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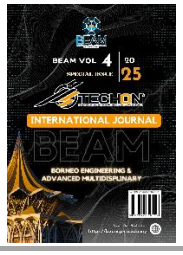

Exploring the Relationship Between Students' Perceptions, Self-Efficacy, and Challenges in Using Artificial Intelligence (AI) Tools in TVET Learning

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Abstract

Artificial intelligence (AI) is increasingly integrated into educational environments, making it essential to understand student interactions with these tools for effective adoption. This study investigates the relationship between students' perceptions of AI as a learning tool and the challenges they face, particularly focusing on the role of self-efficacy. While existing research has explored AI acceptance in higher education, there is a notable gap in empirical evidence specifically examining the interplay of perceptions, self-efficacy, and challenges in AI use within Technical and Vocational Education and Training (TVET) contexts. Guided by Bandura's Self-Efficacy Theory, this research aims to determine if a significant relationship exists between students' perceptions of AI and their encountered challenges, and to what extent self-efficacy (technical, learning-related, and emotional) influences their ability to use AI effectively. A quantitative correlational research design was employed to 103 respondents, involving diploma-level TVET students from Politeknik Kota Bharu. Data was collected via a structured questionnaire and analyzed using descriptive statistics, Pearson correlation, and Cronbach's Alpha for reliability. Findings indicated a generally positive perception of AI among students (M=4.15), alongside moderate challenges, primarily in learning/application (M=2.98). Significant negative correlations were found between positive perceptions and challenges (r ranging from -0.38 to -0.49, $p < 0.01$), and students with higher self-efficacy (fewer reported challenges) showed more frequent AI usage. These results suggest that to enhance AI adoption in TVET, educators and developers should focus on improving student self-efficacy through targeted training, user-friendly tool design, and robust support systems. This study contributes to AI in education research by highlighting the importance of addressing both psychological and practical barriers, thereby enabling students to fully benefit from AI-enhanced learning environments and ensuring its successful integration into TVET.

Keywords: - Artificial Intelligence, perceptions, TVET, self-efficacy, learning challenges

1. Introduction

Artificial Intelligence (AI) has become increasingly embedded in various aspects of society, including the field of education (Pedro et al., 2019; Chen et al., 2020 & Ahmad et al., 2021). According to Singh (2024) & Imamguluyev et al. (2024), AI-powered tools, such as virtual tutors, writing assistants, and content recommenders, have transformed traditional learning environments by offering personalized learning paths, automating repetitive academic tasks, and supporting student engagement through interactive platforms. Technical and Vocational Education and Training (TVET) institutions, which emphasize both theoretical knowledge and hands-on skills, stand to benefit significantly from these innovations. A study by Baharin et al. (2024) affirmed that AI applications in TVET can bridge gaps in teaching resources, offer real-time feedback, and simulate industry-based tasks, which are crucial for students' career readiness.

Despite these promising advancements, the successful implementation of AI in education hinges on how students perceive and engage with these tools (Chanda, 2023). Students' perceptions determine their willingness to adopt and persist in using AI technologies. Moreover, the challenges they face including technical issues, uncertainties in applying AI-generated feedback, and emotional resistance can significantly influence their overall experience (Alessandro et al., 2025). Deckker & Sumanasekara (2025) stated that, one key psychological factor that mediates this process is self-efficacy, or the belief in one's capability to succeed in specific tasks. According to Bandura (1997), individuals with high self-efficacy are more likely to embrace new technologies, persevere through difficulties, and ultimately benefit more from technological innovations. This study investigates how diploma-level students at Politeknik Kota Bharu perceive AI and the challenges they face. It also examines the extent to which self-efficacy influences their interaction with AI tools. To guide this investigation, the following research questions were developed to explore the core aspects of perception, challenges, and the influence of self-efficacy on AI adoption. The Research Questions (RQ) of the study are:

RQ1: What are the students' perceptions of AI as a learning tool?

RQ2: What challenges do students face in using AI for learning, based on self-efficacy dimensions (technical, learning, emotional)?

RQ3: Is there a significant relationship between students' perceptions of AI and the challenges they experience in using it?

