



Development of Ethnomathematics-Based Interactive Learning Multimedia with Android Applications on Transformational Geometry Material

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Abstract

The development of interactive multimedia learning based on ethnomathematics using Android was motivated by the fact that many students were not happy with mathematics subjects, because they considered mathematics difficult and difficult to understand. It is known based on field analysis, one of the causes is that the learning methods used are still conventional, causing monotonous and passive learning. This research aims to develop interactive learning applications to increase student creativity. Learning media was developed in the form of an application equipped with interactive videos in it which is intended for Class IX students. This research uses the development stages of the ADDIE development model (analysis, design, development, implementation, evaluation), as well as learning media quality criteria using three criteria according to Nieveen in 1999, namely that a product developed is said to be of quality if it meets the criteria of valid, practical and effective. The conclusion of this research was obtained from validation which shows that the Bayutrigo application is included in the criteria of being very valid and very practical. The average KBKM of students using the Bayutrigo application is more than 65, the proportion of classical completeness is more than 75%, the average class that uses the Bayutrigo application is more than the average class that does not use the Bayutrigo application, the proportion of classes that use the Bayutrigo application is more than the classes that do not use the Bayutrigo application, and the maximum N-gain and minimum N-Gain values for classes that use the Bayutrigo application are more than the maximum N-gain and minimum N-Gain classes that do not use the Bayutrigo application.

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INTRODUCTION

Mathematics is a basic science for other sciences, and plays a big role in everyday life (Atiyah and Nuraeni, 2022). This is in line with the opinion of Helma and Edizon (2017) regarding mathematics learning in schools, teachers must develop an interdisciplinary mathematics learning context, such as technology or everyday life. In line with this opinion, according to Andriani and Septiani (2020) mathematics learning must be reality-oriented, one of which is by using local culture or what could be called ethnomathematics. Another thing, Ethnomathematics is a knowledge that links mathematics with cultural elements. The form of connection can be shown in the aspect of applying mathematical concepts in a culture. Mathematics learning that is rooted in local culture triggers student creativity and innovation.

Based on the results of an interview with one of the mathematics teachers at SMPN 1 Karangampel, the learning materials came from school textbooks so that ethnomathematics-based learning had never been carried out. Therefore, the researcher tried to integrate ethnomathematics in the form of batik motifs from Indramayu Regency, to increase the feeling of love for the homeland in learning geometric transformation material. This is in line with the opinion of Megawanti, et al (2022) that with ethnomathematics, students will not only be able to get to know the culture and local wisdom of the nation which is very rich and diverse, but also increase their insight into the archipelago and their love for the nation's culture. Apart from that, learning still comes from the 2013 curriculum mathematics package book and uses learning media, namely Geogebra. Therefore, researchers are trying to develop Android-based learning media so that students can play an active role in learning. The learning media is designed with ethno-mathematics nuances in the form of batik motifs found in the students' residence, namely Indramayu Regency, so that it can increase the feeling of love for the country. According to Suwarsono (2020), the benefits of ethnomathematics-based mathematics learning

include students becoming more motivated in learning mathematics, with ethnomathematics, mathematics learning can be linked to the real life context of society, and students also become motivated to care about existing problems and are moved. to improve the existing situation. It is further explained that learning media is a component of learning resources or physical vehicles that contain instructional material in the student environment which can stimulate students to learn (Kosasih et al., 2023). Learning media can be used as a means of communication between teachers and students to achieve learning goals (Yunarti et al., 2022). The use of learning media by displaying animation is expected to be able to arouse students' learning motivation because it has attractive shapes and colors and is able to clarify understanding of the concepts of the subject matter (Yunarti et al., 2022). Meanwhile, according to Baharuddin, et al (2020) the use of media in learning allows students to understand and understand the material presented quickly.

