IMPLEMENTATION OF GAMIFIED MOBILE APPLICATION TO INCREASE ENGAGEMENT AND SOCIETY INCLUSIVENESS BY INTEGRATING STRATEGY GAME AND E-QUIZ

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ABSTRACT

The COVID-19 outbreak has globally affected many countries and sectors, including education. According to a UNESCO report, more than 1 billion students were affected by educational institutions closures in 106 countries, hence forcing the 'new norm' of teaching and learning environment. E-learning and mobile learning (M-learning) are the main choices that also create welcoming communities, building an inclusive society, and achieving education for all. Gamification in educational mobile applications serves as an added value in mobile learning to the instilled sense of enjoyment in educator and learners' interactions. It also leverages students' desires for achievement, competition, status, and to be part of an inclusive social community to increase engagement. Incorporating strategy games in educational mobile applications posed several benefits such as creating continuance usage desire among users, enhance motivation among disengaged learners, encourage strategic thinking, promotes healthy competition, improve self-directed learning and independent thinking, foster collaboration, create a safe environment for learning through experimentation and trial and error, also it helps develop virtuous qualities (patience and persistence) among learners. Meanwhile, an e-quiz which is a form of a quick formative assessment tool helps in the implementation of the 'testing effect' or 'retrieval practices' activity for learners. Implementing progressive gamified e-quiz with a strategy game in learning through mobile technology, supports the current or 'new norm' needs of distance learning while expanding society inclusiveness. This research highlights the development and usage of a gamified e-quiz mobile application whose unique feature is the 'reward' system that is interconnected with a progressive strategy game to enhance engagement and inclusive education in the 'new norm' teaching and learning environment.

Keywords: gamified mobile application, strategy game, e-quiz, inclusive education, society inclusiveness, student engagement

1. INTRODUCTION

Social integration to create an inclusive society means having diversity and equality of opportunity and participation of all people, including disadvantaged and vulnerable individuals and groups. This also includes all races, gender, class, generation, and geography. On the other hand, higher education is challenged by the increasing digitalization of society. Daily lives, work, and school have also become more mobile through the Internet, which is available anywhere, at any time, and on a variety of mobile devices, which also can be personalized and tailored through applications (Ossiannilsson, 2018). Mobile learning (M-learning) is significant when used to support learner-led inquiry, work-based, field-based and game-based learning, communities and social networks, continuous reflection, as a way to promote social inclusion, to collect evidence of achievement, and to sustain lifelong learning (UNESCO Institute for Information Technologies in Education, 2010). Ossiannilsson (2018) mentioned that enhancing the access, social inclusion, quality of M-learning, as well as the use of mobile technology for flexible delivery, will encourage educators and trainers to develop and implement a new approach to learning. The awareness of the importance of including all over society has been increasing over the last years

wherein Patzer et al. (2018) study, highlighted the rights of persons with disabilities to access education, no matter the limitations they are facing. The importance of E-learning and M-learning in educational contexts is increasing, therefore accessibility and inclusion are the requirements that need to be fulfilled. According to Naciri et al., (2020) owning a smartphone nowadays is already a necessity, and students at the tertiary level usually own one for their academic purpose. Nowadays, mobile phones are cheaper than other devices and hence, it is claimed that mobile is suitable for teaching and learning devices for the students at a low cost (Sanga et al., 2016).

In education, assessment is an important phase that supports the success of teaching and learning, used to monitor the students' learning progress mathematically (Pitoyo et al., 2019). The incorporation of quizzes and games may encourage long-term retention of material Vinney et al., (2016), motivating self and peer assessment (Raes et al., 2020) as well as increasing students' interest (Lim & Yunus, 2021). Kingdom Quizzes was developed as a combination of an e-quiz and a strategy game in a mobile application. It serves as an assisting tool for educators and students to engage in a fun learning environment as well as promoting self and peer assessment on students. The unique feature that is highlighted in Kingdom Quizzes is the 'reward' element displayed through the leaderboard function, in which the marks and rank that the students gained in the quiz session will reward them with various 'items' in their game inventory (strategy game). This creates 'motivation' in students to do well in their quizzes and academic tasks which generate engagement in the classroom (physically or virtually), hence 'continuance intention' to use the application. As Kingdom Quizzes is being served as a free download mobile application, it offers affordance and accessibility to the students which eliminate barriers among students with various background, for instance, geography, financial affordance, and social status. It provides these students a unique way to interact with one another and eradicates rigid barriers of the education system hence introducing 'inclusive education. Apart from increasing the speed of learning, the teaching-learning process is entertaining, engaging, and effective which eventually enhances students' inclusion and academic performance.