RQ4: How does self-efficacy influence students' ability to adopt and effectively use AI tools in their learning process?

2.Literature Review

The integration of Artificial Intelligence (AI) in education has reshaped pedagogical approaches, particularly through adaptive learning platforms, automated assessments, intelligent tutoring systems, and natural language processing-based support (Miao & Holmes, 2021). While the capabilities of AI-driven educational tools continue to evolve, research consistently highlights that their successful adoption is not solely a technological matter, but one deeply intertwined with human perceptions and psychological readiness (Dwivedi et al., 2021 & Kumar & Singh, 2022).

Central to understanding student adoption of AI tools is the Technology Acceptance Model (TAM) by Davis (1989), which asserts that perceived usefulness (PU) and perceived ease of use (PEOU) directly influences an individual's intention to use a new technology. Numerous empirical studies (Zhang & Dang, 2021a & Xu et al., 2023a) have validated TAM in educational contexts, including AI-enhanced platforms. When students find AI tools beneficial to their academic progress and simple to operate, their likelihood of consistent usage increases. Positive perceptions are further linked with improved motivation, greater autonomy, and stronger learning outcomes (Dwivedi et al., 2021).

While TAM offers a solid theoretical basis for evaluating student perceptions, Bandura (1997) deepens this understanding by explaining the role of psychological empowerment in technology use. Self-efficacy is defined as one's belief in their ability to perform specific tasks, affects effort, persistence, and resilience in learning. Students with high self-efficacy are more likely to explore and persist in using AI tools, perceiving challenges as surmountable (Omeh et al., 2025). Conversely, low self-efficacy can lead to avoidance, frustration, and reduced engagement with digital platforms, regardless of their technological merit. This is supported Fu et al. (2023), whose studies emphasize that self-efficacy predicts meaningful student interaction with AI tools, especially in online and blended learning environments.

Despite the theoretical appeal and growing empirical support for AI in education, practical and emotional barriers remain substantial. Ivchyk (2024) & Mahmood et al. (2021) identify technological barriers by including poor internet infrastructure, limited access to digital devices, and unintuitive user interfaces as primary deterrents to AI tool usage. These issues are particularly relevant in under-resourced environments, such as many TVET (Technical and Vocational Education and Training) institutions, where disparities in digital access are often more pronounced (Pedro et al., 2019 & Rahiem, 2020).

Moreover, emotional and cognitive obstacles can inhibit adoption. Mairal-Llebot et al. (2024) report that fear of making mistakes, anxiety about data privacy, and discomfort with being evaluated by machines disproportionately affect students with lower digital confidence. These affective barriers are not always mitigated by technical training alone, suggesting a more holistic strategy is needed for AI integration.

Contextual considerations are particularly important in TVET settings, where curricula emphasize practical and hands-on skill acquisition. AI tools, if not aligned with these outcomes, may be perceived as irrelevant or even obstructive. As Baharin et al. (2025) argue, effective AI integration in TVET must be tailored, involving curriculum alignment, pedagogical redesign, and targeted training for both students and educators. Ismail & Khalid (2020) similarly advocate for institutional support structures including ethical guidelines, technical assistance, and ongoing capacity building, to foster responsible and effective AI use in vocational education.

A comparative review of existing studies reveals both convergence and divergence in research focus. Across the board, studies agree on the influence of perceived usefulness and ease of use (Davis, 1989; Kumar & Singh, 2022 & Xu et al., 2023a), as well as the critical role of self-efficacy in shaping student engagement with AI (Omeh et al., 2025). The differences lie in contextual scope: while studies like Miao & Holmes (2021) & Dwivedi et al. (2021) offer a macro-level view of AI in global education, others such as Baharin et al. (2025) focus narrowly on vocational learners and the institutional frameworks that mediate AI uptake. Another notable difference is the growing inclusion of emotional and infrastructural challenges (Mahmood et al., 2021 & Mairal-Llebot et al., 2024), which earlier models like TAM do not explicitly capture.

