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Evaluating an AI-Integrated E-Learning Portal in Malaysian TVET: A DeLone-McLean and TAM Perspective on SmartGradeAi

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ABSTRACT

This research investigates SmartGradeAi, an AI-based e-learning portal, in the Malaysian Technical and Vocational Education and Training (TVET) context. The analysis is based on feedback from a web-based survey with 70 respondents, all students of the Diploma in Electrical Engineering at Politeknik Sultan Abdul Halim Mu'adzam Shah. The research adopts the DeLone-McLean Information Systems Success Model and the Technology Acceptance Model (TAM) to analyze the portal's technical quality, informational, and service support, and to gauge the perceived usefulness, the perceived ease of use, and the user satisfaction, along with the net benefit. The analysis shows a positive outlook to the portal. All the seven dimensions in the study had a favorable rating ranging from 3.78 to 3.95 in the categories of system quality, and perceived usefulness and ease of use. The highest rated attributes were related to the portal's ease of use, the satisfaction with AI feedback, and the endorsement of the system to peers. The portal showed its lowest rating with system stability. This research shows SmartGradeAi as positive, especially in the AI-based evaluation field, and particularly in the management of practical learning in TVET. However, for a more informed academic feedback, the research should include more respondents, conduct psychometric modeling, and longitudinal analysis.

KEYWORDS: *SmartGradeAi; TVET; e-learning; artificial intelligence; DeLone-McLean model; Technology Acceptance Model*

1.INTRODUCTION

In higher education edge, level beyond hosting course materials is now expected. Digital systems (software) in Technical and Vocational Education and Training (TVET) are expected to facilitate attendance, submission of classwork, feedback, progress and communication. AI-based learning portals are being designed to support eductive activities across placement levels and enhance collaboration. Assessments are also being designed to support collaborative experience and construct based learning. In addition to computers' technical functionality feedback is being provided. An important consideration for the success of the system is the jury, the students and teachers, who assess it in relation to the learning outcomes.

This paper is based on a case of a Malaysian polytechnic established for AI-based SmartGradeAi systems. In this case, feedback was given by 70 students from the Diploma in Electrical Engineering program at Politeknik Sultan Abdul Halim Mu'adzam Shah. The learners fill a web-based questionnaire about the learning portal, which is designed to facilitate the learning process. The portal is not a neutral administrative tool and as such the level of engagement was considered. Guide to learning systems that was designed to facilitate learning oriented activities was also considered. The study considers the relevance of the learning activity as it is oriented towards two concepts, the DeLone-McLean Information Systems Success Model.

This paper is accomplishing three goals. First, it organizes the descriptive results of the survey in an articulately structured narrative. Second, it provides context to the survey results and nests them within other literature on e-learning success, user acceptance, and AI-integrated learning. Third, it notes the limitations and consequences that the research study presents for Malaysian TVET. Given the evidence is descriptive rather than inferential, one could argue the case is that SmartGradeAi is encouraging as a support system for practical learning; however, the utility of SmartGradeAi as an educational support system should be understood to be positively perceived, rather than absolutely proven.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The DeLone-McLean model is one of the most widely used models to assess information systems. In the original version of the framework, DeLone and McLean identified six dimensions, namely, system quality, information quality, use, user satisfaction, individual impact, and organizational impact (DeLone & McLean, 1992). In their ten-year review, DeLone and McLean (2003) added service quality and incorporated the several dimensions into one consolidated construct, called net benefits. The model and its dimensions are useful in educational technology because they relate the metrics of technical performance to user outcomes. In an e-learning environment, system quality and information quality are expected to have a high degree of use and satisfaction, which leads to learning-related outcomes.

Adopting their model to evaluate e-learning systems is highly justified. Especially in relation to satisfaction and net benefits, the DeLone-McLean model is one of the most used frameworks to evaluate the success of online learning systems (Sabeh et al.,

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2021). A number of studies have quantitatively assessed the relationship of quality dimensions to the acceptance of learning management systems (Yakubu & Dasuki, 2018; Al-Shargabi et al., 2021; Alotaibi & Alshahrani, 2022). These studies are particularly useful in the current context, since SmartGradeAi integrates platform management and AI-based feedback and assessment.

