

Development of Interactive Learning Android Application for Basic Mathematical Concepts

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Abstract: This project aims to design and develop interactive learning android application Mathematical concepts. The development of this interactive android application is to assist students in learning the basics of Mathematics easily. The model used in this product development is the ADDIE design model which requires five of analysis, design, development, implementation, and evaluation. The analysis phase is carried out through observation to identify problems. For the design phase, the developer produces a storyboard and determines the software to be used. In the development phase, the developer collects and produces multimedia elements such as text, video, audio, animation, and graphics. For the implementation phase, they develop a prototype by using all the materials that have been produced according to the storyboard. The evaluation was conducted by three (3) experts in a creative multimedia field from the Faculty of Technical and Vocational Education, University Tun Hussein Onn Malaysia, and experts in Mathematical content. The instrument of study used is the expert checklist form. Data analysis used frequency methods. The results of the study found that three (3) experts gave positive feedback on this developed product. The development of this interactive learning android application can help teachers in carrying out the teaching and learning process and be used as a guide by students in practicing the basic Mathematical namely addition, subtraction, multiplication, and division operations.

Keywords: Interactive Learning Android Application, Mathematical Concept

1. Introduction

Mathematics is one of the key elements in the development of Science, Technology, Engineering, and Mathematics (STEM). Mathematics is one of the fields of knowledge that can train a person's mind to think logically and systematically in solving a problem and making the right decision. However, according to Iji, Abah, and Anyor, (2017) many students have a negative perspective on mathematics difficulties as a school subject, and this misunderstanding is compounded using teaching strategies that

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do not improve mathematics mastery among students. As well as subjects that students often consider difficult subjects are Mathematics subjects that are even impossible to master (Arshad, 2017). Awareness of the importance of mathematical knowledge is also a priority and its application is often emphasized at every age, namely among children, adolescents, and adults (Lukowski et al., 2019). This can be proven through the study of Yahya and Amir, (2018) who explained that mathematical knowledge is needed to realize hopes and dreams to produce human beings who will develop and develop the country in the future.

Therefore, this study was conducted to find alternatives that can help teachers and students to overcome difficulties in mastering mathematics and increase interest in mathematics in themselves. The alternative that wants to be developed is to make it easier for teachers to help students in learning and master mathematics more easily and to attract students' interest to further increase their desire to learn mathematics in students. In addition, the alternative is also to prove to students that mathematics is very easy to learn and understand.

1.1 Research Background

According to the survey results obtained by Salleh, (2013), the problem in terms of inefficiency of teachers is clearly visible in some situations. Among them are educators who have taken courses related to mathematics cannot apply their knowledge in actual teaching due to some constraints that can cause them to make mistakes in terms of teaching and learning strategies, teaching methods, teaching preparation planning, use of materials and teaching aids to show teacher inefficiency and declining achievement also occurred as well as lack of student acceptance in mathematics classes. This proves that the number of teachers who follow the field of mathematics teaching is not a determinant in ensuring that this field can be developed.

There are many other factors that cause students' weakness in the subject of mathematics. Among the factors according to Habibah's study, (2018) is the relationship between students' attitudes and motivation, parents' awareness of children's education, students' self-awareness of the importance of mathematics subjects and teachers' approach in guiding students through the process of teaching and learning mathematics. Most students think that mathematics is not a science that provides strategies to communicate effectively. In fact, they also do their best to try to stay away from mathematics and consider mathematics as a subject that has many rules, and they need to follow the rules taught by the teacher even if they find it difficult to understand the rules.

1.2 Problem Statement

Based on the background of the problems that have been explained, the subject of mathematics is very important in determining the progress of technology and the importance of daily life, especially in the field of science and technology. There are also many factors that influence the low level of achievement in mathematics subjects among students. Among the main aspects that have been emphasized in this study are students' awareness of the importance of learning mathematics, parental awareness, attitudes, and self-motivation of lessons, the inefficiency of educators, teaching and learning strategies, teaching methods, teaching preparation planning, and use of materials and aids. In addition, the achievement in mathematics subjects among students is very unsatisfactory and very low where the failed grades in mathematics subjects obtained the highest number through studies that have been done by previous researchers.

1.3 Research Objective

The objectives of this study are to:

- i. Designing interactive learning applications of basic Mathematical concepts

- ii. Develop an interactive learning application of basic Mathematics concepts based on three designs namely content design, interface design, and interaction design.
- iii. Test the functionality of interactive applications of basic concepts of Mathematics based on three designs namely content design, interaction, and interface.

2. Methodology

The development model used to develop the Basic Mathematical Concepts Interactive Learning Application is the ADDIE model. The ADDIE model includes five phases, namely Analysis (analysis), Design (design), Development (development), Implementation (implementation) and Evaluation. According to a study conducted by Baharuddin et al., (2008), this ADDIE model is one of the systematic and effective design models in the production of computer-based learning materials and has user-friendly elements. Based on the observations made by Che Hassan (2013), the ADDIE model has succeeded in providing a positive impact as a teaching aid tool through the software that has been developed. The ADDIE model has five main divisions namely analysis, design, development, implementation, and evaluation.