One of the strengths of the reviewed literature is its strong theoretical anchoring, with TAM and Self-Efficacy Theory offering complementary insights into behavior and belief. However, limitations exist. Many studies focus on higher education or general K-12 contexts, with fewer empirically grounded in TVET environments where learner profiles, pedagogical needs, and infrastructure differ markedly. Furthermore, while perceived ease of use and self-efficacy are frequently measured, less attention has been paid to how institutional readiness, curriculum fit, and socio-emotional factors intersect to influence adoption decisions.

Taking together, the literature suggests that AI adoption in education is a multifaceted process shaped by individual perceptions, psychological readiness, and contextual affordances. The intersection of TAM and Self-Efficacy Theory offers a rich lens through which to understand students' behavioral intentions and engagement. However, this understanding must be broadened to encompass emotional, infrastructural, and institutional variables, especially in the TVET sector where learners are often at the intersection of digital exclusion and educational transformation.

Drawing on these insights, the present study seeks to explore how perceptions, self-efficacy, and adoption challenges influence the integration of AI tools among TVET students. In doing so, it aims to contribute to a more nuanced, context-aware model of AI adoption in vocational education, ultimately supporting equitable and effective digital learning transitions.

3. Methodology

This study employs a quantitative correlational design to investigate the relationship between students' perceptions of AI as a learning tool and the challenges they face, with a focus on self-efficacy-based challenges. A structured questionnaire was developed to measure self-efficacy-related challenges in using AI. Based on Bandura (1977) Self-Efficacy Theory, the survey adapted 15 items across three dimensions namely technical self-efficacy, Learning self-efficacy and emotional/motivational self-efficacy from the previous studies by Kumar & Singh (2022), Zhang & Dang (2021b), Xu et al. (2023b), Khairuddin et al. (2024) & Chen & Lee (2023). Responses are measured on a 5-point Likert scale ranging from Strongly Disagree to Strongly Agree. The target population includes 103 diploma-level students enrolled in various programs at Politeknik Kota Bharu. These students were selected due to their exposure to both practical and digital learning environments, including the use of AI-based educational tools. This study employed a convenience sampling technique to select participants. The convenience sampling was used to efficiently access a group of diploma-level students with exposure to AI-supported learning environments. While this approach allows practical access to relevant participants, it limits the generalizability of findings to broader TVET populations due to potential sampling bias (Etikan et al., 2016). In this context, students from Politeknik Kota Bharu were invited to participate based on their availability and voluntary consent. This method was chosen due to its efficiency in reaching a specific group of learners familiar with AI tools in academic settings. While convenience sampling may limit the generalizability of the findings to broader populations, it offers valuable insights into the perceptions and challenges faced by students who actively engage with AI-supported learning environments. The collected data were analyzed using Statistical Package for the Social Sciences (SPSS) 27.

Descriptive statistics were used to summarize demographic data and mean scores for perception and challenge variables. Pearson's correlation coefficient was employed to examine the strength and direction of the relationship between students' perceptions of AI and the challenges they faced. Reliability analysis using Cronbach's Alpha determined the consistency of each scale. Generally, a Cronbach's Alpha value above 0.70 is considered acceptable, above 0.80 is good, and above 0.90 is excellent, indicating high internal consistency or reliability of the items within each scale (Hair et al., 2019). In this study the Cronbach Alpha value is α=0.867 which shows a good internal consistency.

4. Result and Discussion

4.1 TVET Students' Perceptions of AI

The average mean score for perceptions across 12 items was 4.15 on a 5-point Likert scale, suggesting a strong openness to integrating AI technologies in vocational and technical education (Table 1). Students particularly agreed that AI improves their understanding (B1, M=4.21), saves time in completing assignments (B9, M=4.21), and that they would recommend AI to others (B12, M=4.22). Many recognized the advantages AI offers, such as its relevance to academic needs (B5, M=4.20), providing helpful feedback (B3, M=4.17), and improving performance (B11, M=4.16). This generally positive perception aligns with recent literature emphasizing the increasing acceptance of AI tools when students perceive them as useful and easy to use (Kumar & Singh, 2022; Dwivedi et al., 2021). The findings also resonate with Xu et al. (2023b), who found that both perceived ease of use and usefulness were strong predictors of students' intention to use AI tools in educational contexts. Similarly, Khairuddin et al. (2024) demonstrated that students generally held positive views toward AI, recognizing its potential to enhance understanding and manage academic tasks more efficiently.