Based on the results of distributing questionnaires to students, all students in the class have Android-based cellphones, meaning that 100% of students now have their own cellphones. Furthermore, most students use cellphones for playing games and social media, while only a few students use cellphones for learning. Therefore, it is hoped that the interactive multimedia learning product based on ethnomathematics using Android can be used as a learning medium for learning mathematics, especially in transformational geometry material. According to Fredlina, et al (2021) the use of technology in education must be seen as one way to encourage improvements in the quality of education in this era, as well as in mathematics learning. Furthermore, the role of media in learning makes students do more learning activities and other activities such as observing, doing, demonstrating, and so on.

Based on the analysis that has been carried out, it can be concluded that learning that can stimulate students to be more active is by utilizing the technology and culture that exist where students live. transformation geometry is one of

the materials that can be connected with technology that is integrated with ethnomathematics in the form of batik motifs from Indramayu Regency. To help students understand transformation geometry material that can be found in cultural aspects, researchers have integrated batik motifs from Indramayu Regency with transformation geometry material and designed it into learning media. The name of this learning media is Bayutrago which is an abbreviation of Batik Indramayu transformation geometry.

METHOD

This research uses the ADDIE development model (analysis, design, development, implementation, evaluation). The ADDIE instructional model is an instructional process that is commonly used traditionally by training developers (Cahyadi, 2019). There are five phrases, namely analysis, design, development, implementation and evaluation which present a guide to dynamic training and performance development tools. Meanwhile, the quality criteria for learning media use three criteria according to Nieveen in 1999, namely that a product developed is said to be of quality if it meets the criteria of valid, practical and effective. The validity of a development product is said to be good if the product is in accordance with the learning content and learning indicators. The practicality of the resulting media product is seen from the extent to which users consider that the product being developed is interesting, easy to use and can be applied by teachers and students in accordance with the objectives of the media development. A development product is said to be effective if the results of trials carried out in the field are in accordance with the objectives and achieve the objectives expected from the development.

The data collection techniques used in this research were interviews, questionnaires, learning outcomes tests, and documentation. The instruments used in this research were expert validation questionnaire sheets, practitioner questionnaire sheets, and posttest questions.

RESULTS AND DISCUSSIONS

Development of learning multimedia Bayutrago done with using the ADDIE development model, which consists of of five stages development , namely: (1) stage analysis, (2) stage design, (3) stages development, (4) stages implementation, and (5) stages evaluation.

In the Results Analysis Stage, the Initial Process is carried out for product Bayutrago that is with do a number of analysis For know things that become consideration in development products, so that the products developed can make optimal learning and achieving effectiveness. Analysis First that is analysis competency, selected learning materials For developed in learning media Bayutrago is material Geometry Transformation with four part, namely translation, reflection, rotation, and dilation . In KD 4.5 students directed For finish problem contextually related with Geometry Transformation. Learning with use multimedia learning assistance interactive based on ethnomathematics on batik motifs from area Indramayu is solution for KD 4.5. Students directed For use various type transformation For drawing batik motifs from area Indramayu. Analysis second that is learning media needs, Based on results questionnaire, needs student to other sources besides book For increase understanding material mathematics obtained presentation by 69% which means fall into the “very need” category. In addition, the need student will different media nuances with appearance more Lots colors, pictures, a little writing, and there is element batik motif culture in the Regency Indramayu obtained presentation by 75.9% which means falls into the “very needy” category. Based on results the explanation of the data above, it can be seen that interesting learning media is really needed by students. So that with Bayutrago media assistance will developed expected learning will more optimal and more good. Analysis third that is use technology as a learning medium, Based on results questionnaire that all student have an android- based cellphone, meaning 100% of students Now Already have their own cell phones. Furthermore, the use of cell phones is mostly used for playing games and social media namely to obtain presentation by

48.3% and 44.8%. Meanwhile use of mobile phones for learning only to obtain presentation by 6.9%. Therefore, Bayutrigo media product made expected can utilized as a learning medium For Study mathematics, especially in the material Transformation Geometry.

