

Research Article

Mobile Game Apps for Innovative Occupational, Safety and Health (OSH) Learning for University Students

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Abstract: Teaching the Occupational Safety and Health (OSH) course (code FSG471) is presumed as dull and mundane, despite its importance to the industrial environment. This is because of several reasons including (1) extensive memorization and fact-gathering required on the massive, related act and regulation in OSH practices, (2) extensive wordy documents, and (3) unavailable attractive teaching and learning materials. Nonetheless, mastering this subject is vital for chemistry students, especially for Chemistry with Management program (AS222) to possess an intensive knowledge of the OSH pertaining to the workplace. Therefore, appropriate initiatives should be adhered to anticipate the above-mentioned concern. The theoretical framework of Constructivist learning suggests that learners construct knowledge more effectively when they are actively engaged in the learning process, and digital games can serve as a potent medium for such active learning. With the advent of object-oriented computer gaming software and the widening use of digital education platforms including computers, smartphones, and tablet-oriented gadgets, we proposed to develop a game-based learning system for interactive teaching in OSH subjects. This includes chapter-specific notes and assessments that emphasized this wide range of topics related to chemical industries, mainly focusing on the Occupational Safety and Health Act 1994 and the Factory and Machinery Act 1967. The content was adapted from the UiTM lecture notes and past year's exam questions. The game was developed using Build Box Classic software. This innovation transcends existing pedagogical norms, presenting a novel convergence of gaming and OSH education. As such, our research not only addresses the identified gaps but also pioneers a new direction in OSH pedagogy, emphasizing the imperative for adaptability and innovation in teaching methodologies. This game entices students to learn this subject in an entertaining and engaging way. The developed game has the potential to be commercialized towards innovative OSH learning courses throughout tertiary education and private companies.

Keywords: Build Box Software, Chemistry, post-COVID-19, game-based learning, blended learning.



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1. INTRODUCTION

Occupational Safety and Health (OSH) courses are vital for science students as preparation for working across various industries. While OSH courses are undeniably critical, the traditional

pedagogical approaches often lack the dynamic and engaging elements crucial for optimal learner engagement, potentially compromising comprehension and retention (Schulte et. al, 2022). This poses a significant challenge, given that OSH professionals play a critical role in ensuring workplace safety and reducing occupational hazards. The theoretical framework of Constructivist learning suggests that learners construct knowledge more effectively when they are actively engaged in the learning process, (Zhou, 2023) and digital games can serve as a potent medium for such active learning. The importance of keeping learners engaged in such critical topics necessitates innovative teaching approaches. To address this problem, our research intends to design, develop, and evaluate a prototype mobile game app. This paper presents the development of a game-based learning module tailored for OSH courses. An engaging, immersive module can enhance their motivation to learn, deepening their understanding of complex safety concepts. While game-based learning has been applied in various educational fields, its integration into OSH courses especially in Malaysia remains largely unexplored. Our module offers a unique blend of game mechanics with OSH content, ensuring both engagement and educational value. Using a mixed-methods approach, we assess its impact on students' retention and application skills and qualitatively understand their learning experiences. Our endeavor is not merely academic. By potentially elevating engagement and deepening comprehension in OSH courses, we aspire to better equip learners for real-world applications. This could have far-reaching implications, from reducing workplace accidents to fostering a culture of safety as they transition into professional roles, thereby amplifying industry-wide safety standards. The game is designed not merely for university or college students but is also suitable for OSH practitioners, trainers, and coordinators, from both training institutes or industries serving a congruent purpose.

2. METHOD & MATERIAL

2.1 Study Design: Mixed-Method Approach

This prototype adopt the mixed-method approach. It undergoes several rounds of evaluation using both quantitative (in-game analytics, post-game assessments) and qualitative (feedback sessions, interviews) methods.

2.2 Mobile Apps Game Development

The core of the project involves developing an OSH mobile game using the Buildbox software, chosen for its intuitive interface and robust game development capabilities. The lecture notes from UiTM and past year questions are also incorporated into the questions. The raw picture and editing were done using the Canva Platform.

