Usability Evaluation of e-KuPang: Digital Kuda Kepang Courseware for Mathematics Learning

Jasni Ahmad[✉], Gee Hui Yee, Tan Soon Jing, and Fakhrul Anuar Aziz

School of Multimedia Technology and Communication, Universiti Utara Malaysia, Kedah, Malaysia
`jasni@uum.edu.my`

Abstract. e-KuPang is an interactive mathematics education courseware that employs the representation concept to promote Kuda Kepang and enable Level 1 (Year 1 to 3) students to learn mathematics in a creative way. Students find the existing education system to be rather tedious since study sessions are too lengthy and lack interaction. In addition, students perform poorly in mathematics because they struggle to master the subject. Mathematics abilities and performance are negatively affected by traditional teaching methods, but innovative multimedia technology can boost students' enthusiasm in studying mathematics. There is no other existing mathematics courseware that utilised Kuda Kepang elements to teach students. In addition, this project's learning module and quiz module used HOTs and representation concepts to pique students' interest in mathematics. Kuda Kepang dance is a traditional Malaysian performing art that has been practiced for generations and is widely popular in Johor. Currently, fewer successors are eager to study it, leading to its gradual extinction. This project's main objective is to design and develop electronic Kuda Kepang (e-KuPang) while promoting the beauty of Kuda Kepang and engaging students' interest in studying mathematics. This project examines whether e-KuPang achieved its goals by employed a quantitative methodology and 30 primary school students were involved. Summative evaluation results focus on usability of the e-KuPang's user interface design (4.6), ease of use (4.4), and effectiveness (4.1). Therefore, it can be concluded that this is an effective project with a high level of usability. It is intended that by including the representation concept into e-KuPang, students would be able to study and solve mathematics in an engaging manner.

Keywords: Digital Kuda Kepang · e-KuPang · Mathematics · Higher-Order Thinking Skills

1 Introduction

Kuda Kepang (KK) is being promoted to Level 1 students through interactive mathematics education courseware. The courseware enables students to learn mathematics operations entertainingly and creatively. Students' mathematics skills remained low, and studies indicate that students perform poorly in mathematics due to their inability to master the subject [1, 2]. Besides, students felt analytical thinking difficult when

Table 1. Average for user interface design, ease of use, and, effectiveness

	N	Minimum	Maximum	Mean ($\bar{x}$)	Std. Deviation
AvgUID	30	3.80	5.00	4.6400	.45758
AvgEOU	30	3.67	5.00	4.4333	.48857
AvgE	30	2.60	5.00	4.1933	.74182

they are answering Higher-Order Thinking Skills (HOTS) question [3]. Consequently, the utilisation of multimedia technology can increase students' enthusiasm for learning mathematics [4]. The Javanese community in Malaysia, particularly in Johor, performs the Kuda Kepang dance [5]. However, the Kuda Kepang dance is being increasingly forgotten and fewer successors are willing to learn it [6, 7]. To prevent Kuda Kepang from being obliterated by modernity, this project aims to create a 2D animation courseware to increase awareness and teach students about the beauty of this traditional culture.

The most common cause of failure and poor performance in Mathematics is a lack of L&T environment. As a consequence, the educational design of an effective L&T environment should be regarded as a critical aspect in the prevention and treatment of Mathematical learning difficulties in students.

Taking up the problem, we offer a Digital Kuda Kepang (DKK) conceptual model as a new way to teaching mathematics in primary schools. This approach incorporates the usage of KK as "game" features. The model mixes the KK atmosphere (actors, kuda kepang, scenes, sounds and music, and narrations) with mathematics subject content (Level 1). The goal is to assist in the creation of an effective L&T environment that will improve mathematics learning and prevent the KK from becoming extinct.

1.1 Prototyping Digital Kuda Kepang: A Viable Solution

e-KuPang develops mathematics learning incentives for Level 1 students in primary school. The study utilised the notion of representation to achieve this objective. Different numbers were allocated to the characters and props, and students must respond utilising Higher-Order Thinking Skills (HOTS). HOTS are an important skill in the 21st century [8].

Higher-level thinking is more than just memorising or repeating information back as it was given to the student [9]. Before attempting to solve a problem, students must first understand it. As an example of addition, consider the blue kuda kepang represents 10 and red kuda kepang represents 5. Students must utilize HOTs to find the sum. In addition to the graphical representation, animation and audio representations have been introduced to the Quiz Module. This innovative approach enables students to study mathematics in the range of 1 to 100 based on KSSR Level 1.

