INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 11, Issue 2, (2022) E-ISSN: 2226-6348

BC-DIGIT: A Digital Game Application for Learning Building Construction Technology Course among Undergraduate Students

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To Link this Article: http://dx.doi.org/10.6007/IJARPED/v11-i2/13053 DOI:10.6007/IJARPED/v11-i2/13053

Published Online: 07 May 2022

Abstract

Covid-19 has changed most of the education teaching approaches around the world either synchronous or asynchronous approaches. This includes the Building Construction education for construction sites experiences and practices which are challenging for students. New pedagogical paradigms need to emphasise creative thought. In this case, gamification in teaching and learning is a creative way to inspire students to learn by incorporating game features to achieve an enjoyable and exciting learning experience. Here, Building Construction Digital Board Game (BC-DIGIT) is a digital board game project created for Building Construction education. this gamification project can help develop knowledge and information about Building Construction and improve essential skills for the construction industry's students and future personnel. This study uses a non-experimental research design in which a survey was developed. The study adopts a theoretical framework, technology acceptance model (TAM) that identifies the variables relevant to the study. The survey was conducted to investigate the features, perceived usefulness, and examine the students' BC-DIGIT satisfaction. The study was conducted in Jan 2022 and the respondents selected for this study were students from Diploma in Building programme at Universiti Teknologi MARA, Cawangan Sarawak. Via online, registered students were instructed to participate in the digital game. Based on findings, most respondents perceived the usefulness of BC-Digit to them are very high. Overall, none of the respondents disagreed, 47.69% agreed, and 40.31% strongly agreed with the overall perceived usefulness. In addition, most respondents perceived user satisfaction were high. Overall, only few respondents disagree (0.92%) or were undecided (12.00%) that the digital game was useful to them. On the other hand, most respondents were either agreed or strongly agreed with the user satisfaction. This study is aimed to examine the effectiveness of Building Construction Digital Board Game (BC-DIGIT), a digital-based gamification online learning, specifically its perceived usefulness and

perceived satisfaction. Findings, implications, and future research are discussed in following sections.

Keywords: Educational Digital Game, Digital Game-Based Learning, Game Application, Interactive, Learner Engagement.

Introduction

Nowadays, the application and usage of gamification-based learning (GBL) is seen to have many benefits in helping to improve the process of quality teaching and learning. Game-based learning incorporates new skills and concepts by voluntarily enhancing learning engagement and encouragement among players. Gamification is also a successful way to improve students' habits and attitudes towards learning (Mahat et al., 2021). Here, Building Construction Digital Board Game (BC-DIGIT) (*See figure 1*) is a digital board game project created for Building Construction education. The board game promotes knowledge and information creation, particularly for built environment students. this gamification project can help develop knowledge and information about Building Construction and improve essential skills for the construction industry's students and future personnel. this study employs a self-designed survey, developed based on theoretical foundations of the identified variables to answer the following questions:

1. How are the features of BC-DIGIT useful to facilitate learning?
2. What are the features on BC-DIGIT related to students' perceived levels of satisfaction?

Figure 1: BC-DIGIT Interface

Perceived Usefulness

Well-designed features in gamification can enhance remote teaching and learning. One of the essential criteria in the adoption of technology is perceived usefulness, which correlates with students' behavioral intention to use technology in their learning especially distance learning. Perceived usefulness is also deemed as an indicator to demonstrate the extent of students' acceptance towards the integrated technology, which leads to students' satisfaction (Alqahtani & Mohammad, 2015). In fact, one of the constructs in the Technology Acceptance Model (TAM) (Davis et al., 1989), (see Figure 2), is perceived usefulness, which defines the degree to which a person believes that using a particular technology would enhance his or her job performance. This factor significantly influences learners' intention to employ technology.