2.3 Participants

During the post-development phase, a pilot group of university students enrolled in OSH courses will engage with the game. Quantitative data, including knowledge retention rates and in-game metrics, will be collected before and after gameplay to measure the game's efficacy. Simultaneously, qualitative data will be gathered through focus group discussions, shedding light on students' perceptions and experiences. This dual approach ensures a comprehensive evaluation of the game's educational impact.

2.4 Data Collection Tools and Techniques

The data will be analyzed using statistical tools for quantitative metrics and thematic analysis for qualitative insights. Through this methodology, we aim to assess the potential of game-based

learning in enhancing OSH education. Google Forms is the medium used to collect feedback and analytical statistics will be computed using Microsoft Excel.

2.5 Data Analysis

To ensure a comprehensive understanding of the game's efficacy and its impact on learners, multiple data collection methods will be employed to evaluate questionnaire feedback. First, in-game analytics in Google form will be integrated to capture various metrics, including the time spent on individual modules, the number of attempts required to pass specific levels or scenarios, points or scores accrued by users, overall progression and completion rates, and the frequency of interactions with embedded help or resource features. Post-game assessments will be administered, gauging knowledge retention, understanding of OSH concepts, and the application of these principles in hypothetical contexts. Moreover, surveys will be deployed after gameplay sessions, aiming to collect feedback on overall user satisfaction, the perceived game difficulty, insights on their emotions during gameplay, their perceptions of the game's strengths and weaknesses, areas for enhancement, and learners' impressions of the learning outcomes achieved.