However, despite these positive perceptions, item scores indicated slightly less agreement concerning trust in AI information (B6, M=4.02) and AI suggestions (B7, M=4.01), and concerns about data privacy, accuracy of AI outputs, and the possibility of over-reliance on technology were also commonly expressed in the broader context of AI adoption. This ambivalence suggests that while students are open to adopting AI, they seek transparency, reliability, and appropriate support to maximize its benefits. For educators and TVET institutions, these insights emphasize the importance of not only providing AI tools but also

addressing students' concerns through training, ethical guidelines, and ongoing support to foster effective and confident use of AI in learning.

Table 1: The TVET students' perceptions of using AI

Item	Description	M	SD
B1	AI helps me better understand topics	4.21	0.78
B2	I find AI tools easy to use in learning	4.19	0.82
B3	AI provides feedback that helps me improve	4.17	0.80
B4	I enjoy using AI as part of my study routine	4.14	0.84
B5	AI tools are relevant to my academic needs	4.20	0.77
B6	I trust the information provided by AI tools	4.02	0.91
B7	I trust the suggestions provided by AI tools	4.01	0.88
B8	I feel motivated to learn when using AI	4.03	0.87
B9	AI saves my time in completing assignments	4.21	0.79
B10	AI saves my time when studying	4.18	0.81
B11	AI has improved my learning performance	4.16	0.83
B12	I would recommend AI tools to classmates	4.22	0.76
	Total	4.15	0.825

4.2 Challenges in Using AI Among TVET Students

The findings (Table 2) revealed that students face a range of challenges when using AI tools, categorized into technical, learning/application, and emotional/confidence dimensions, reflecting aspects of self-efficacy. Students reported a moderate level of technical challenges, with an average mean score of 2.71 across five items. Specific issues included struggling with the operation of AI tools (C1, M=2.80), sometimes needing assistance (C2, M=2.75), and a moderate perceived lack of technical skills (C5, M=2.78). Many students expressed difficulty in navigating AI platforms and resolving unexpected errors, with comments like, "I often get stuck figuring out how the AI works" illustrating the struggle with system complexity. As for learning/application challenges, the dimension presented the highest average challenge score (M=2.98). Students reported uncertainty on how to apply AI suggestions effectively (C6, M=2.88), difficulty in judging the accuracy of AI-generated content (C7, M=2.97), and notable concern about overdependence on AI (C8, M=3.22). Some participants reported uncertainty about how to integrate AI effectively into their study routines or skepticism about the accuracy of AI-generated feedback, reflected in statements such as, "I'm not sure if the AI suggestions actually help me improve".

The emotional/confidence challenges were reported at a low to moderate level, with an average mean score of 2.58. This included mild anxiety when using AI (C11, M=2.67), mild self-doubt about using AI correctly (C12, M=2.62), and some avoidance due to fear of making mistakes (C13, M=2.45). Emotionally, anxiety and frustration emerged as significant barriers for some, with students admitting that fear of making mistakes or feeling overwhelmed caused them to avoid fully engaging with AI tools.

Table 2: The TVET students challenge using AI

Item	Description	M	SD
C1	I struggle to understand how AI operates or functions.	2.80	0.95
C2	I need technical assistance when using AI.	2.75	0.93
C3	I face limited internet access problems when using AI.	2.61	1.06
C4	I have devices (laptop/smartphone) that are less suitable for using AI.	2.59	1.13
C5	I lack the technical skills to use AI effectively.	2.78	0.97
C6	I am unsure how to use suggestions or feedback from AI in my learning.	2.88	0.88
C7	I find it difficult to assess whether information or content generated by AI is accurate and reliable.	2.97	0.90
C8	I am worried about becoming too dependent on AI, reducing my ability to think for myself.	3.22	1.03
C9	I feel confused by the variety of AI tools available and do not know which one is most suitable for me.	3.06	0.93
C10	I am not sure if using AI will truly help improve my exam results or academic performance	2.85	0.93
C11	I feel anxious or worried when thinking about using AI in my learning.	2.67	1.00
C12	I doubt my own ability to use AI correctly.	2.62	0.92
C13	I avoid using AI because I am afraid of making mistakes.	2.45	0.98
C14	My confidence is affected when I encounter problems while using AI.	2.63	0.90
C15	I am worried that others will judge me if I am not proficient in using AI.	2.53	1.01
	Total	2.76	0.97

