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The Effectiveness of Gamification Using the BuildSmart Mastermind Application Among Diploma in Quantity Surveying Students in Malaysian Polytechnics

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Abstract: This study aims to evaluate the effectiveness of the BuildSmart Mastermind application in enhancing students' knowledge in the field of Quantity Surveying. Although gamification has gained growing attention in educational research, its effectiveness within Quantity Surveying programmes in Malaysian Polytechnics remains underexplored in supporting the conceptual mastery of quantity measurement. A quantitative approach was employed involving 140 students from Politeknik Sultan Azlan Shah, Politeknik Sultan Abdul Halim Muadzam Shah, Politeknik Kota Bharu, and Politeknik Kota Kinabalu. The research instrument consisted of a self-developed questionnaire using a five-point Likert scale that included demographic information and items aligned with the study objectives. The data were analysed descriptively, with mean scores used to determine the effectiveness level of the gamification application. The findings show that all evaluated elements fall within the high category, with a mean score of 4.514, indicating that BuildSmart Mastermind supports flexible revision, strengthens understanding of quantity measurement concepts, and enhances student engagement. Overall, this study provides empirical evidence that strengthens the pedagogical value of gamification in technical and vocational education, highlighting its potential to improve learning effectiveness and to support technology-driven instructional strategies that prioritise engagement, autonomy, and deeper conceptual understanding.

Keywords: *Gamification, Quantity Surveying, Malaysian Polytechnics*

1.0 Introduction

The need for gamification in education has become increasingly significant, as this approach can make the teaching and learning process more engaging, interactive, and effective. Students participating in gamified learning environments can work towards shared goals by collaborating with their teams in competitive settings, which encourages idea sharing, debate, critical thinking, and strategic decision making (Mulkeen, 2018). Gamification in education has transformed the way learners interact with instructional materials, shifting traditional learning into a dynamic and interactive format. By integrating game elements into the learning process, students become more motivated to invest additional effort, time, and focus, turning education into an enjoyable journey rather than a monotonous task. This combination of entertainment and learning has proven to be a powerful tool in enhancing student engagement and fostering deeper understanding (Swain, 2024).

Recent global research highlights that gamification can strengthen motivation, autonomy, and engagement through mechanisms that support intrinsic motivational processes, which aligns with Self Determination Theory that emphasises autonomy, competence, and relatedness as key drivers of sustained learning effort (Ryan and Deci, 2020). Gamification also presents content through visual, interactive, and multimodal features that enhance cognitive processing, reduce mental load, and support deeper understanding (Koivisto and Hamari, 2019). These advantages are especially relevant for technical fields such as Quantity Surveying, where students often face challenges in mastering abstract and procedural concepts related to quantity measurement when learning depends only on textbooks.

Although gamification is increasingly used in higher education and technical and vocational education, its effectiveness in Quantity Surveying programmes, particularly within Malaysian Polytechnics, remains insufficiently examined. Past studies have demonstrated positive outcomes of gamified learning in engineering, science, and vocational subjects (Subhash and Cudney, 2018), yet there is limited empirical evidence on how gamification supports conceptual understanding, revision practices, and learning flexibility in the context of quantity measurement. Moreover, digital resources

designed specifically for Quantity Surveying education are scarce, highlighting the need for pedagogical innovation that supports visual learning, repeated practice, and self-paced revision.

This gap strengthens the importance of evaluating digital gamified tools such as the BuildSmart Mastermind application, which is designed to help students strengthen their understanding of Quantity Surveying and measurement concepts through interactive tasks, visual cues, and flexible learning access. Given that quantity measurement is a core competency that requires procedural accuracy and conceptual clarity, gamification offers a suitable platform to address learning difficulties commonly reported among Quantity Surveying students.

Therefore, this study aims to evaluate the effectiveness of the BuildSmart Mastermind application in enhancing students' knowledge in the field of Quantity Surveying. By exploring how gamification influences learning engagement, conceptual understanding of quantity measurement, and overall learning flexibility, this study provides new empirical insights that support the advancement of digital pedagogical strategies in technical and vocational education, particularly in Malaysian Polytechnics.

2.0 Literature Reviews

Gamification has emerged as an important pedagogical strategy in education to enhance student engagement, motivation, and learning outcomes. Gamification transforms traditional learning environments into dynamic and interactive experiences by integrating game elements that resonate with learners, especially those from Generation Y and later generations who prefer learning experiences that blend education with entertainment. Its ability to cultivate collaboration, critical thinking, and problem-solving has made it a widely discussed innovation in the field of educational technology (Özyurt and Ayaz, 2022). This approach creates an enjoyable learning atmosphere and supports essential twenty-first-century competencies, aligning well with the needs of contemporary learners (Wangi et al., 2022).

