education, equipping students with the necessary skills for achievement in the contemporary labour market.

- **Reduce the Administrative duties**: The incorporation of Artificial Intelligence (AI) to mechanise administrative duties in Technical and Vocational Education and Training (TVET) establishments offers substantial advantages for both instructors and learners. By employing artificial intelligence (AI) to automate tasks like assessing assignments and delivering tailored feedback to students, educators in Malaysia can conserve precious time that can be reallocated to more significant facets of their responsibilities. This is especially pertinent in Technical and Vocational Education and Training (TVET) institutions, where students frequently participate in practical projects and assignments that demand extra time and attention from educators. Moreover, AI can aid instructors in detecting areas of student difficulty by analysing performance data and offering insights into areas of inadequate performance. This allows educators to provide more individualised instruction and mentoring to assist students in overcoming challenges, ultimately improving the educational standards in technical and vocational education and training (TVET) institutions. AI in Malaysia relieves teachers of administrative tasks, allowing them to concentrate on guiding and coaching students to reach their maximum potential (Hassan, Z. B., Janius, N., Atan, N. A., & Idris, M. D. B., 2018). This contributes to enhancing TVET education in the area. Hence, the integration of artificial intelligence (AI) into administrative tasks within Technical and Vocational Education and Training (TVET) institutions in Malaysia not only simplifies procedures but also enriches the educational journey for students, ultimately equipping them for triumph in their respective areas of interest.

4. Discussion

The integration of Artificial Intelligence (AI) in Technical and Vocational Education and Training (TVET) has yielded substantial benefits for students and educators alike, in line with the worldwide movement to utilize AI for improving learning experiences and fostering skill acquisition. The implementation of AI in TVET (Technical and Vocational Education and Training) in Malaysia shows potential for transforming the educational environment by providing students with the essential competencies needed to excel in the current employment market. The implementation of AI in Technical and Vocational Education and Training (TVET) allows students to receive customized learning experiences that cater to their specific needs. This approach enhances their ability to acquire skills more efficiently, ultimately improving their employability and preparedness for the requirements of the modern workforce. Furthermore, AI enables the assessment and monitoring of students' abilities, offering educators a valuable observation on student advancement and areas requiring enhancement. The incorporation of virtual reality and simulation technologies enhanced by AI enhances the educational experience in TVET program. Providing students with immersive and practical training opportunities. Moreover, the implementation of artificial intelligence (AI) in automating administrative tasks enables educators to allocate more attention towards guiding and coaching students, thereby augmenting the overall standard of education. In general, the application of Artificial Intelligence (AI) in Technical and Vocational Education and Training (TVET) Malaysia highlights the region's dedication to promoting creativity and developing a competent workforce capable of addressing the demands of the contemporary economy.

In addition, AI can assist teachers in identifying areas where students may be struggling, enabling them to provide targeted coaching and support. This personalized approach to education aligns with the goals of TVET schools to ensure that students receive the necessary guidance to succeed in their studies and future careers. (K Shiohira, 2021). By reducing the amount of administrative work that teachers must perform, AI can help improve the quality of education at TVET schools. This allows instructors to focus on their strengths, which is guiding and coaching students to help them realize their maximum potential (C Cantrell, 2020). The shift in emphasis on teaching and mentoring at TVET schools in Malaysia improves the standard of education by allowing educators to allocate more time and attention to the specific requirements and growth of their students. In summary, the incorporation of artificial intelligence (AI) in TVET schools in Malaysia has the dual benefit of simplifying administrative tasks and enabling educators to effectively guide students in achieving their full potential in the ever-changing and competitive job market.

AI programs provide substantial advantages for students through the provision of customized learning experiences that are specifically tailored to their unique needs and capabilities. By adapting the content and speed of education to cater

to the specific needs of individual students, AI facilitates a more efficient acquisition of skills and knowledge for students enrolled in TVET programs. The individualized approach to learning is especially beneficial in Technical and Vocational Education and Training (TVET) programs, as students frequently possess varied backgrounds and learning preferences. Through the utilization of artificial intelligence (AI), vocational education and training (TVET) institutions can effectively address the individual requirements of their students, guaranteeing that they receive the necessary assistance and direction for achieving academic and professional triumph. In addition, the utilization of AI technology in personalized learning enhances the learning environment, resulting in increased student motivation and retention in TVET programs.