Results of the Design Phase on the Learning Media Application Entitled BAYUTRAGO (Batik Indramayu) Transformation Geometry). Indicator achievement objective learning after using media namely: (1) Determine related settlement strategies with Transformation Geometry (reflection, translation, rotation, and dilation).

(2) Finishing related projects with Transformation Geometry (reflection, translation, rotation, and dilation)

Media designed for facilitate understanding and resolution problem Transformation Geometry. Design image used in the learning media, namely batik motifs that exist in the Regency Indramayu. The material consists of from translation, reflection, rotation, and dilation. The Bayutrigo creation process flow that will be developed is shown in Figure 1.

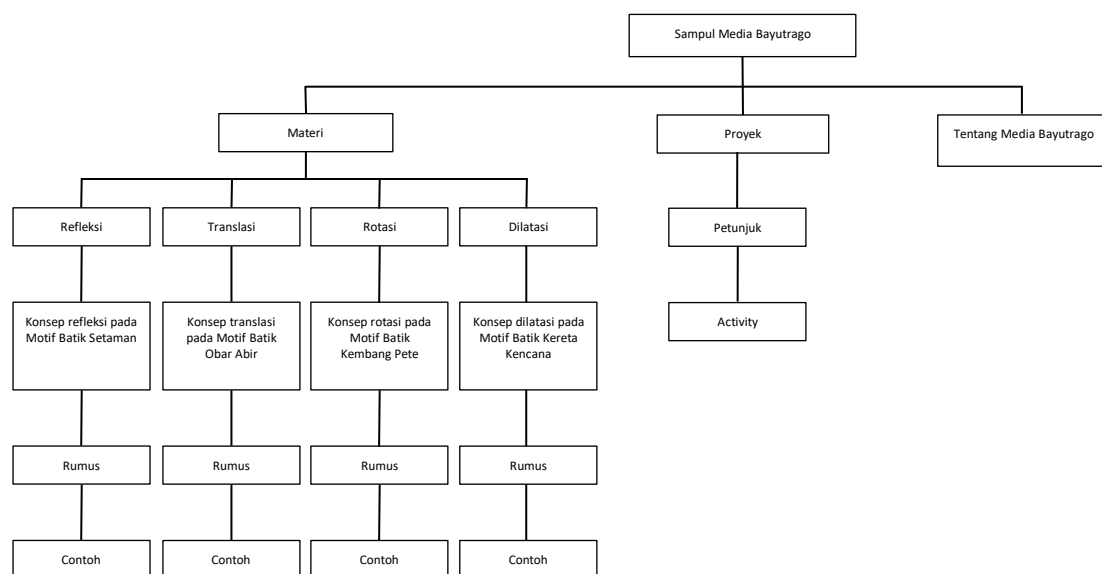


Figure 1 Bayutrigo Flowchart

Stage Results Development is stage development product according to the flowchart that has been compiled. The following is appearance from development of Bayutrigo media that was developed.