2. MATERIALS AND METHODS

ADDIE model which stands for Analysis, Design, Development, Implementation, and Evaluation, was selected for the development model and is also known for being a system-oriented model in producing a good instructional design.

2.1: Analysis Phase

In this phase, the process of analyzing requirements based on the types of games preferred by students was carried out. Based on observation, current trends, as well as verbal feedback from students themselves, a 'strategy game concept' is much more preferable by not only teenagers but also children in primary school. In addition, some other analyses such as the analysis of potential users and the analysis of the learning environment were also carried out.

2.2: Design Phase

The whole view regarding the theme of the product, structure, gamification elements, types of game, and technology was confirmed after the analysis phase. Kingdom Quizzes was design based on the concept of 'reward motivation', thus the developer decided to divide the activities into two parts that are correlated with each other through the 'reward' element; (i) answering part (quiz section) and (ii) game playing a part (game section). The quiz reward is defined by 'ranking' achieved by the player displayed on the 'leaderboard'. Apart from the leaderboard being the tool for evaluation of students' performance, it will also indicate the type of reward that will be populated in the game module 'inventory'.

2.3: Development Phase

In the development phase, the application was developed using C# programming language in Unity 3D as well as incorporating Firebase Realtime Database that stores and sync data 'real time' to store the questions and answers for the quiz section. The architecture of Kingdom Quizzes is being displayed in

Figure 1. It involves the authentication of users, which are the educator and student. The game section was firstly developed, followed by the database, login, and quiz section. Lastly, the connection between the quiz section to the game section was constructed in which involves a 'reward' concept resulting from answering the quiz that contributed to the inventory of the gameplay.

2.4: Implementation Phase

The implementation phase aims to make sure that this application is built to meet the objective and is suitable for the usage of the targeted users. This phase has produced a completely functional application for the educator module and student module. The ranking and result that the student gained after each quiz session will contribute to the game session through the inventory system. This means that the better rank that the student gets in the quiz session, the higher chance of winning the tower defense game. This is due to the accumulated weapon and items they had gained for selection in their inventory system.

2.5: Evaluation Phase

In this evaluation phase, the study performed (i) comparison between the functions and features of other gamified e-quiz applications such as Kahoot! and Quizizz with Kingdom Quizzes and (ii) conducting Integration Testing and Module Testing towards Kingdom Quizzes as it involved network connection, cloud database as well as purchasing module.

3. RESULTS AND DISCUSSION

User Acceptance Testing (UAT) had been done amongst UTHM Diploma of IT students (first-year students) in December 2020 with the participation of 142 students. The students performed the survey at their residential college. Meanwhile, five quizzes for course Multimedia had been done using Kingdom Quizzes in eight weeks in that current semester, in which all of them completed virtually (online) and not face-to-face, using their own mobile devices.