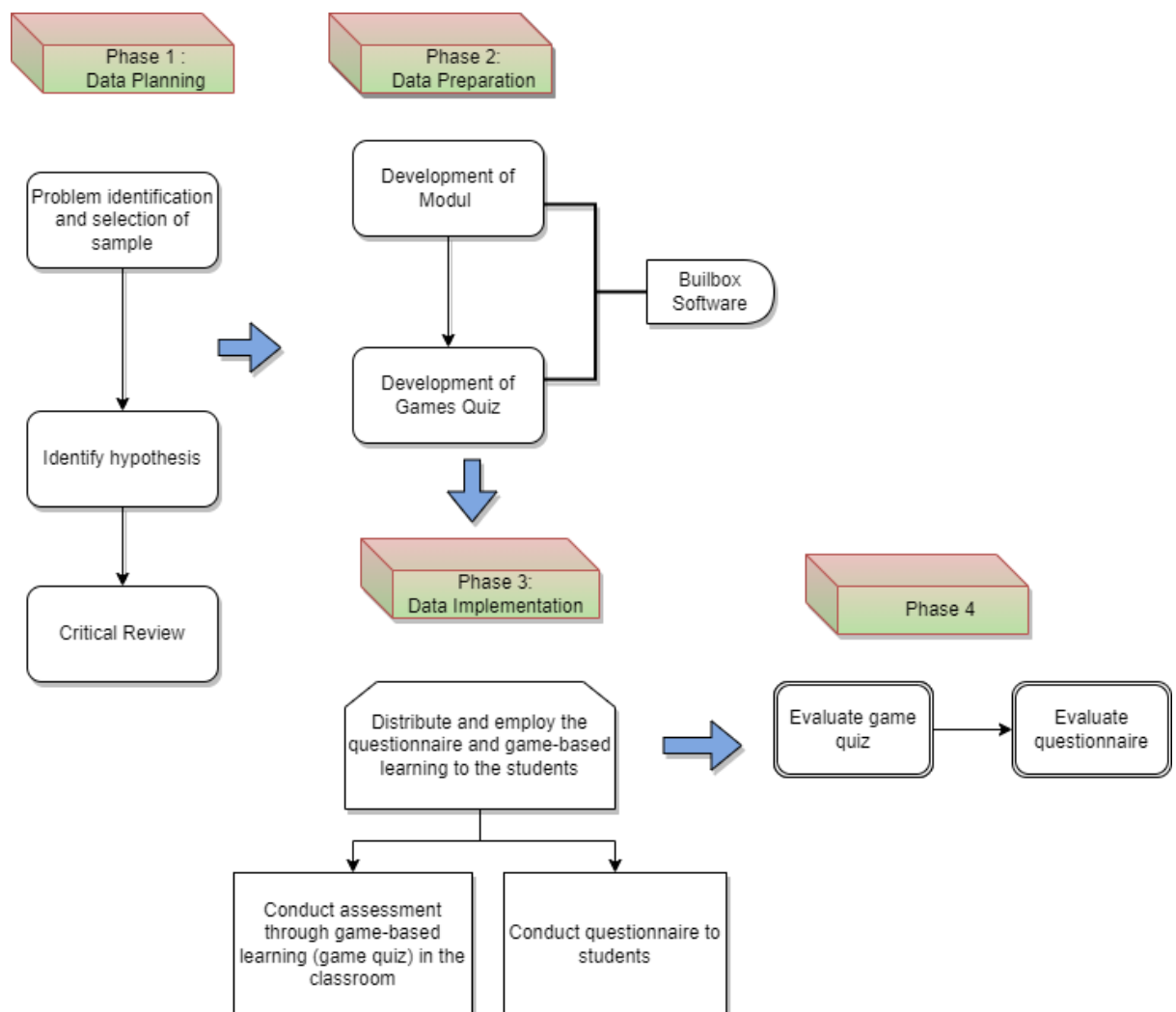


Figure 1. Flow of methodology

3. FINDINGS

Our module's innovative blend seeks to bridge the engagement gap in traditional OSH education. The game-based learning consists of two parts; (1) Lecture notes and (2) Quiz Games. A few criteria are incorporated into the games including text explanation, informative visual aids, eye-catching animations, videos and pleasant sound effects. The font size and color are carefully selected to cover the 4 modes of students' learning style model, VARK (Visual, Aural, Read and Kinesthetic). Examples of the question and splash screen of the game-based apps of SafetyBlitz were shown in figure 2.



Figure 2. Game-based apps in OSH teaching and learning, SafetyBlitz

For OSH learners, this game-based approach can transform their educational experience, deepening understanding and enhancing real-world applicability. As these students transition into the workforce, they could be pivotal in fostering a culture of workplace safety.

4. DISCUSSION

Our module's unique blend of game mechanics and OSH content is poised to bridge the engagement gap in traditional OSH education. The overwhelmingly positive initial feedback, coupled with the documented efficacy of game-based learning paradigms, strongly suggests a promising avenue for wider adoption and scalability. The preliminary positive feedback underscores the potential benefits for OSH students. By interacting with real-world scenarios in a game-based environment, learners can develop a more nuanced understanding of OSH principles. This experiential learning, where students actively engage with content rather than passively consuming it, could result in better problem-solving skills, heightened situational awareness, and a more intuitive understanding of safety protocols. Additionally, game-based learning has been shown to enhance cognitive abilities such as perception, reasoning, critical-thinking, spatial navigation, and memory retention (Naseri et al., 2022). As these students transition into the workforce, their enriched educational foundation could make them invaluable assets in maintaining and promoting workplace safety. The game-based learning module

holds transformative potential for OSH education. Its implications extend beyond academia, promising a safer and more informed workforce ready to uphold and promote industry-wide safety standards.

5. CONCLUSION

The developed game-based learning module for OSH courses provides a promising approach to enhance learner engagement and comprehension. With further research and refinement, such modules could revolutionize OSH education, making it more accessible, engaging, and effective. The game-based learning module we have developed for OSH courses represents a potentially groundbreaking approach in the realm of safety education in Malaysia. By intertwining the engaging dynamics of gaming with the critical knowledge of OSH, it offers a learning experience that is both enjoyable and enlightening. As the field continues to evolve, such innovative educational tools will not only revolutionize how OSH is taught but also significantly impact real-world safety outcomes. The implications of this study extend beyond mere academic outcomes. By fostering a generation of OSH students who are deeply engaged and well-versed in safety protocols, industries could benefit from a workforce that is not only knowledgeable but also passionate about implementing and upholding safety standards. However, potential limitations include a learning curve for non-gamers and over-reliance on game mechanics.

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