In Table 3, the summary for the challenge dimensions indicates that technical challenges presented a moderate level of difficulty, with a mean score of 2.71 and a standard deviation of 1.14. Similarly, learning/application challenges were also found to be of a moderate level, showing a mean of 2.98 and a standard deviation of 1.08. Emotional/Confidence challenges were interpreted as low-moderate, with a mean of 2.58 and a standard deviation of 1.06.

Table 3: The summary of challenges dimensions and interpretation

Dimension	M	SD	Interpretation
Technical	2.71	1.14	Moderate
Learning/ Application	2.98	1.08	Moderate
Emotional/ Confidence	2.58	1.06	Low-Moderate

4.3 Relationship between Perceptions and Technical, Learning and Emotional Challenges

The analysis in Table 4 reveals a significant relationship between students' perceptions of AI and the challenges they encounter. Pearson correlation analysis showed moderate to strong negative correlations between overall positive perceptions and the three challenge dimensions, perceptions vs. technical challenges: r = -0.42, $p < 0.01$, perceptions vs. learning challenges: r = -0.49, $p < 0.01$ and perceptions vs. emotional challenges: r = -0.38, $p < 0.01$. The technical challenges were also found to be highly correlated with learning and emotional challenges, highlighting the interconnected nature of these barriers. For example, technical issues can increase frustration and anxiety, which may undermine students' confidence and willingness to use AI-based learning tools (Xu et al., 2023a & Zhang & Dang, 2021b). These significant negative correlations indicate that students who hold more favorable views of AI tend to report fewer obstacles in all challenge categories. This suggests a reciprocal relationship where improving students' perceptions might reduce their perceived difficulties, and vice versa. Students who view AI positively, recognizing its usefulness and ease of use, generally report fewer difficulties in navigating and applying these technologies. In contrast, those with more negative perceptions tend to experience greater challenges, which can hinder their engagement and learning outcomes. This finding underscores the importance of fostering positive attitudes toward AI to minimize barriers and enhance students' overall experience. Interventions aimed at enhancing familiarity with AI tools and demonstrating their benefits could therefore improve both acceptance and usability.

Table 4: The relationship between TVET students' perceptions of AI and the challenges

Variable	Perceptions
Technical Challenges	-0.42**
Learning/Application challenges	-0.49**
Emotional/ Confidence Challenges	-0.38**

Note: p<0.01 (2 tailed)

4.4 Influence of Self-Efficacy

Correlations between the self-efficacy-based challenge categories and AI usage frequency were found to be technical challenges vs. AI usage frequency: r = -0.29, learning challenges vs. AI usage frequency: r = -0.37, emotional challenges vs. AI usage frequency: r = -0.34 as shown in Table 5 below. These negative correlations suggest that students experiencing fewer challenges (indicative of higher self-efficacy in those areas) are more likely to use AI tools regularly. When students believe they can handle new technology, they're more likely to try out AI features, explore how they work, and stick with it even when it gets challenging. This supports Bandura (1997) idea that self-efficacy influences how people approach and persevere through difficult tasks. In a TVET context, where hands-on learning is key, students who feel more capable (higher self-efficacy) are also more likely to see AI as useful and easy to use. Studies by Fu et al. (2023) back this up, showing that higher self-efficacy often leads to more positive attitudes toward AI and greater actual use. Alajmi (2021) also found that students with higher confidence in their ability to use digital tools were more likely to effectively engage with online learning platforms and overcome challenges related to technology use. Conversely, low self-efficacy can result in anxiety and avoidance of AI tools, limiting their educational benefits. These findings suggest that building students' confidence through digital literacy training or guided practice with AI tools could go a long way in encouraging meaningful and effective use of AI in technical and vocational learning environments