In addition, AI-powered technology can assess and monitor students' progress in acquiring practical skills, providing guidance and instant feedback to both instructors and students, and enabling timely interventions to improve learning (K Saritha, 2022). This instantaneous feedback mechanism not only aids educators in comprehending students' aptitudes and deficiencies but also enables prompt interventions to improve learning results. Furthermore, the utilization of AI-driven technology provides students enrolled in TVET programs with immediate feedback regarding their acquisition of practical skills. This allows them to pinpoint areas that require improvement and adapt their learning strategies accordingly. AI enables ongoing evaluation and feedback, fostering a flexible and adaptable learning environment in TVET programs. This ensures that students receive the necessary assistance and direction to excel in their studies and future professional endeavors. In general, the incorporation of artificial intelligence (AI) into Technical and Vocational Education and Training (TVET) programs improves the efficacy and productivity of hands-on skill acquisition, enabling students to excel in the competitive labour market.

Virtual reality and simulation technology may be used to educate students about automotive, HVAC, electronics, and renewable energy by allowing them to engage with 3D representations of technical components and systems (A Vallejo Guevara, 2019). VR and simulation technology offer a regulated and secure environment for experiential learning, allowing students to engage with three-dimensional models. This enhances their comprehension and expertise in technical disciplines. Moreover, AI can have a pivotal impact on alleviating the administrative workload of teachers in TVET programs through the automation of tasks like paper grading and the provision of tailored feedback to students. This enables instructors to prioritize advising and mentoring students, directing them towards realizing their maximum potential in their academic pursuits and future professional endeavors. By utilizing both virtual reality (VR) and simulation technology, as well as artificial intelligence (AI)-driven automation, vocational education and training (TVET) institutions can improve the standard of education and more effectively equip students for success in the highly competitive job market. Collectively, the incorporation of these technologies into TVET programs in demonstrates the region's dedication to fostering ingenuity and superiority in vocational education.

While the advantages of AI in Technical and Vocational Education and Training (TVET) are significant, there are also challenges that need to be addressed. The factors encompassing prejudice in AI algorithms, restricted technological accessibility, overreliance on AI, and the necessity for educator and student training and support (Hassan, Z. B., Janius, N., Atan, N. A., & Idris, M. D. B., 2018). By confronting these obstacles and embracing the possibilities of AI-assisted education, the TVET sector can embark on a transformative path towards improving educational results, promoting innovation, and preparing a proficient workforce for the requirements of the 21st-century economy.

5. Conclusion

In general, the incorporation of Artificial Intelligence (AI) into Technical and Vocational Education and Training (TVET) programs in Malaysia offers a multitude of benefits. These benefits include the creation of personalized learning experiences, the enhancement of skill development, and the expansion of job opportunities (Janius, N., Hassan, Z. B., Atan, N. A., & Idris, M. D. B., 2018). Television and Vocational Education and Training (TVET) institutions in Malaysia can significantly improve the quality of education and better prepare students for the evolving demands of the contemporary job market if they take advantage of the benefits of artificial intelligence (AI) and address the challenges that it presents. Although there are significant benefits associated with artificial intelligence (AI), it is essential for all parties involved to maintain vigilance regarding the potential drawbacks of AI and to ensure that the technology is used responsibly to prevent its misuse. As the demand for skilled professionals in technical fields such as engineering and technology continues to rise, the incorporation of artificial intelligence (AI) into technical vocational education and training (TVET) holds the potential to improve the sector's efficiency and relevance in Malaysia and beyond. It is essential for individuals and society to take an active role in embracing these advancements, cultivating an atmosphere of adaptability and readiness to take advantage of the opportunities that are presented by artificial intelligence technology in technical and vocational education and training (TVET). Malaysia can position itself at the forefront of technological innovation in vocational education by taking informed action and working together with other organisations. This will pave the way for a world that is more prosperous and competitive in the future. Therefore the

vocational school and institution in Malaysia such as Politeknik, Kolej Vokasional, may grab this opportunity to implement the new Teaching and Learning pedagogy process by using AI so that our students can be more advance and can be more competitive in real world in the vocational field.

Compliance with ethical standards

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The authors declare no conflict of interest.

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