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Research Article

Enhancing Simple Interest Understanding through Game-Based Learning

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Abstract: *Tertiary students struggle with mathematics anxiety. An interactive pedagogical approach is crucial to cultivating students' interest in mathematics. This study focuses on Mastery Interest (MAIN), a customised board game that simulates real economic environments to teach students about simple interest in a fun way. Forty-four UiTM students participated in this study. The data that were gathered using the GAMEX and MSLQ frameworks were examined using quantitative analysis. The output shows strong engagement, task value, and critical thinking from most students. This suggests that the MAIN effectively scaffolds mathematical concepts. Game-based learning supports financial comprehension, self-regulated learning, and cognitive overload reduction.*

1. INTRODUCTION

The Ministry of Higher Education Malaysia (MOHE) strongly emphasises the implementation of technologies in teaching and learning, especially in Science, Technology, Engineering, and Mathematics (STEM) subjects. In the meantime, one of the disciplines that educators are concentrating on is mathematics. Students tend to have a big challenge learning mathematics and experience "mathematics anxiety" throughout their study journey. Instead of relying solely on "chalk and board", universities are urged to incorporate interactive teaching methods. Gamification is one of the interactive methods employed in classroom-oriented lectures. This approach is well supported by Mayer's theory (Mayer, 2021), where educational games are useful to boost the students' self-understanding of the subject taken and reduce extraneous cognitive overload. This paper focuses on the new intervention of the board game named "MAIN" (Mastery Interest), a targeted pedagogical intervention specifically designed to teach the complexities of business mathematics. This analysis demonstrates how a simulated economic environment—heavily reminiscent of traditional property-

trading games like Monopoly—can serve as an extraordinarily powerful tool for cognitive scaffolding, affective emotional regulation, and the deep mastery of complex financial concepts. Concurrently, it produces a significant learning environment that involves students' higher-order thinking skills and brings fun to the learning process. Furthermore, integrating board games into business mathematics significantly increases students' financial knowledge, behaviour, and overall attitude.

2. LITERATURE REVIEW

Science, Technology, Engineering, and Mathematics (STEM) is one of the important emphases of education, particularly in Malaysia. STEM education focuses on pedagogical approaches that integrate knowledge and skills from science, technology, engineering, and mathematics for the application to real-world situations (Jamaluddin, Razak, & Rahim, 2024). Among these subjects, the emphasis on the subject of mathematics continues to pose a challenge for many students in higher education. Mathematics anxiety often contributes to these challenges, leading to low confidence among students and adversely affecting their overall academic performance (Ashcraft, 2002). Therefore, there is an increasing need for new approaches that address both the cognitive and emotional issues of learning, especially for conceptual understanding.

In line with this, the Ministry of Higher Education Malaysia (MOHE) encourages innovative student-centered approaches, which go beyond the traditional 'chalk and board' teaching methods (Baharin, Kamarudin, & Manaf, 2018). Gamification has been considered a promising approach to enhance student engagement by integrating game elements into learning. Moreover, teaching and learning experience with game-based elements has helped improve students' understanding of topics regarding trigonometry (Kenyang, Ong, Tuh, Ting, & David Buan, 2026).

Furthermore, traditional gamification methods such as board game-based learning bring benefits through collaboration among peers as well (Ho, Hung, & Kwan, 2022). A study conducted by Hromek and Roffey (2009) found that board games supported social and emotional learning by facilitating communication, cooperation, and positive interactions among participants. Not only that, the application of concepts and immediate feedback can also be provided through game-based learning, which improves students' learning experience (Kiili, Devlin, Perttula, Tuomi, & Lindstedt, 2015). Board games that simulate real-life economic situations may allow students to grasp abstract financial concepts such as simple and compound interests, promissory notes, Banker's Rule, and cash flow. This approach could potentially reduce cognitive and emotional load while encouraging active learning, leading to mitigating mathematics anxiety (Mayer, 2021).

Therefore, this paper proposes a custom-designed board game tailored specifically for Business Mathematics, namely, Mastery Interest (MAIN), to improve students' learning experience and understanding of the concepts involved.

3. METHODOLOGY

Quantitative research was carried out in this study where data were collected using a self-administered questionnaire distributed via Google Forms. The questionnaire focuses on students' demographic background and, more importantly, their perspectives on the effectiveness of the Mastery Interest (MAIN) board game in improving their conceptual understanding regarding simple interest.

The questionnaire can be separated into 3 sections, namely, Section A, B, and C. Section A consists of 5 questions, gathering demographic information from the respondents, including name, email, gender, course, and program of study at UiTM Sarawak. Section B consists of 10 questions

adapted from the Gameful Experience (GAMEX) framework (Eppmann, Bekk, & Klein, 2008). The framework evaluates the level of absorption, enjoyment, creative thinking required, activation, the absence of negative affect, and perceived capability of the participants. The validity of this framework lies in its wide application for researchers and organizations to evaluate the effectiveness of educational gaming, marketing, and corporate training. Finally, Section C consists of 10 questions designed using the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, & De Croot, 1990). The goal is to evaluate students' motivation and learning preferences as well as their engagement with the MAIN board game. The level of measurement considered for both Sections B and C involve a five-point Likert scale with the representation of 1 (Strongly Disagree) and 5 (Strongly Agree).