The DeLone-McLean model is complemented by the Technology Acceptance Model (TAM). The TAM model focuses more on cognitive dimensions. The primary logical dimensions in technology acceptance as argued by Davis (1989), are perceived usefulness and perceived ease of use. These perceived dimensions have invariably shaped the intention, satisfaction, and actual use of technology in the classroom. Also, adopting IT in learning environments is dependent on students' perceptions of the ease of learning the IT systems and effectiveness in enhancing learning (Al-Adwan et al., 2013; Chahal & Rani, 2022). The TAM model fits the SmartGradeAi scenario as submission, viewing grades, and receiving feedback have been simplified in SmartGradeAi.

The importance of the AI component cannot be dismissed. The innovative AI-learning systems are expected to enhance the personalization speed, adaptive learning provision, and provision of focused constructive feedback. If the learners do not view the system as relevant, trustworthy, and pedagogically useful, these innovative systems cannot be effective. AI-driven learning environments have been reported to shape learners' perceptions positively thereby increasing the probability of continued use (Kashive et al., 2021). The potential of AI in learning is incomparable to the dimensions of the challenges that involve infrastructure, quality of the user interface, data security, and readiness of the instructors to transform their learning modalities and support the learners (Liu & Yu, 2023). That context also holds true in the digital learning initiatives in the area of TVET in Malaysia, where having the relevant systems is not enough for the successful implementation of technology (Razak et al., 2022).

Used in conjunction, conceived frameworks help support the analytical structure of the current paper. Smart-Grade Ai can, indeed, be considered a successful system using DeLone-McLean. Meanwhile, using TAM, the rationale behind acceptance or rejection of Smart-Grade Ai by students can be posited. This combination of frameworks is particularly pertinent and useful in the TVET context, where the usage of technology is primarily directed toward the performance of concrete learning activities.

3. METHODOLOGY

This study utilized a quantitative descriptive design conducted via a web-based questionnaire. Feedback was collected to evaluate SmartGradeAi, which was then distributed to Semester 2 students enrolled in the Diploma Kejuruteraan Elektrik program at Politeknik Sultan Abdul Halim Mu'adzam Shah. In total, there were 70 responses. Thus, respondents' profiles were confined to specific institutions, particular programs, and were homogeneous in academic status.

There were general demographic and usage questions which were then followed by questions on a Likert scale about the seven constructs, which are system, information, and service quality, perceived usefulness and ease of use, user satisfaction, and net benefit. Likewise, these constructs were the outcome of the integrated use of the DeLone-McLean and the Technology Acceptance Model (TAM) frameworks. The data set was representative of the population and provided item level statistics along with some descriptive statistics which included mean, median, mode, and standard deviation as well as frequency distributions of some of the questions.

This paper has also adopted an interpretivist descriptive approach. The paper has combined the data of the survey with some of the available literature and draws some conclusions, while keeping in mind the available data. The paper has not included any additional analysis, causal relationships, and/or psychometric evaluations as the data does not allow for such in-depth analysis.

4. FINDINGS

The respondent profile defines a narrow user group. Out of 70 respondents, 84.29% identified as male and 15.71% female. The majority, or 82.86%, were 19, with the remainder of ages varying from the larger group of 18, 20, and 21. Each of the respondents were enrolled in the Diploma in Electrical Engineering and were all in Semester 2. From an analytical point of view, it is useful that this element is uniform across the respondents as it reduces variation from what the respondents were studying, but it does negatively impact the generalisability of the findings across the board.

Illustrating the data from the respondents, it can be concluded that SmartGradeAi is in an early stage of adoption. 35.71% of respondents had used the portal for less than a month. 34.29% had used the portal for between one and three months. 25.71% had used it for between four and six months, and finally, 4.29% had used it for more than six months. The respondents had moderate access to the system with 45.71% reporting that they used the system once or twice a week and 44.29% reporting that they used it three or four times a week. 48.57% of respondents used a smartphone to access the system, and this was the largest segment. The remainder of respondents used the system via one of the following devices: 32.86% of respondents used a laptop, a desktop (14.29%), and/or a tablet (4.29%). We can say that the respondents had generally ordered and relatively good Internet access. 48.57% of respondents reported having a mostly stable connection, 38.57% had stable connections, 11.43% had unstable connections, and 01.43% of respondents reported having a frequently unstable connection. These data are a useful starting point, as they suggest that users the system because the system was configured primarily for use on a mobile device and had variable connectivity.