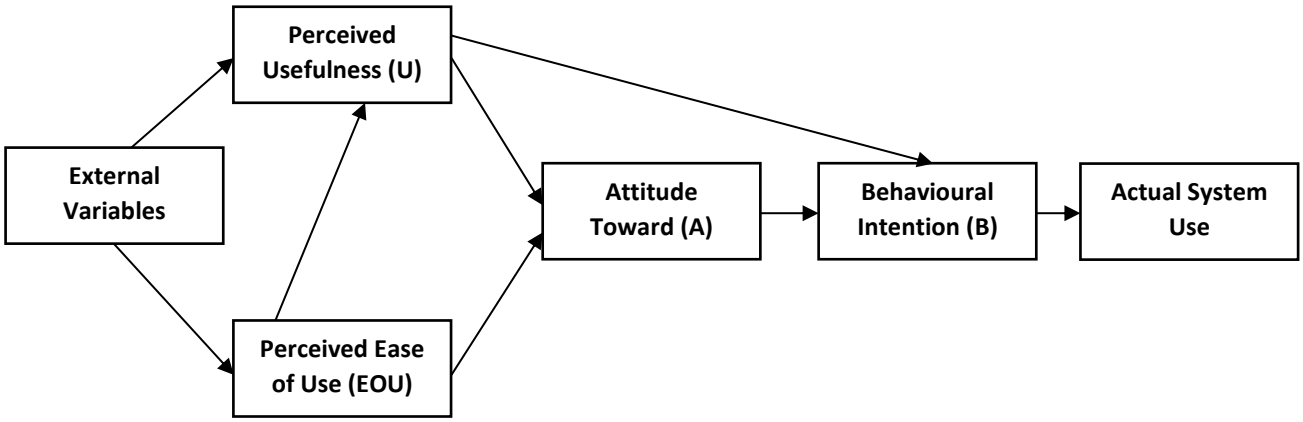

Figure 2: Technology Acceptance Model (TAM) (Davis et al., 1989, p.985).

Students Satisfaction

Students' satisfaction can be defined as the short-term perception from their evaluation of their educational experience, services and facilities during their study period (Weerasinghe & Fernando, 2017). Goh et al (2017) has argued that three learning experiences can be identified to determine the learning outcomes and satisfaction, namely, course design, interaction with the instructor, and interaction with peer students. It is important to consider the students' satisfaction as it enables them to increase their interest, focus, and interaction, leading to a higher understanding of the basic concepts and thus increasing the course learning outcomes (Rahrouh & Ghanem, 2020).

Since the pandemic, the teaching and learning platform has transformed from contemporary methods to online and distance learning (ODL) worldwide, including in Malaysia. A researcher has identified that the key success factor in ODL is the importance of engaging the students in an active atmosphere where students can participate in learning activities and live discussions (Rahrouh & Ghanem, 2020). The limitation in ODL has increased educators' effort to innovate to help overcome the shortcoming of face-to-face activities by introducing gamified environment or gamification (Nieto-Escamez & Roldán-Tapia, 2021). Gamification can be described as features of an interactive system that aim to motivate and engage end-users through game elements and mechanics (Seaborn & Fels, 2015). The usage of gamification during ODL is crucial due to its ability to provide dynamic learning, motivation and also the ability to provide positive stimuli (Rincon-Flores & Santos-Guevara, 2021).

Methodology

This study uses a non-experimental research design in which a survey was developed. The study adopts a theoretical framework (*See figure 2*) that identifies the variables relevant to the study. Based on identified academic journals, the variables studied were finalized and extended. The survey was conducted to investigate the features, perceived usefulness, and examine the students' BC-DIGIT satisfaction. The study was conducted in Jan 2022 and the respondents selected for this study were students from Diploma in Building programme at Universiti Teknologi MARA, Cawangan Sarawak. Via online, registered students were instructed to participate in the digital game. The research instrument contained three sections, one for the demographic, and the rest encompassed two sections that examined proposed variables/constructs. Each section is comprised of 5 items. A Google form was used to administer the survey and the link was sent to prospective respondents via email and WhatsApp messages. The data and information were then collected anonymously and stored

automatically in a spreadsheet for subsequent data analysis. Descriptive statistics were used to analyse to the findings.

Findings and Discussion

The total number of responses collected was 65, and there were from students that enrolled in Building Construction III course (BGN214) during October 2021 – April 2022 semester in Universiti Teknologi MARA, Cawangan Sarawak. Based on record, there were 78 students registered for this course. Therefore, the percentage returned questionnaires were 83% and has achieved very high representation of the population studied due to the high returned. Due to the nature of the study that focuses on a small group of students, the demographic was limited to age and gender. There were 40% male and 60% female respondents and with four categories of ages: 19 years old (20%), 20 years old (70.7%), 21 years old (7.7%) and 23 years old (1.5%)