There are a total of 44 respondents, of whom 13 students were from the Diploma in Accountancy (AC110), 10 students were from the Diploma in Public Administration (AM110), 2 students were from the Diploma in Halal Management (IC120), and 19 students were from the Bachelor of Administrative Science (Honours) (AM238). Figure 1 shows the distribution of respondents differentiated by the program code.

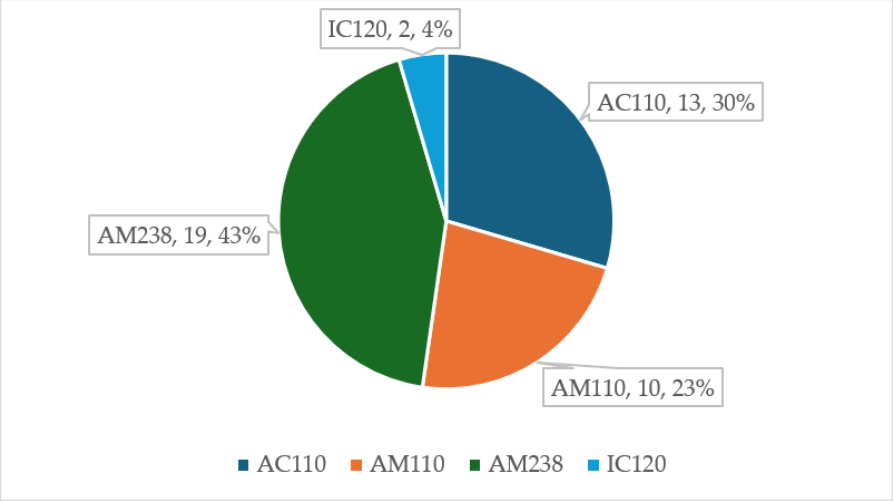

Figure 1. Distribution of Respondents by Program Code

Further analysis was performed using descriptive statistics where the frequencies, percentages, means, modes, and standard deviations were calculated and presented in a pie chart and bar charts.

4. FINDINGS

The responses were analysed against the five dimensions of the Gameful Experience Scale (GAMEX) (Eppmann, Bekk, & Klein, 2018) and the six subscales of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, & De Groot, 1990) at the level of item and composite dimension averages (M) and standard deviations (SD). Each of the five dimensions of the GAMEX resulted in average scores higher than 4.30 on a five-point Likert scale, indicating a consistently high level of gamified experience, as shown in Figure 2. Enjoyment was the most significant dimension, with the highest composite mean across the dataset (M = 4.511, SD = 0.587), and the highest item mean for excitement while playing (M = 4.636, SD = 0.487). Visual and Conceptual Appeal also received elevated scores (M = 4.477, SD = 0.660), trailed by Activation and Feedback (M = 4.455, SD = 0.623) and Creative Expression and Achievement (M = 4.455, SD = 0.623). The Absorption dimension, although remaining

high, showed the lowest composite mean and the greatest response variability among all GAMEX subscales (M = 4.364, SD = 0.714).

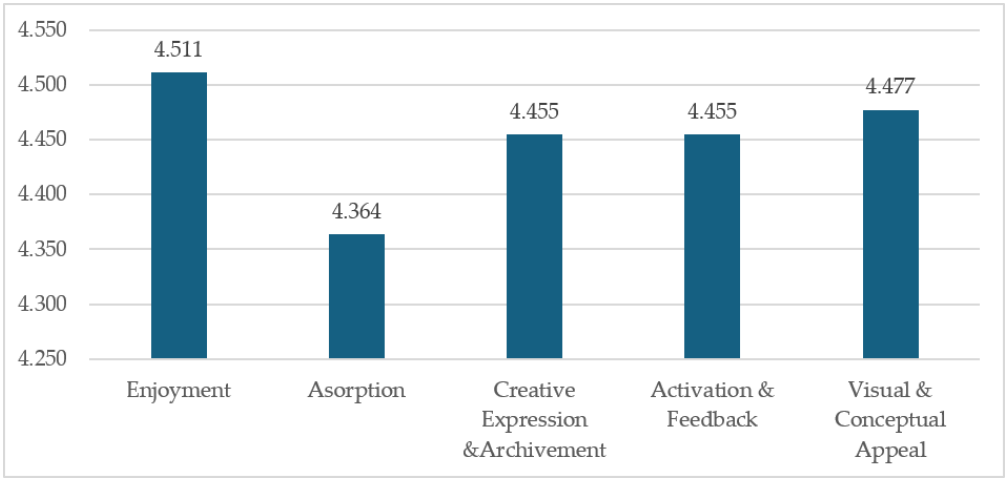

Figure 2: Mean scores for five dimensions under the GAMEX framework.