Research shows that gamification positively influences various aspects of student behaviour and academic performance. Studies have demonstrated that gamification increases student motivation and engagement, which then leads to improved learning achievement (Nurtanto et al., 2021; Li, 2023). These findings align with Self Determination Theory, which emphasises the psychological needs of autonomy, competence, and relatedness as drivers of intrinsic motivation, suggesting that learners are more willing to persist and engage when these needs are fulfilled (Ryan and Deci, 2020). Gamified learning environments naturally encourage voluntary participation and self-driven exploration, contributing to more meaningful and sustained learning experiences.

Gamification also enhances cognitive outcomes by presenting content in formats that support multimodal learning. Interactive tasks, visual elements, and immediate feedback help reduce cognitive load and allow students to process complex information more efficiently. These features are especially useful for subjects that involve abstract reasoning or procedural knowledge (Koivisto and Hamari, 2019). Technical disciplines such as Quantity Surveying require students to interpret drawings, understand measurement rules, and perform calculations accurately. Studies in vocational and engineering education indicate that gamified tools can improve conceptual understanding, enhance spatial reasoning, and support repeated practice, which is essential for mastering technical skills (Bovermann and Bastiaens, 2020).

Empirical studies have also highlighted that gamified learning promotes collaborative learning and strengthens students' interactions with peers. Collaborative activities within gamified platforms allow students to share strategies, negotiate solutions, and learn through peer support, which leads to better comprehension and active participation (Belmonte et al., 2020). Gamification further supports

motivation and engagement in online, blended, and remote learning settings, which reflects its versatility across different educational contexts (Rahayu et al., 2022). These findings demonstrate that gamification can serve as a bridge between traditional teaching methods and technology-driven learning environments.

Although the benefits of gamification are widely reported across disciplines, its application in Quantity Surveying remains underexplored, particularly in the context of Malaysian Polytechnics. Most existing research on gamification focuses on engineering, computer science, and general vocational education (Subhash and Cudney, 2018). A few studies investigate how gamification supports conceptual understanding, revision practices, or learning flexibility within quantity measurement, which is a core component in Quantity Surveying programmes. Students often struggle with interpreting drawings, understanding measurement procedures, and memorising rules when relying only on printed notes or static classroom materials. Given these challenges, there is a clear need for learning tools that facilitate visual understanding, interactive practice, and flexible revision.

The BuildSmart Mastermind application was developed to support learning in Quantity Surveying, particularly in quantity measurement. Its gamified features allow students to revisit lessons anywhere and at any time, practice measurement concepts repeatedly, and strengthen their understanding through interactive and visual elements. However, despite its potential, the effectiveness of this application has not been empirically examined within Malaysian Polytechnics. This creates a significant gap in the literature and underscores the need to evaluate the extent to which gamification can improve learning outcomes in technical and vocational education. Therefore, strengthening the evidence base through empirical evaluation is crucial. This study contributes valuable insights to support the development of digital pedagogical practices in the Quantity Surveying programme.

3.0 Methodology

This study employs a quantitative research design to evaluate the effectiveness of the BuildSmart Mastermind application among Diploma in Quantity Surveying students in Malaysian Polytechnics. A total of 140 respondents, comprising students and lecturers from four institutions, were selected through convenience sampling, which is appropriate as the target group consists of individuals directly engaged in quantity measurement learning. Data was collected through a questionnaire using a five-point Likert scale that included demographic information and items aligned with the study objectives. Content validity was established through expert review to ensure that the items accurately reflected the intended item, while a pilot test produced Cronbach's alpha values above 0.70, confirming acceptable reliability and consistency of responses. All data were collected online, and ethical procedures, including voluntary participation, informed consent, and anonymity, were strictly observed. The data were analysed using descriptive statistics, with mean scores interpreted according to the effectiveness categories proposed by Ngadiman and colleagues in the year 2019. Although convenience sampling and descriptive analysis limit generalisability and do not establish causal relationships, this methodological approach provides a clear overview of respondents' perceptions and offers a suitable foundation for early-stage evaluation of gamified learning tools in technical and vocational education.

4.0 Data Analysis and Findings

Based on Table 1, the respondent demographics consist of two categories, namely students and lecturers. The majority of respondents are students, with 124 individuals representing 88.57 percent of the total sample. Meanwhile, 16 lecturers participated in the study, accounting for 11.43 percent of all respondents. In total, 140 respondents were involved in this research, indicating a much higher participation rate from students compared to lecturers.