Perceived Usefulness of BC-DIGIT

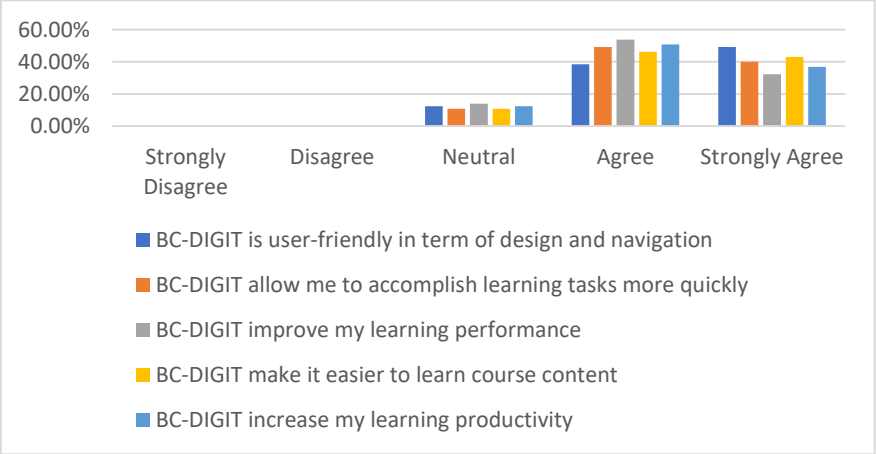

Figure 3: Clustered columns of percentage of responses for each perceived usefulness of BC-Digit

Figure 1 shows most respondents perceived the usefulness of BC-Digit to them are very high. Overall, none of the respondents disagreed, 47.69% agreed, and 40.31% strongly agreed with the overall perceived usefulness. Respectively, the mean score and (standard deviation) for each perceived usefulness is 4.36 (0.69) for user-friendliness in terms of design and navigation, 4.29 (0.64) for allowing them to accomplish learning tasks more quickly, 4.18 (0.65) for improving their learning performance, 4.32 (0.65) for making them easier to learn course content and 4.24 (0.65) for increasing their learning productivity. The mean score of more than 4 indicates a high degree of agreeable while almost similar standard deviations of each perceived usefulness suggest that most respondents' scores are very consistent.

User Satisfaction of BC-DIGIT

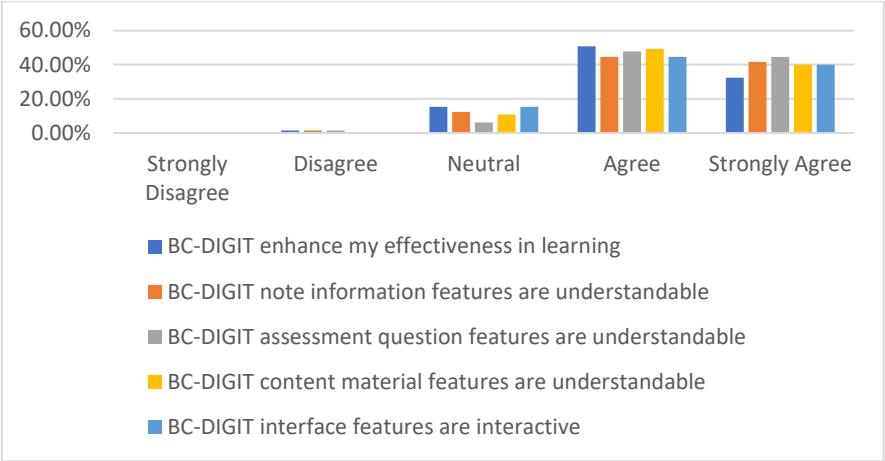

Figure 4: Clustered columns of percentage of responses for each user satisfaction of BC-Digit

Figure 2 points that most respondents perceived user satisfaction were high. Overall, only few respondents disagree (0.92%) or were undecided (12.00%) that the digital game was useful to them. On the other hand, most respondents were either agreed or strongly agreed with the user satisfaction. Respectively, the mean score and (standard deviation) for each user satisfaction is 4.13 (0.72) for enhancing respondents' effectiveness in learning, 4.26 (0.73) for creating understandable information features, 4.35 (0.66) for creating understandable assessment questions, 4.29 (0.64) for creating understandable digital game's content features and 4.24 (0.70) for creating interactive interface features. Importantly, the overall mean score is very high at 4.25 (average), which means the perceived most respondents were satisfied with the digital game. However, compared to the previous section on perceived usefulness, the standard deviation is higher, which indicates a bit less consistent in respondents' scores.

Conclusion

Engaging students to understand learning during the pandemic season focuses on providing effective learning. The gamification approach is an approach to engage students to be actively involved. The results of this study found that students agreed that the use of BC-Digit is beneficial in terms of understanding. Also, students agreed that they were satisfied with the use of BC-Digit.

Being in a very modern world and within the constraints of Covid-19, most university learning is also done online. The use of BC-Digits is beneficial for students to interact with each other. Students are also a generation skilled in using technology, and the construction of this gamification tool will attract students to be actively involved.

This study is a pilot study for the construction of BC-Digit as a gamification tool in online teaching and learning. Conclusion: there are constraints such as the number of students involved and comparisons of different cohorts that need to be made. The study can also be developed for students who are physically in the classroom. These BC-digits can also be applied to other subjects by changing the content of this board game. It is hoped that the construction of gamification tools such as BC-Digit can improve the quality of teaching and understanding of students in the field of construction.

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