Results within the MSLQ framework were similarly favorable, as illustrated in Figure 3. Task Value and Critical Thinking both achieved the highest composite dimension means (M = 4.511, SD = 0.587 and M = 4.511, SD = 0.606, respectively), with Self-Efficacy following closely (M = 4.485, SD = 0.624). Regarding the MSLQ paradigm, the Peer Learning dimension yielded a substantial composite average (M = 4.477, SD = 0.628), while Goal Orientation followed with a similarly high mean score (M = 4.455, SD = 0.589). Among all, Metacognitive Self-Regulation produced the lowest mean subscale score across the entire MSLQ (M = 4.364, SD = 0.650) framework.

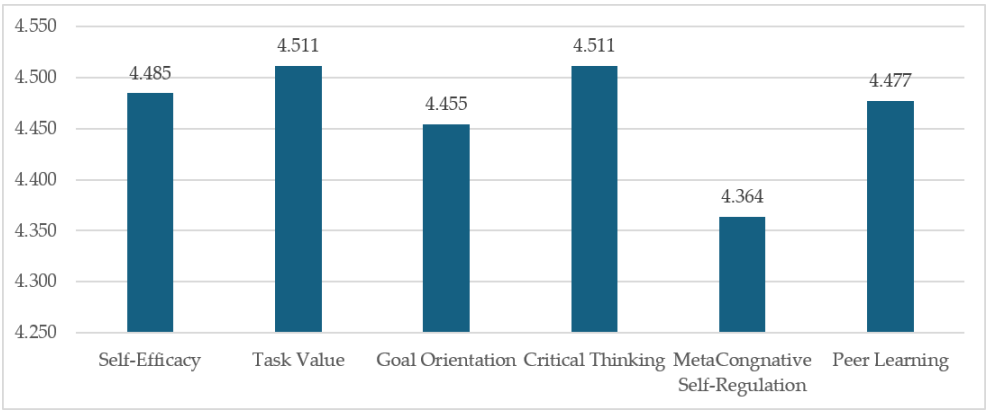

Figure 3. Mean scores based on six dimensions under the MSLQ framework.

5. DISCUSSION

The findings strongly suggest that the Monopoly-based educational strategy can help Business Mathematics students in higher education to be more emotionally engaged and more self-manageable in their own learning. The GAMEX framework's emphasis on the Enjoyment dimension, which is consistent with previous studies that have identified the enjoyment of games as a key component of

immersive learning experiences (Eppmann, Bekk, & Klein, 2018). The high scores for Visual and Conceptual Appeal suggest that the actual game elements (tokens, character cards, and game board) acted as cognitive scaffolds that guided students to make connections between abstract mathematical concepts and real-world situations of financial decision-making.

Despite these findings, the Absorption dimension with relatively higher variance requires further investigation. The temporal dissociation item had the lowest mean (M = 4.318, SD = 0.771) and the most variability among all assessed items. This data suggests that the cognitive load involved in performing manual interest calculations may have interrupted the immersion state for some individuals. Therefore, future iterations of the intervention may include instructional supports that reduce unnecessary cognitive load, such as scaffolded calculation aids or directed computational resources in the first phases of games, to support enhanced engagement and immersion for students.

Interestingly, both the Task Value and the Critical Thinking scores were high within the MSLQ framework. It shows that the simulation-based learning environment has successfully contextualised the basic interest formula, I = Prt, in settings that students find personally engaging and can understand better in this environment. As a result, the subject matter was perceived as more practically relevant, beyond its exam-focused purposes. Further, the high score on Self-Efficacy (M = 4.485, SD = 0.624) indicates frequent engagement with low-stakes possibilities.

6. CONCLUSION

The MAIN (Mastery Interest) board game demonstrates this approach to teaching and learning of Business Mathematics, which may reduce the cognitive and emotional load of traditional "chalk-and-board" approaches. The game integrates a Monopoly-inspired board game to engage students in conceptual understanding. On top of that, the immediate feedback provided also contributed to fostering active participation and discussion among students. Our findings indicated that students found the game to be engaging and enjoyable (M = 4.511). This points out the potential of MAIN as an innovative approach to deliver conceptual understanding, in alignment with the focus of the Ministry of Higher Education Malaysia (MOHE) on innovation in STEM education. It also reinforces Mayer's finding, which states that game-based education may help mitigate cognitive and emotional strain.

Nevertheless, minor fluctuations in student engagement highlight a potential area for further improvement. One of them is the process of manual calculations, which often disrupts the flow of gameplay. Future versions of the MAIN board game should consider these factors for a better and more rewarding experience. In this version of the MAIN board game, the scope focuses on concepts regarding simple interest. However, it would be more beneficial to expand this board game to topics including compound interest, promissory notes, and annuity as these applications more closely resemble real-world scenarios.

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