To ensure that a learning goal can be implemented, the selection of a systematic instructional design is important. Therefore, the ADDIE model has been selected as the development model of this Interactive Learning Android Application Basic Mathematical Concepts. This is because, the process of designing teaching and learning materials involves five phases namely analysis, design, development, implementation, and evaluation. The selection of this ADDIE model is expected to facilitate and meet the criteria in the development process of Interactive Learning Android Application Basic Mathematical Concepts. Figure 1 show that ADDIE design model (Muhammad Izuan Abd Ghani, 2015) for this research.

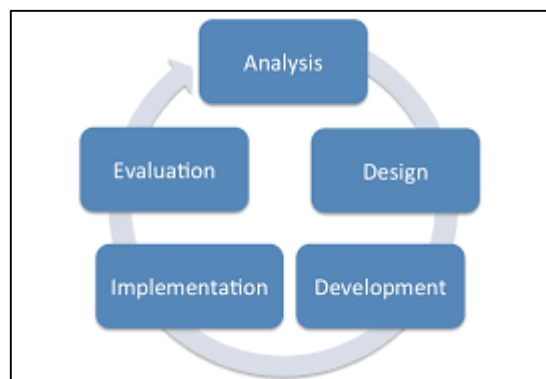


Figure 1: ADDIE design model (Muhammad Izuan Abd Ghani, 2015)

2.1 Analysis Phase

This phase of analysis includes several processes of determination as well as identifying the problem encountered and ways to solve them. Developers can identify the problem using the methods of questionnaires, interviewers, observations, surveys, and so on. Thus, the developer chooses the observation method to identify the problem. The developer also has defined the target group which is teachers and students. This is because of the observations that have been done the teaching and learning process will be easier and more effective by using teaching aids like interactive slides (Ismail, 2012).

2.2 Design Phase

According to M. Zuki (2016), The phase of design is a process of transferring information from the analysis phase to a physical sketch that will be used during the product development process. Besides that, this phase also involves content design, interaction design, and interface design.

2.3 Development Phase

The phase of development involves the process of developing and storyboarding before implementing the software development process. A storyboard is a type, example, or figure that is sketched as a guide to symbolize the original product ideas to be developed and used to find defects in the phase carried out (Azmy 2013). In addition, in this phase also, the elements of multimedia will be produced using the Adobe Animate software and other support software.

2.4 Implementation Phase

The implementation phase is the phase of development and implements the product. According to Ismail (2012), the purpose of this phase is to test the effectiveness and identify if there are problems that were not realized during the implementation of the previous phase.

2.5 Evaluation Phase

The aim of the evaluation phase is to ensure that the product system runs smoothly and achieves the objective (Cozby, 2001). For this phase, the developer used the informal evaluation which involved the experts for the observations and comments.

2.6 Research Instrument

To ensure this application functioned well, 3 experts in Creative Multimedia and Mathematics teachers three of them also experts in the contents of the Information Technology in Education course were selected and they evaluated the application through an expert checklist form. The expert checklist form involves five part which is expert demographic, content design evaluation, evaluation of interface design, interaction design evaluation, comments, and suggestions. Developers have distributed checklist forms using WhatsApp and face-to-face.

3. Results and Discussion

Developers have made confirmation of three experts for the evaluation of the Interactive Learning Android Application Basic Mathematical Concepts. As a result of the evaluation, it was analysed using methods in the frequency of acceptance. Table 1, 2, and 3 shows the validation findings of content design, interface design, and interaction design experts. As a result of the findings, of all the items that were submitted, there were some items that obtained 'NO' from the experts. In addition, there are suggestions and views from experts related to content design, interface design, and interaction design in several items. Overall, all experts have provided positive feedback on the design of Interactive Learning Android Application Basic Mathematical Concepts. If necessary, raw data that is too long to be included in this section can be moved to the appendix.

3.1 Content Design Expert Assessment

Content expert evaluation is an evaluation of the content found in an interactive learning android application that has been developed. The purpose of this assessment is so that the information presented in this interactive learning application can be clearly understood by users. The developer provided seven question items related to content design. Developers use a frequency approach in describing the analysis of findings from expert reviews of content design evaluations. Table 1 shows the results of the expert evaluation study on the content design for the interactive learning applications developed.