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Table 1. Respondent Profile and Usage Context

Indicator	Reported Result
Sample size	70 respondents
Gender	84.29% male; 15.71% female
Age	82.86% were 19 years old; smaller groups were aged 18, 20, and 21
Semester	100% Semester 2
Programme	100% Diploma Kejuruteraan Elektrik
Usage duration	<1 month: 35.71%; 1-3 months: 34.29%; 4-6 months: 25.71%; >6 months: 4.29%
Weekly access	1-2 times: 45.71%; 3-4 times: 44.29%; 5-7 times: 7.14%; >7 times: 2.86%
Access device	Smartphone 48.57%; laptop 32.86%; desktop 14.29%; tablet 4.29%
Internet stability	Mostly stable 48.57%; always stable 38.57%; sometimes unstable 11.43%; often unstable 1.43%

Table 2. Construct-Level Summary of Findings

Construct	Overall Mean	Interpretive Note
System Quality	3.78	Highest item: device compatibility (3.91); Lowest item: system stability (3.50)
Information Quality	3.89	AI-generated feedback helpful and informative (3.94)
Service Quality	3.84	Prompt lecturer/admin response (3.91); support speed lower (3.76)
Perceived Usefulness	3.95	Makes it easier to submit practical work on time (4.04)
Perceived Ease of Use	3.95	Overall ease of use (4.01)
User Satisfaction	3.93	Recommend to other students (3.99); continue using portal (3.91)
Net Benefits	3.93	Engagement/motivation (3.96); efficiency in practical work process (3.96)

Positive mean scores were recorded for SmartGradeAi across all seven major constructs. Overall system quality registered a mean of 3.78, information quality 3.89, service quality 3.84, perceived usefulness 3.95, perceived ease of use 3.95, user satisfaction 3.93, and net benefits 3.93. The results show that technical and service dimensions were rated positively, while user-centred acceptance dimensions were rated even higher. This may indicate that students are willing to overlook some operational issues in a system that is supportive of their academic work.

SmartGradeAi's system quality highlighted device compatibility, which recorded a mean of 3.91, while ease of navigation, QR-based attendance, and data security recorded means of 3.86. The weakest item from all of the constructs of the survey was recorded for the system quality of the SmartGradeAi system. The mean for the system quality item, "stability portals and minimal system failure and error," was reported as 3.50. This focus is important. System failure is clearly not occurring, but from the results, it is instructing that it is failing to illustrate stability, which is the most significant operational risk for SmartGradeAi. The TVET context and the practical work that needs the submissions and the work to flow may mean that even the slightest sign of instability in the system may cause students to lose faith in the system.

Information quality was rated consistently highly. Construct clarity, accuracy, sufficiency, and AI-generated feedback (mean 3.94) drew positive feedback. Notably, the AI feedback statement drew responses indicating the feedback was helpful and informative (median, mode = 4; SD = 0.74; heavy skew toward agreement). The results suggest students viewed the AI feedback as substantive, contrary to many other AI design implementations students have experienced, and are willing to construct to be positive and engaging. This positive AI construct was especially notable given the presence of some contradictory design elements, notably the portals non-integrated design with other elements of the learning program (signified by the students' concerns regarding AI supremacy).

Service quality and feedback were mostly positive concerning the promptness of responses to Personal Lecturers or Administrators (3.91) and the timeliness of notifications on the portal (3.86). Support speed when students experienced difficulties was slightly weaker (3.76). Improvement in efficiency seems to be a focus regarding the service ecosystem surrounding the portals. Research on digital learning shows that the support structure plays a significant role in maintaining the use of a construct following initial positive feedback.

These TAM findings are most uplifting. The survey found perceived usefulness to be one of the highest construct means at 3.95. Its most impressive item was statement 'Using the SmartGradeAi portal makes it easier for me to submit my practical work on time', which mean 4.04, the highest response for that item on the survey. Due to the management of deadlines, tracking of submission, and the efficiency of workflow, practical-course management makes this SmartGradeAi portal for TVET courses submission all the more valuable. The portal also achieved an ease of use mean of 3.95 and portal mean of 4.01. The students showed utility and recognized the system for its simplicity.

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User satisfaction and net benefits were no different. They achieved a mean of 3.94 for overall satisfaction, portal use for a mean of 3.91, and a mean of 3.99 for their recommendation to their peers. The recommendation item is notable because it represents the highest form of user's adoption. The net benefits also followed a clear trend of 3.96 for engagement and motivation, 3.96 for efficiency improvement of the practical-work processes, and 3.97 for the overall learning benefits. With these survey means, it is clear to say that the students perceived SmartGradeAi not just as an administrative submission platform, but as a system that solved their learning organization, workflow, and motivation issues of submission.