Table 5: The correlations between the self-efficacy-based challenge categories and AI usage

Self-Efficiency Type	*r*-value	Interpretation
Technical	-0.29	Weak negative
Learning/Application	-0.37	Moderate Negative
Emotional/Confidence	-0.34	Moderate Negative

5. Conclusion and Recommendations

In conclusion, this study confirms that TVET students at Politeknik Kota Bharu generally hold a very positive perception of AI as a learning aid, recognizing its potential to improve understanding, save time, and enhance performance. However, they continue to face notable technical, learning-related, and emotional/confidence challenges in its adoption and use. Among these, learning/application challenges appeared to be the most pronounced.

The clear negative relationships identified between students' positive perceptions and these challenges strongly suggest that efforts to improve students' attitudes toward AI may help to mitigate these barriers. Consistent with the Kamoun et al. (2024) which also revealed that challenges related to ease of use, lack of clarity on AI's educational value, and limited training affect students' willingness to adopt these tools fully. Furthermore, the self-efficacy of learners, as outlined in Bandura (1997) theory, appears to significantly influence how comfortably students engage with AI. The inverse relationships found between the reported challenges and AI usage frequency support the notion that students with higher confidence in their digital skills and fewer perceived obstacles were more likely to explore and benefit from AI tools. This aligns with Fu et al. (2023), who also found that self-efficacy significantly affected student engagement in AI-supported environments, a pattern mirrored in our participants' responses. Moreover, findings from Khairuddin et al. (2024) suggest that while students are generally receptive to AI, many still express concerns about overreliance and

the authenticity of AI-generated content, which our data also reflected in some reservations noted regarding trust in AI information and suggestions. This highlights the ongoing need for fostering digital literacy and critical thinking to ensure responsible use. Supporting this, Xu et al. (2023b) noted that students' attitudes towards technology also vary with demographic and motivational factors, such as gender and academic background which merit further exploration in the TVET context.

For AI to be effectively integrated into TVET education, educators and administrators must address both practical technical issues and the emotional factors that affect student engagement. Providing comprehensive support and fostering a positive AI learning environment will be critical in ensuring that AI tools fulfill their potential in enhancing vocational and technical education outcomes.

This study contributes to the growing body of research on AI in education by offering insights into how TVET students perceive and interact with AI learning tools, and what challenges they encounter. While students generally value the potential of AI to improve learning outcomes and streamline academic tasks, they also face obstacles related to usability, access, and understanding.

To support effective AI adoption in TVET institutions, several recommendations are made. Educational leaders must invest in comprehensive teacher and student training programs focused on AI literacy, practical application, and the critical evaluation of AI outputs. Furthermore, reliable technical support systems must be established and made easily accessible to both students and educators to promptly address operational challenges. Clear ethical frameworks and guidelines for AI use in academic settings should also be developed and disseminated to promote responsible and equitable use, addressing concerns about data privacy and academic integrity. Finally, institutions should actively work to create a learning environment that fosters innovation while maintaining academic integrity and accessibility for all students, which includes integrating AI tools in a manner that aligns with course requirements and diverse learning styles.

To further build upon these findings, future research should consider integrating qualitative methods such as interviews or focus groups to gain deeper insights into learners' experiences with AI, particularly regarding the nuances of their challenges and perceptions. Expanding the participant pool across different TVET institutions and regions would improve the generalizability of findings and allow for comparative analysis. Including the perspectives of educators and administrators could offer a more comprehensive view of AI integration challenges and successes from an institutional standpoint. Longitudinal studies are also encouraged to explore how students' perceptions, challenges, and usage patterns evolve over time with increased exposure and experience with AI tools. Moreover, further exploration into the ethical, pedagogical, and institutional dimensions of AI in TVET settings would help guide more effective and responsible implementation strategies. By addressing these areas, future research can contribute to a more comprehensive and actionable understanding of how AI can be effectively and responsibly integrated into TVET and other educational settings.

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