Table 1
Categories of respondents involved in the study

Category	Number	Percentage (%)
Students	124	88.57
Lecturers	16	11.43
Total	**140**	**100.00**

Based on Table 2, the institutions involved in this study consist of four polytechnics. The highest number of respondents came from Politeknik Sultan Azlan Shah (PSAS) with 76 respondents, representing 54.29 percent of the total. This is followed by Politeknik Sultan Abdul Halim Muadzam Shah (POLIMAS) and Politeknik Kota Bharu (PKB), each with 22 respondents or 15.71 percent, respectively. Politeknik Kota Kinabalu (PKK) contributed 20respondents, which represents 14.29 percent of the sample. These findings show that PSAS recorded the highest participation compared to the other institutions.

Table 2
Categories of respondents involved in the study

Institution	Number	Percentage (%)
PSAS	76	54.29
POLIMAS	22	15.71
PKB	22	15.71
PKK	20	14.29
Jumlah	**140**	**100.00**

Based on the data obtained, the effectiveness level of the evaluated elements falls within the high category, with a mean score of 4.514. The findings show that learning that depends only on textbooks is often viewed as boring by students. In contrast, the BuildSmart Mastermind application offers the flexibility to revise anywhere and at any time, making it a relevant and effective learning tool. The application also increases interest in quantity measurement through appealing graphics, helpful illustrations, and clear explanations. Its sample questions further strengthen basic understanding and make learning more engaging. These results highlight the benefits of gamification in enhancing flexibility and student engagement. The revised study items are presented in Table 3.

Table 3
Study items related to the effectiveness of the BuildSmart Mastermind application

Item	Mean	Effectiveness Level
Learning that relies only on textbooks is perceived as boring.	4.514	High
BuildSmart Mastermind allows students to revise anywhere.	4.514	High
It allows students to revise at any time.	4.514	High
It increases students' interest in learning quantity measurement.	4.514	High
It has appealing graphics that encourage continuous revision.	4.507	High
Its illustrations improve understanding of measurement methods.	4.486	High

Its explanations help students apply correct measurement techniques.	4.486	High
It encourages deeper exploration of quantity measurement.	4.464	High
Its sample questions support better subject understanding.	4.457	High
It strengthens students' basic knowledge of quantity measurement.	4.429	High
It makes learning quantity measurement more enjoyable.	4.414	High
It motivates students to be engaged in quantity measurement lessons.	4.257	High

The findings clearly demonstrate that the evaluated elements fall within the high category, with a mean score of 4.514. The results also show that traditional textbook-based learning is perceived as dull. In contrast, the BuildSmart Mastermind application offers students the flexibility to revise their lessons anytime and anywhere, making it a relevant and effective learning tool. These findings further highlight the strengths of gamification in education, particularly in increasing flexibility and student engagement throughout the learning process.

5.0 Discussion and Conclusions

The findings show that the BuildSmart Mastermind application is highly effective in supporting students' learning of quantity measurement concepts, as reflected by the overall high mean score of 4.514. This indicates that gamification provides meaningful pedagogical value within Quantity Surveying education by strengthening learning flexibility, conceptual understanding, and student engagement. These results are consistent with earlier studies showing that gamified environments enhance motivation, cognitive processing, and active participation compared to conventional textbook-based approaches (Koivisto and Hamari, 2019; Nurtanto et al., 2021). The outcomes also align with Self Determination Theory, which emphasises autonomy, competence, and relatedness as drivers of intrinsic motivation and deeper learning (Ryan and Deci, 2020). The study contributes empirical evidence to an underexplored area, as gamification has rarely been examined in Quantity Surveying or Malaysian Polytechnic settings, where students often face difficulties with abstract and procedural tasks such as interpreting drawings and applying measurement rules. The multimodal features of BuildSmart Mastermind, including visual prompts, illustrations, and structured practice items, appear to reduce cognitive load and support clearer comprehension, consistent with findings that interactive and visually rich materials improve understanding in technical learning contexts (Bovermann and Bastiaens, 2020; Li, 2023).

Overall, this study concludes that the BuildSmart Mastermind application enhances the learning experience of Quantity Surveying students by providing an interactive and flexible digital environment that complements traditional teaching methods. While limitations such as convenience sampling, reliance on self-reported perceptions, and descriptive analysis constrain generalisability and do not reveal actual performance gains, the findings offer valuable early evidence of gamification's potential in technical and vocational education. This aligns with broader research emphasising the importance of innovative digital tools in promoting student-centred, engaging, and effective learning environments (Rahayu et al., 2022). Therefore, this study provides strong principles for future research that incorporates experimental, longitudinal, or mixed method approaches to evaluate learning performance, conceptual mastery, and long-term retention, particularly in Quantity Surveying subjects that demand procedural accuracy and visual comprehension.

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