Trial and validation of etnobatic applications as a media mathematics learning based on android

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Abstract: This study aims to develop mathematics learning media using ethnomathematical elements in Javanese batik which are called an android-based ethnobatic application. Ethnobatics is an android-based learning application designed to be used in learning mathematics combined with Javanese batik culture to increase students' interest and understanding in learning mathematics by relating everyday realities through Javanese batik motifs. The research method used in this study is RnD (Research and Development) with the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The trial and validation were carried out at three elementary schools in Cirebon Regency with a sample of 30 students. The data collection technique used in this study was a questionnaire instrument to test the validity of the application used for expert validators and elementary school students as users. The results of this study indicate that the android-based ethnobatic application can be used as a medium for learning mathematics based on the assessment of expert validators and also the assessment of students in the use of ethnobatic applications in mathematics learning activities.

Keywords: Ethnomathematics of Batik; Javanese Batik Motifs; Android Applications, Learning Media; Ethnobatic Applications.

Uji Coba dan Validasi Aplikasi Etnobatik sebagai Media Pembelajaran Matematika Berbasis Android

Abstrak: Penelitian ini bertujuan untuk mengembangkan suatu media pembelajaran matematika dengan menggunakan unsur etnomatematika pada batik khas Jawa yang disebut aplikasi etnobatik berbasis android. Etnobatik merupakan aplikasi pembelajaran berbasis android yang dirancang untuk digunakan dalam belajar matematika yang digabungkan dengan kebudayaan batik khas Jawa untuk meningkatkan minat dan pemahaman siswa dalam belajar matematika dengan mengaitkan kenyataaan sehari-hari melalui motif batik khas Jawa. Metode riset yang digunakan dalam penelitian ini adalah *RnD (Research and Development)* dengan model ADDIE *(Analysis, Design, Development, Implementation and Evaluation)*. Ujicoba dan validasi di lakukan pada tiga sekolah dasar Kabupaten Cirebon dengan sampel sebanyak 30 siswa. Teknik pengumpulan data yang digunakan dalam penelitian ini adalah instrumen kuesioner untuk melakukan uji coba validitas terkait aplikasi yang digunakan kepada validator ahli dan siswa sekolah dasar sebagai pengguna. Hasil penelitian ini menunjukkan bahwa aplikasi etnobatik berbasis android dapat digunakan sebagai media pembelajaran matematika berdasarkan penilaian dari validator ahli dan juga penilaian siswa dalam penggunaan aplikasi etnobatik dalam kegiatan pembelajaran matematika.

Kata Kunci: Etnomatematika Batik; Motif Batik Jawa; Aplikasi Android; Media Pembelajaran; Aplikasi Etnobatik

INTRODUCTION

The independent curriculum which came into effect this year for schools has become a new challenge for teachers and students to adapt to change. The vision of Indonesian

education is to realize an advanced Indonesia that is sovereign, independent, and has personality through the creation of Pancasila students. On this basis, there is a need for changes and various innovations in the world of education that must be faced by teachers and students. One of them is by strengthening school human resources, namely the implementation of technology in learning activities where students are expected to be able to learn independently so that future teachers will become knowledge facilitators. Augmented Reality technology on the Android platform is sufficient to meet the needs of the context of presenting the material (Sila et al., 2022). The development of learning media based on this android application aims to help achieve educational learning objectives (Hakam et al., 2022).

Many opinions state that mathematics is a difficult, complicated, and fearful learning, and many students have negative perceptions of mathematics (Dewi, 2019; Fauzy & Nurfauziah, 2021; Monariska, 2019; Mulyanti et al., 2018; Sukmawati & Jumarniati, 2006; Supardi, 2013; Untari, 2013). Based on this opinion, it can be seen that it is undeniable that mathematics is a subject that is considered difficult for most students. Many factors cause students to be less interested in learning mathematics, one of which is that there are still many teachers who have not linked mathematics learning with students' daily lives so students' numeracy skills are not optimal, especially for basic education levels.