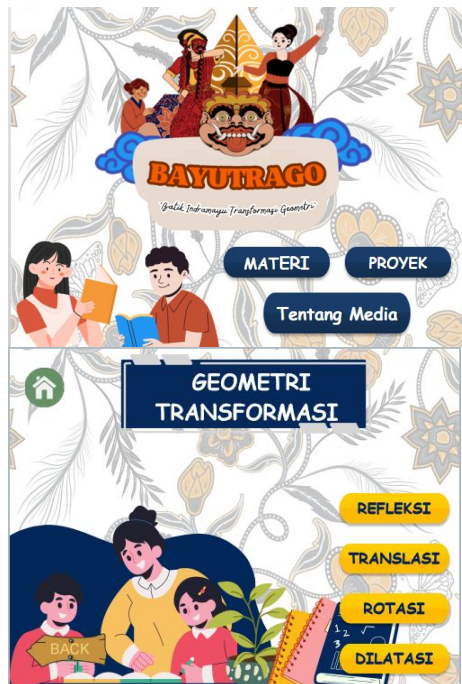


Figure 2 Cover and material view



Figure 3 Display of Reflection and Concept Material Reflection

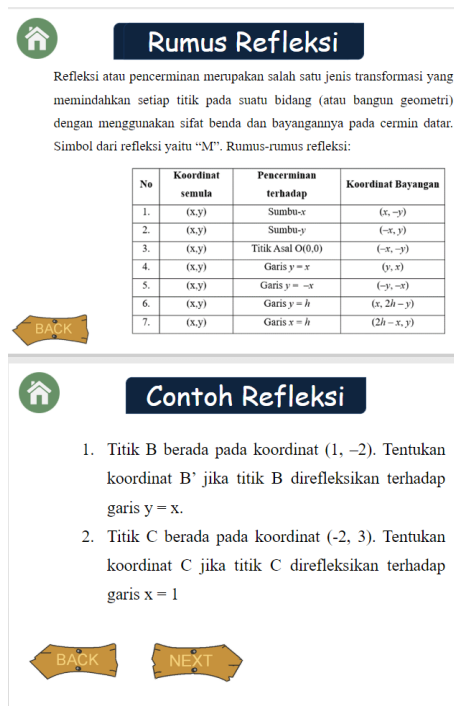


Figure 4. Appearance Formula Reflections and Examples Reflection



Figure 5. Appearance Projects and Instructions Workmanship Project



Figure 6. Project Activity View and About Media

In the development of Bayutrago media need selection and appointment device software. Device software used is Articulate Storyline application. In addition, to develop learning media This also supported by other applications that aim for change application format become android based. Other applications in question is DriveToWeb and APK Builder. Validation media design was tested by 3 media experts including expert materials, media experts, and experts education. Expert test material done by a lecturer expert material with results learning media assessment shown in table 1.

Table 1. Material Expert Test Results

Rated aspect	Value Acquisition
Compliance objective learning	4
Learning materials	4
Presentation	3
Quality	4
Total Score	15
Mark	94%
Category	Very good

Validation results expert material show that assessment on aspect (1) suitability objective learning get score 4 with information objective

learning contains KD, GPA, and the material presented is very appropriate; (2) suitability material learning get score 4 with information fulfillment all over indicators on the material learning; (3) presentation get score 3 with information fulfillment clarity material, allocation time used, speed material, sequence material, but in the choice of words/ sentences and the appropriateness of the language to material No fulfilled; and (4) quality get score 4 with information fulfil all indicator quality of the multimedia created. So that can taken conclusion results validation expert This get a total score of 15 and declared "Very Good" with presentation by 94%. Advice given by experts material that is practice on learning media customized with the learning model used.

Media expert test is carried out by a person lecturer media expert with results learning media assessment shown in table 2.

Table 2Media Expert Test Results

Rated aspect	Value Acquisition
Appearance screen	4
Coloring	4
Use of Words and Language	4
Programming	3
Animation	4
Total Score	19
Mark	95%
Category	Very good

Validation results media experts show that assessment on aspect (1) appearance screen get score 4 with information load indicator background selection, completeness information on the packaging Outside, the button/navigator form is presented with attractive, proportional layout and attractiveness cover design; (2) aspects coloring get score 4 with information load indicator conformity color with Indramayu Batik motif theme, as well as color No bother text and images; (3) use of words and language get score 4 with information load indicator election size letters that are proportional, appropriate election type letter so that readable and clear, and selection Language according to EYD; (4) programming get score 3 with information load indicator can be installed on android OS, easy button menu found, convenience understand structure navigation, speed and accuracy in to order function buttons; and (5) animations get

score 4 with information load indicator conformity animation with material, animation in accordance with Indramayu Batik motifs, and the selection and use of animation that is not crowded. So that can taken conclusion results validation media experts got a total score of 19 and were declared “Very Good” with presentation by 95%. The advice given by media experts is proportion too many icon symbols small so that no seen while on screen mobile phone and vulnerable can cause misclick knob.