5. DISCUSSION

The results suggest SmartGradeAi performs well when analyzed via the combined DeLone-McLean and TAM framework. From the DeLone-McLean perspective, the portal is successful, given that all three dimensions of quality scored highly and were paired with strong user satisfaction and perceived net benefits. This trend is similar to previous e-learning studies, where system, information, and service quality have been considered necessary antecedents to satisfaction and the educational value of a system (Yakubu & Dasuki, 2018; Alotaibi & Alshahrani, 2022). Given the quality of information, the SmartGradeAi case deserves special attention, as this high score of the AI-generated feedback feature helps explain why, despite the functional stability feedback received, the SmartGrade Ai portal was highly rated by the students.

From a TAM perspective, the findings also indicate that students perceive the portal as useful due to the increased ease of performing a core learning task—submission of practical work—and also, due to the perceived ease of use, as evidenced by the overall ease-of-use items scoring above 4.00. This congruence in perceptions of utility and ease of use is what TAM postulates as a precursor for technology acceptance (Davis, 1989). The strong recommendation score and preference for continued use further indicate that acceptance is active, as evidenced by the level of confidence in the system's perceived educational value. Analogous results have been provided in other e-learning studies, where user perceptions of the system's usefulness and ease of use are keys to continued use (Al-Adwan et al., 2013; Chahal & Rani, 2022).

The findings are of particular importance in the TVET context. The process of digitization is most challenging for programs that need to be evaluated based on practical skills. These programs require continuous mentoring, coordination of workflow, and feedback in a timely manner. In this regard, SmartGradeAi seems to resolve various real challenges of operations. SmartGradeAi sets schedule for the submission, streamlines the process of taking attendance, and students report that the feedback generated by SmartGradeAi is helpful. It is the case that, SmartGradeAi addresses challenges that AI moderated e-learning tools are meant to resolve (Kashive et al., 2021; Liu & Yu, 2023).

These findings should also not be overly optimistic. It is in every virtual learning platform that the negative perceptions of the system when it comes to the stability of the system is no small issue. Assessment and attendance involve system functionalities that can be detrimental to the perception of the system. The speed of support and availability of help resources also ranked the lowest, which indicates that tech implementation should accompany improvement in user support and clear, step-by-step instructions for first-time users. Essentially, the success of SmartGradeAi is achievable, but the potential is even more real. If the reliability of operations does not keep value, the potential will no longer exist.

6. LIMITATIONS AND FUTURE RESEARCH

There are a number of limitations of this study with respect to establishing more robust causation or generalization. First, this study is built on a single narrow sample of 70 respondents from a single program, a single semester, and a single institution. Second, this study will claim to be more generalizable only to the extent that the sample is uninterested/ not heavily biased. Third, the evaluation of the portal example was of respondents in the early/ the first three months of portal usage. The first three months of usage is a period of portal noveltas. In that positive ratings are highly correlated with the novelty of the portal.

On the other hand, this study is also constructed from a number of design constraints. Repeated measures design, or the design of collecting data from the same respondents/ single sample more than once, veers referral bias or loss of data bias, and in this study constitutes collected sample data on measures of noxi blotched. Furthermore, there is no objective or valued added measure of change. As a result, there is no measure of change either in terms of respondents' grades, completion rates, or the average grades/ outcomes of the cohorts. In that regard, future studies should utilize a more disciplined approach to multiple sampling within and across Malaysian TVET. Use of sampling that is more structured, and sampling paired with the collected data from respondents, the data also being in a more structured format, than unstructured.

7. CONCLUSION

SmartGradeAi is looked upon favorably by the student group in this research, where overall performance across multiple indicators is observed positively. Upper performance is noted across information quality, service quality, perceived usefulness, perceived ease of use, user satisfaction, and net benefits; system stability, however, is the primary concern. When viewed using the DeLone-McLean model and TAM, it can be interpreted that the portal has gained in the early legitimation stages of a support system focused on TVET practical learning. It appears that the portal's greatest support is achieved by the informing AI and the facilitation of workflow within a system. However, due to the lack of descriptive and comprehensive evidence, the stronger argument is that SmartGradeAi is promising. The portal, on its own, is not useful, and to ensure that the system can become a valid AI learning system that can be implemented in TVET Malaysian models, it would require further technical improvements and a more extensive user satisfaction survey.

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