Relating mathematics to everyday life in the form of contextual problems is a hallmark of realistic mathematics learning (Misdalina et al., 2009; Rahayu et al., 2008; Rusiyanti et al., 2022; Supiarmo et al., 2022; Ulya et al., 2010; Yuli & Bella, 2022). Based on this opinion, it is appropriate that the research was appointed by the researcher, namely developing realistic mathematics integrated mathematics learning media in the form of batik culture integrated with mathematics in the form of ethnomathematics into android-based media called ethnobatics. Ethnomathematics is a bridge between mathematics and culture, mathematics that exists in culture, customs both material and intangible in society (Arisetyawan et al., 2014; Cimen, 2014; Faiziyah et al., 2021; Febrina et al., 2022; Fitrianawati, 2016; Hidayat, 2022; Muhtadi et al., 2017; Permita et al., 2022; Rahayu et al., 2008; Risdiyanti & Prahmana, 2017; Rosa & Orey, 2013; Sintiya et al., 2021; Turmuzi et al., 2022). The advantage of this research is that it integrates culture, mathematics, Realistic Marthematics, and technology into an android application system that is still rarely studied by other researchers. Produce learning media that can contribute to mathematics learning activities by integrating culture, mathematics, and android technology.

METHOD

This study uses the RnD (Research and Development) method with the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) approach (Hamdani & Priatna, 2021; Hartati et al., 2017; Saputro & Poedjiastoeti, 2017; Wahid et al., 2020). ADDIE is very relevant to the research we are doing with detailed stages of each stage in this research. The RnD method is used because in this study it will produce a product in the form of a mathematics learning application with ethnomathematical concepts in Javanese batik based on Android.

This research focuses on the subjects in this study elementary school students. Data was collected by filling out questionnaires to see the results of the assessments of media experts and material experts. Furthermore, it was tested on 30 grade VI elementary school students. This is done as part of the implementation and evaluation process of the ADDIE approach. The ADDIE model is shown in Figure 1.
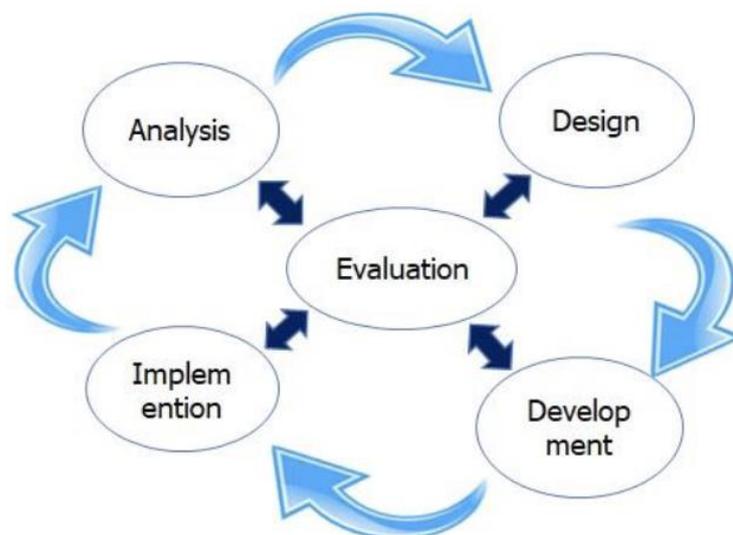

Figure 1. ADDIE Model (Dwitiyanti et al., 2020)

Figure 1 shows that there are 5 stages in the ADDIE model. The initial stage is analysis. The analysis stage here is divided into three parts. That is the stage of collecting batik data on the island of Java, the second stage is to do gray and scale on existing batik motifs and the next stage is the analysis of batik motifs. Then the second stage is the design of an Android-based mathematics learning application. At this stage, the screen display design and the content framework of the application program will be determined. Program content framework to describe the overall content of the material includes theory, sample questions, pictures of batik motifs, layout, background, and colors. After that, the third stage is development, namely the product realization stage. The development of an application program with Android is carried out and adjusted to the design that has been carried out at the analysis and design stage. At this stage, product validation testing is carried out by material experts and media experts. Next is the fourth stage, namely the implementation stage, where at this stage the product is implemented and the respondents are assessed. Learning media testing is done by testing a questionnaire. The last stage of the ADDIE model is the evaluation stage, where in this stage is the evaluation process of the application that has been made which is adjusted to the previous stage. This evaluation is based on application trials conducted by the validator and an application feasibility assessment is carried out through the distribution of questionnaires. The result of this stage is a report on the results of application testing. Based on this stage, the application made is corrected if a system error is found in the application so that the application can be widely used as a medium for learning mathematics. The assessment criteria used in this study follow table 1 (Widyawati & Prodjosantoso, 2015).