3.1: Response on the usage of Kingdom Quizzes

Feedbacks were gathered through Google Form surveys in which resulted in more than 88.72% of respondents expressed interest in further usage (continuance usage intention) of Kingdom Quizzes with other courses. Meanwhile, 93.7% stated that using Kingdom Quizzes increases their motivation to perform better in the next quizzes. These results corresponded to the success of the development of this gamified e-quiz mobile application in contributing to the users' motivation and continuance usage intention of the product. Other positive effects are as follows; the students tend to (i) improve themselves by revising previously executed quizzes, (ii) prepare themselves beforehand by studying the topics involve in the quiz that they will be doing, and lastly (iii) perform self and peer assessment based on the leaderboard function provided in KQ. The detail of the responses is listed in Table 1.
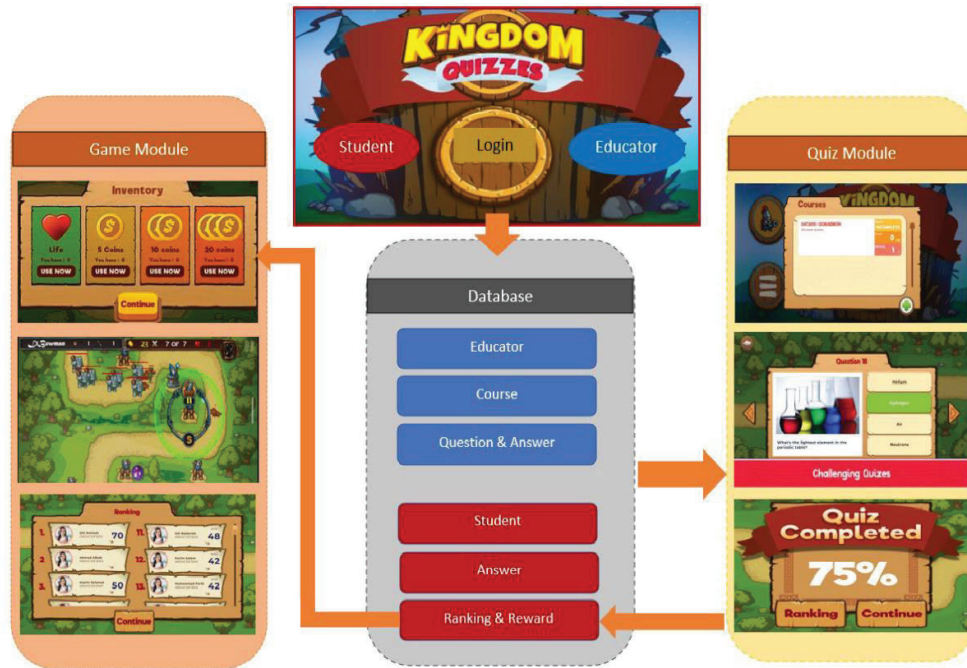
Figure 1. The architecture of Kingdom Quizzes

Table 1. Survey result

Question	Percentage (%)
Continuance intention in Kingdom Quizzes usage	88.72
Useful 'leaderboard' display	91.5
Preparation for a quiz before KQ usage	93.7
Increase students' motivation	93.7
Useful 'revision' function for self-improvement	98.6

4. CONTRIBUTION AND USEFULNESS/COMMERCIALISATION

Based on the result gathered, the advantage of Kingdom Quizzes was being highlighted as an engaging gamified e-quiz mobile application by incorporating strategy games with students' quiz performance. Positive responses on the usefulness of the gamification functions embedded in this product have increased the motivation in learning amongst the students (users). The reward element based on ranking on the leaderboard has managed to create 'continuance use intention'. On the other hand, summarizing the importance of Kingdom Quizzes to education are; (i) as a 'portable' medium of learning in the form of a 'quiz' adventure game using mobile devices, (ii) enhances the engagement in learning and teaching inside and outside of the classroom which takes place effectively through combining multimedia elements and (iii) transform paper-based test/quiz into electronic quiz (e-quiz). From the commercialisation perspective, Kingdom Quizzes had been copyrighted through MyIPO with file number CRLY00026552 and also published on Google Play Store for free download, however, it has 'In App Purchase' for an educator to create a quiz set (40 questions). As Kingdom Quizzes is in English while the questions are based on the educator's preferred language (stored in the database), thus it is user-friendly and may be used internationally.

5. CONCLUSION

This research highlights the development and usage of a gamified e-quiz mobile application for M-learning purposes, eradicating education barriers related to students' affordance, accessibility, and social background. This also promotes society's inclusiveness in education during this 'new norm' era. The unique feature that sets Kingdom Quizzes apart from other e-quiz platforms, is the 'reward' system that is interconnected with a progressive strategy game through leaderboard or ranking. Interesting strategy games also contributed to entice students in creating persistency and continuance usage of the product. The application can help the students interestingly perform e-quiz and revision, ease the educators' work and also enhance the quality of teaching and learning.

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