1.2 Evaluating e-KuPang

This paper aims to determine whether the e-KuPang courseware met its objectives. The results are collected to improve future project designs and implementations. The

summative evaluation of a product's usability is essential for tracking its usability over time and comparing it to competitors. This summative evaluation focuses on the e-KuPang courseware's user interface design, ease of use, and effectiveness.

2 Measures of Central Tendency for User Interface Design, Ease of Use, and Effectiveness

Table 1 display the result obtained of e-KuPang evaluation from the summative evaluation questionnaire, and Table 2 shows the results for each item of e-KuPang evaluation. User interface design focuses on the overall visual layout of the elements that the user will interact with the product. User interface design is significance for the development of e-KuPang as it focuses on maximising usability and the user experience. The user interface design section involved a total of 10 items, which are The courseware has attractive screen design (Item 1), The buttons size is appropriate (Item 2), The buttons colour is appropriate (Item 3), The text is clear and easy to read (Item 4), The colours used are attractive (Item 5), The graphics are attractive (Item 6), The narration is clear (Item 7), The sound effects used are appropriate (Item 8), The animations in this courseware are attractive (Item 9), and The courseware instructions are clear (Item 10). Table 1 shows the descriptive analysis of the user interface design section. The mean value for user interface design of e-KuPang is 4.64 and the standard deviation is 0.46.

These results indicate that most respondents strongly agree that e-KuPang has a well-executed and appealing interface design. Most design elements of e-KuPang met the needs of the respondents and give them a good user experience when interacting with the courseware.

Ease of use is a fundamental concept that encompasses all user experience elements related to how simple it is for users to operate, learn and discover content with a product. The ease-of-use section involved a total of three items, which are the courseware is easy to use (Item 1), I can use it successfully every time (Item 2), and I learned to use it quickly (Item 3). Table 2 shows the descriptive analysis of the ease-of-use section. The mean value for ease of use of e-KuPang is 4.43 and the standard deviation is 0.49. These results show that most respondents agree that e-KuPang is easy to use and allows users to find familiar and intuitive experience.

Effectiveness is the most vital part of the development of e-KuPang as it can be determined whether the courseware has achieved the goals with a high degree of accuracy. The effectiveness section involved a total of 5 items, which are the learning module is easy to understand (Item 1), The content of the learning module is suitable for me (Item 2), The quiz module is easy to understand (Item 3), The content of quiz module is suitable for me (Item 4), and the courseware helps me be more effective in learning mathematics operations (Item 5). Table 1 shows the descriptive analysis of the effectiveness section. The mean value for effectiveness of e-KuPang is 4.19 and the standard deviation is 0.74. These results show that most respondents agree that e-KuPang is effective and users can learn sufficient knowledge of mathematical operations on in a meaningful manner.

Table 2. e-KuPang evaluation

A.	User Interface Design	1	2	3	4	5	Mean	Std. Deviation
1.	The courseware has attractive screen design.	0	0	0	9	21	4.7	0.4661
2.	The buttons size is appropriate.	0	0	0	10	20	4.6667	0.4795
3.	The buttons colour is appropriate.	0	0	0	8	22	4.7333	0.4498
4.	The text is clear and easy to read.	0	0	3	10	17	4.4667	0.6815
5.	The colours used are attractive.	0	0	0	8	22	4.7333	0.4498
6.	The graphics are attractive.	0	0	0	7	23	4.7667	0.4302
7.	The narration is clear.	0	0	4	9	17	4.4333	0.7279
8.	The sound effects used are appropriate.	0	0	0	10	20	4.6667	0.4795
9.	The animations in this courseware are attractive.	0	0	0	9	21	4.7	0.4661
10.	The courseware instructions are clear.	0	0	3	8	19	4.5333	0.6815
B.	Ease of Use	1	2	3	4	5	Mean	Std. Deviation
1.	The courseware is easy to use.	0	0	0	10	20	4.6667	0.4795
2.	I can use it successfully every time.	0	2	8	9	11	3.9667	0.9643
3.	I learned to use it quickly.	0	0	0	10	20	4.6667	0.4795
C.	Effectiveness	1	2	3	4	5	Mean	Std. Deviation
1.	The learning module is easy to understand.	0	0	3	12	15	4.4	0.6747
2.	The content of learning module is suitable for me.	0	0	3	10	17	4.4667	0.6815
3.	The quiz module is easy to understand.	0	4	5	10	11	3.9333	1.0483
4.	The content of quiz module is suitable for me.	0	4	8	9	9	3.7667	1.04

3   Discussion

As shown in Table 2, the user interface design of the produced courseware has gotten extremely positive response. User interface design is about predicting what the user wants to accomplish and making sure the interface has elements that are easy to navigate. Furthermore, user interface design must appeal to users, be simple, intuitive, and help to ensure that users can use it effortlessly (User Interface Design, n.d.). Previous research has found that interface design has a considerable impact on students' perceptions of their learning, and it also enhances retention and increases the quality of teaching and learning [10]. The collected data showed a high mean value (4.64), indicating that most respondents were satisfied with the overall design of the courseware. The graphics are attractive (Item 6) in the user interface design section shows the greatest mean score (4.77). This result shows that most respondents like e character design and overall visual environment of e-KuPang.