Table 1. Assessment Criteria

Score Range	Eligibility Catagory
0% – 20%	Very unworthy
21% - 40%	Not worth it
41% - 60%	Quite decent
61% - 80%	Worthy
81%-100%	So worth it

RESULT AND DISCUSSION

The results of this study are an android-based ethnobatic application as a medium for learning mathematics using ethnomathematical elements in Javanese batik. The stages of the development of the results of this study are adjusted to the ADDIE model which consists of Analysis, Design, Development, Implementation, and Evaluation. The following are the stages in the development of android-based mathematics learning media according to the ADDIE model.

Analysis (Analysis)

The analysis stage here is divided into three parts. That is the stage of collecting batik data on the island of Java. The process of collecting data is based on documentation, literature study, interviews, and field observations. This research was conducted during the COVID-19 pandemic so a lot of data collection was done online and coordination was done online with related parties. The location of this research is the center of traditional batik culture in the form of batik in the provinces of West Java, Central Java, and East Java. Each of these locations was sampled from several cities/districts in a purposive manner, in which areas with a lot of batik motifs have ethnomathematical elements in them. The second stage is to do gray and scale on existing batik motifs and the next stage is to analyze batik motifs and see the patterns and curves found in the batik motifs so that the similarities between batik motifs can be compared with each other in detail or whether there are ethnomathematical elements or not so that These motifs can be said to come from the same family of batik motifs.

Design (Design)

At this design stage, a design is made for an Android-based ethnobatic application and the components contained therein. At this stage, it also includes making Flowchart and Pseudocode designs for ethnobatic applications on Android smartphones as learning media, as well as storyboards used to explain the layout of the media display which is equipped with the necessary explanations. The next step is the preparation of the assessment questionnaire. Then, this questionnaire will be validated by experts until it is declared valid, practical and effective or not this application is used.

Development (Development)

      The results of developing an Android-based ethnobatic application can be seen in the following pictures:

Figure 2: Home

Figure 3: List of batik motifs

Figure 4: Mega mendung batik motif

      As seen in Figures 2, 3, and 4 are one of the main views related to the application being developed considering that this research was carried out in 3 provinces, namely West Java, Central Java, and East Java. So in the main view in Figure 2, you can see the area selection. Figure 3 is selected for the province of West Java, and a list of batik motifs in West Java will appear. Figure 4 shows one of the batik motifs in West Java from Cirebon, namely the Mega Mendung motif.
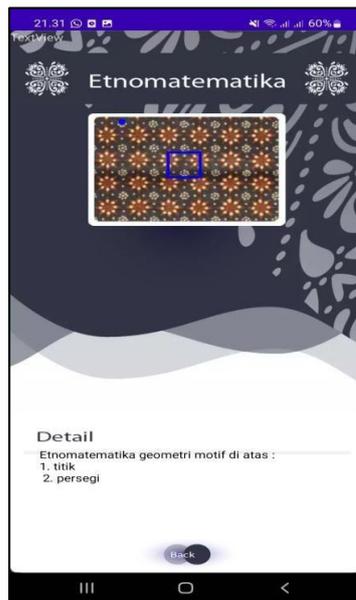

Figure 5: History

Figure 6: Ethnomathematics

Figure 7: Example

      Figures 5 and 6 show the sub-menu on the batik motif menu. The submenu displays two choices, namely history and revealing ethnomathematical elements in each batik motif

from the area of origin of the motif. Figure 7 is a display of the sample question menu which is a collection of sample questions and discussion questions that present questions related to mathematics and batik

Figure 8: Practice questions   Figure 9: Score   Figure 10: About

Figure 8 shows practice questions related to the ethnomathematical elements of batik. The questions contained in the practice questions are 10 questions where each correct question will get a score of 10 and if it is incorrect then the value is 0 the final score will be shown in Figure 9. Figure 10 is a display of the application and researchers who developed this application.

After the ethnobatic application was completed, it was then validated by two material expert validators and two media expert validators. Material validation includes 3 aspects, namely the suitability of the material concept. Language and presentation of practice questions. Each of these aspects contains 5 indicators so the total statement is 15 items. The results of the validation data by material experts are presented in table 2 as follows:

Table 2. Results of Material Expert Validation Assessment

Aspect	Percentage	Eligibility
Conformity of Material Concept	85,42%	So worth it
Language	80,00%	Worthy
Exercise	75, 00%	Worthy
Average	80,14%	Worthy

Based on table 2, it can be seen that two material experts assessed that the ethnobatic application was by the various presentations in the ethnobatic application. The average value of the two validators reaches 80%, meaning that this application is suitable for use as a

medium for learning mathematics which is expected to contribute to the world of education, especially mathematics education, to make it easier for students to like and make it easier for students to understand mathematics contextually.