Table 1: The findings of the expert evaluation study on content design

Item	Statements	Frequency	
		Yes	No
1	The content of this interactive learning application is appropriate to topic	3	0
2	The content of the interactive learning application is clear	3	0
3	The content of the interactive learning application meets the learning objectives	3	0
4	Information related to learning the basics of Mathematics is easy to understand	3	0
5	The order of the contents is orderly	3	0
6	Quizzes in interactive learning applications test students' comprehension	3	0
7	The use of language used is easy to understand	3	0

Referring to the results of the study, the first, second, and third items from part B which is the content design part of the three experts agreed that the content of this interactive learning application is appropriate to the topic, the content of interactive learning application is clear, and the content of interactive learning application meet the learning objectives. Next, the fourth, fifth, and sixth items also received positive feedback where all three experts agreed that information related to basic learning of Mathematics is easy to understand, the arrangement of content is orderly, and quizzes in interactive learning applications test students' comprehension. The last item from part B has also received positive feedback where the use of language used is easy to understand agreed by all three experts.

3.2 Interface Design Expert Evaluation

The interface design expert evaluation is an evaluation related to some of the multimedia elements found in this interactive learning android application that has been developed. This evaluation is done to ensure that the interactive learning android application developed can provide clear and interesting information to users. The interface expert questionnaire in section C contains several items related to the multimedia elements used such as text, graphics, audio, animation, interaction design, and video. In this section, there are 13 questions provided by the developer to the experts to make an assessment. Therefore, a frequency analysis is performed in describing the results of the review findings from experts. Table 2 shows the results of the expert evaluation study on the interface design for the interactive learning android applications developed.

Referring to the results of the study, the first item from part C which is the interface design part of both experts namely expert 1 and expert 3 agreed that the interface design on this interactive learning android application attracts users. However, expert 2 disagreed with the interface design of this interactive learning android application appealing to users. Next, the second, third, and fourth items received positive feedback where all three experts agreed that the icons used are appropriate to the content, the icons used are understood their function and the use of icon colors appropriate to the theme. For the fifth, sixth, and seventh items, all three experts also agreed that the font type chosen was appropriate, the use of accurate text size, and video quality in good condition.

Meanwhile, for the eighth item, expert 2 did not agree that the video quality was in good condition because according to expert 2, there was an inverted video. However, experts 1 and expert 3 agree that the video quality is in good condition. The ninth, tenth, and eleventh items received excellent feedback where all three experts agreed that the use of background color matches the text color on each display, the use of animation in interactive learning applications is interesting and the button design used is appropriate. For the last item from part C, the twelfth and thirteenth items received positive feedback

where all three experts agreed that the use of button color used is appropriate and the button color used is attractive.

Table 2: Results of expert evaluation study findings on interface design

Item	Statements	Frequency	
		Yes	No
1	The interface design on this interactive learning application attracts the interest of users	2	1
2	The icons used correspond to the content	3	0
3	The icon used is understood in its function	3	0
4	Use icon colors that match the theme	3	0
5	The selected font type is appropriate	3	0
6	Use of accurate text size	3	0
7	Consistent text positioning	3	0
8	Video quality in good condition	2	1
9	The use of background color corresponds to the color of the text on each display	3	0
10	The use of animation in interactive learning applications is interesting	3	0
11	The design of the buttons used is appropriate	3	0
12	The use of button color used is appropriate	3	0
13	The color of the buttons used is attractive	3	0

3.3 Interaction Design Expert Assessment

This evaluation of the interaction design of this Interactive Learning Android Application Basic Mathematical Concepts focuses on the design, position, and function of the icons and control buttons provided in this interactive learning android application. There were five question items provided to the multimedia evaluator expert to evaluate this interaction design. Table 3 shows the results of the findings of the expert evaluation study on the interaction design for the interactive learning android applications developed.

Table 3: Findings of the study of expert evaluation of interaction design

Item	Statements	Frequency	
		Yes	No
1	All buttons are connected to the correct display	3	0
2	Buttons can be used properly without any errors	2	1
3	The navigation buttons provided work well	3	0
4	The navigation buttons are easily controlled by the user	3	0
5	The navigation buttons provided on each interface display are appropriate	3	0

Referring to the results of the study findings obtained, the first item from part D which is the interaction design part of the three experts agreed that all the buttons are connected to the correct display. However, the second item received poor feedback where experts 1 and three agreed that the buttons could be used well without any errors. But expert 2 does not agree that the button can be used properly without any errors whereas according to expert 2 part of the answer button does not work well. Next, the third and fourth items received positive feedback from all three experts where all three experts agreed that the navigation buttons provided work well and the navigation buttons are easy to control by the user. For the last item part, D has also received positive feedback where the navigation buttons provided in each interface display are appropriate has been agreed upon by all three experts.

4. Conclusion

In conclusion, the questions were answered. Improvements made to any problems faced were also done. As a result of the findings of the study based on the assessment, developers found that the development of the Interactive Learning Android Application Basic Mathematical Concepts. is an attractive medium and helps users in understanding and get a clear picture of the topic they learned? Comments and suggestions from experts were included in this product development to meet the needs and requirements of the users. Mostly all specialists agree on content design, interaction design, and interface design as well as Multimedia presentation for this application.

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