However, the narration is clear (Item 7) in the user interface design section shows the smallest mean score (4.43). This is because the narration used in e-KuPang is generated by a text-to-speech generator. The generator was unable to pronounce certain words correctly, such as the word "Kuda Kepang".

Next, data in Table 2 also reveals that e-KuPang is easy to use. Ease of use refers to guiding the user through an interface when they are operating it. Ease of use corresponds directly to usability and is the most fundamental concept behind a constructive user experience [11]. The obtained data reveals a considerable mean value (4.43), showing that most respondents concur that e-KuPang is easy to use and offers users a highly clear and comfortable experience. The courseware is easy to use (Item 1), and I learned to use it quickly (Item 3) received the same and highest mean score (4.67). This indicates that most respondents are not puzzled when using e-KuPang. They comprehend the button's functioning logic and how to finish the quiz module. I can use it successfully every time (Item 2) in the section on ease of use had the lowest mean score (3.97). This is because e-KuPang requires a higher level of computer hardware to work smoothly, and students lack the necessary hardware to have the greatest experience. They encountered system crashes while operating activities simultaneously in e-KuPang.

In addition, data in Table 2 also reveals that e-KuPang is relatively effective for Level 1 students to learn mathematics operations. Effectiveness is the goal's precision and comprehensiveness [12]. Effectiveness depends on whether users can achieve their objectives with a high degree of precision. A significant portion of a product's efficacy depends on the support offer to users when employing the product [13]. The collected data revealed a relatively high mean value (4.19), indicating that most respondents agreed that e-KuPang is effective and users may acquire sufficient knowledge of mathematical operations with it. In the effectiveness section, the item with the highest mean score is The content of the learning module is suitable for me (Item 2) with the mean value 4.47. This result demonstrates that most respondents can comprehend the content and concepts of mathematics operations, despite the use of representation principles in the tutorial videos. The item with the lowest mean score in the effectiveness section is the content of quiz module is suitable for me (Item 4) with the mean value 3.77. This is because some students lack a solid foundation in mathematics and consequently require additional time to comprehend and answer HOTS questions. One study revealed that HOTS in mathematics is still relatively new in Malaysia, despite the prevalence of module-based instruction among rural students [14]. Malaysia placed 48th out of seventy-nine countries for mathematics in the most recent Programme for International Student Assessment (PISA) 2018 rankings and this rating revealed that Malaysian students felt analytical thinking difficult [3]. The Ministry of Education revised the difficulty of the primary school curriculum few years ago to improve our country's PISA ranking. However, revealed that at least four to five children in each class received the worst grades in each subject, which is not ideal [15]. Therefore, students need to enhance their higher order thinking skills through more novel teaching materials.

4 Conclusion

This paper identifies the summative evaluation for the courseware e-KuPang. This courseware is a beneficial and interactive mathematics education courseware designed to allow Level 1 primary students to understand mathematics operations in a novel and entertaining approach through Kuda Kepang. Level 1 primary students can gain the opportunity to understand the concept of mathematical operations by using the representation concept. This report's goal is to determine whether the e-KuPang courseware

met its objectives. The instrument in this report focuses on e-KuPang's user interface design, ease of use, and effectiveness. There are 30 primary school Level 1 (Year 1 to Year 3) students who participated in the evaluation of this project. This study revealed that users provided positive feedback on the three evaluation aspects, which are user interface design, ease of use, and effectiveness. The results showed that most respondents strongly agree that e-KuPang has a well-executed and attractive interface design (m = 4.64), e-KuPang is easy to use and provides users with a very recognisable and simple experience (m = 4.43), and e-KuPang is effective and users can acquire sufficient knowledge of mathematical operations in a significant way (m = 4.19). Consequently, it can be stated that this is a significant project with a high degree of usability. This study may have some substantial limitations. Most of the results were descriptive statistics. To establish generalizability and raise the credibility of the study results, other studies with larger samples and various research techniques and designs should be done.

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