The assessment on the media aspect is the same as the assessment on the material aspect, filling out an assessment questionnaire sheet consisting of 3 aspects, namely the graphic aspect, the program processing aspect, and the practicality aspect of use (Dwitiyanti et al., 2020). The total number of statements from all aspects is 12 statement items. The results of media expert validation are presented in table 3.

Table 3. Media Expert Validation Assessment Results

Aspect	Percentage	Eligibility
Graphics	79,69%	Worthy
Program processing	81,25%	So worth it
Practicality of use	81,25%	So worth it
Average	80,73%	Worthy

Table 3 shows the assessments of two media validators who stated that the learning media in the form of ethnobatic applications was suitable for use due it appearance, and practicality of use. Based on this, it is expected that students can easily operate this media and can be used as learning media in schools.

Implementation

Products that have been declared valid are implemented fot 30 elementary school students, both students who carry out online and offline learning processes, by providing ethnobatic applications to students to be installed on their respective smartphones. After the application is installed and used, an assessment is carried out by students through a questionnaire by looking at 3 aspects including interest in learning, ease of understanding, and media presentation (Hamdani & Priatna, 2021). The results of student assessments are presented in Table 4 below.

Table 4. Student Assessment Results

Aspect	Percentage	Eligibility
Interest to learn the usage	90,21%	So worth it
Understanding	91,17%	So worth it
Media presentation	80,28%	So worth it
Average	87,22%	So worth it

Table 4 shows that the overall percentage of student assessment of ethnobatic applications is 87.22% with the "Very Eligible" category to be used as a medium for learning mathematics. Judging from the results of these trials, it is hoped that students will better understand mathematics in everyday life, especially related to batik, where in the batik motif

many elements of flat geometry can be used as a medium for learning mathematics, especially for elementary school students.

Evaluation

The evaluation stage is carried out in this research and development. Android-based learning media for elementary school students has been declared suitable for use by material experts and media experts with some minor improvements that need to be made to improve this application. with the suggestions of validators and students. Then, at the implementation stage, positive results were obtained from student assessments where the application was very feasible to use. Researchers have evaluated this application for elementary students according to suggestions and input from validators and students.

This discussion is related to the testing and validation of an Android-based ethnobatic application developed using the ADDIE model which has the main menu page. When the application has entered the main menu, there are 5 buttons to display some information about West Java, Central Java, East Java, Practice Questions, and About the Development Team. When the user enters one of the selected menus for West Java batik, eight batik motifs from regions in the city of West Java will appear on the screen. Then, the motif menu will display three menu options including history, ethnomathematics, and sample questions. When the user enters the History menu, a display will appear about the description of the origin of batik from the selected motif. Likewise, when the user enters the ethnomathematics menu, the batik images and the ethnomathematics contained in the batik motif will be displayed. When the application has entered the sample practice questions menu, it displays several examples of questions about the batik motif. In the practice questions menu, this page is considered as an evaluation of student's understanding of the mathematical material contained in certain batik motifs. Finally, the menu explains the purpose of making this ethnobatic application and the team that compiles and develops this application so that it can be widely used by students.

Based on this, it can be concluded that android-based ethnobatic applications are valid practicality, effectiveness to be used as learning media that can support mathematical numeracy activities, especially for basic education by incorporating mathematics learning into the cultural and artistic context of batik motifs packaged in android-based technology. The hallmark of interactive multimedia is having a controller to be able to run multimedia as desired (Wahyuni & Ananda, 2022). The development of information and communication technology in the 21st century has influenced the characteristics and perspectives of students in terms of learning (Dilson et al., 2022). The mathematics learning process requires a tool to support learning without having to dwell on boring learning in a class filled with assignments (Nugroho et al., 2017). The use of technology in learning activities is an added value to support the learning process (Heswari & Patri, 2022). Previous research has not explored the integration of mathematics, culture, and technology. This is the advantage of this research combining 3 dimensions into one that is packaged to realize literacy and numeracy for students, especially at the basic education level to be able to know the importance of learning numeracy to be applied in everyday life.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that the ethnobatic application is valid, practicality, effectiveness to use based on the assessment of two material expert validators, two learning media expert validators, and the results of trials that have been carried out on a small scale to elementary school students. The next step the research team will take is to implement and disseminate information to elementary school students on the island of Java.

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