Expert test education done by a lecturer expert education with results learning media assessment shown in table 3.

Table 3 Results of the Education Expert Test

Rated aspect	Value Acquisition
Eligibility Contents	3
Language	4
Total Score	7
Mark	88%
Category	Very good

Validation results expert education show that assessment on aspect (1) feasibility Contents get score 3 with information load three indicators on aspects eligibility Contents that is accuracy concepts and definitions presented in the material , suitability images and learning models used, and suitability the approach used in the media used; (2) aspect Language get score 4 with information use clear, appropriate sentences with diction and size letters . So that can taken conclusion results validation expert education This got a total score of 7 and was declared “Very Good” with presentation by 88%. Advice given by experts education namely the batik motif used customized with draft the material to be discussed. Next, the trial group small done for know eligibility in a way empirical with evidence in the form of ratings and comments from the subject that has been selected. The results of the learning media assessment shown in table 4.

Tabel 4. Learning media assessment results

Rated aspect	%	Criteria
Appearance	88	Very Practical
Programming	90	Very Practical
Learning	90	Very Practical

Language	94	Very Practical
Average	90	Very Practical

Based on results trial assessment group small in table 4, can concluded that from aspect appearance, aspect programming, aspects learning, and aspects multimedia language learning interactive based on ethnomathematics with android application stated practical For used as a learning medium.

Based on evaluation expert materials, media experts and experts education, then revise the learning media done for increase quality based on bait come back expert. Here is results revision as per suggestion from expert. First from expert material that is adjust type of quiz with the learning model used. The media slide image before revised shown in figure 7.



Figure 7. Display Before Revision

Furthermore fixed with replace the quiz menu with the project menu, so that in accordance with the learning model used that is

PjBL. As for the media slide image after revised shown in figure 4.8.

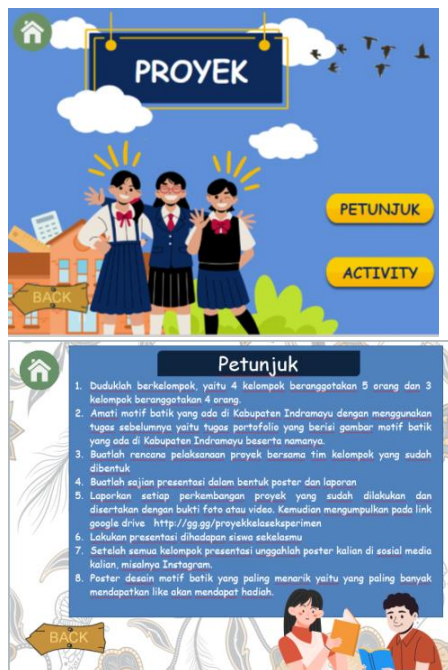


Figure 8. Appearance After Revision

Second suggestion from media expert namely too many icon symbols small so that No seen while on screen mobile phone and vulnerable can cause misclick button, so that students who use can cause misclick or No visible. As for the icon before revised and after revised shown in figure 9.



Figure 9. Display Before and after Revision

Third suggestion from expert education that is selection of batik motifs that are not integrate one of Material in Transformation

Geometry, giving rise to confusion for students who use the media. The batik motifs chosen before revised and after revised shown in figure 10.



Figure 10 Selection of Batik Motifs Before and after Revision

After application through stage validation experts and trials group small, next product tested on groups big. As for the results evaluation practicality by students group big through questionnaire shown in table 5.

Table 5. Results of practicality assessments by large groups of students

Rated aspect	%	Criteria
Appearance	92	Very Practical
Programming	92	Very Practical
Learning	94	Very Practical
Language	95	Very Practical
Average	93	Very Practical

Based on results trial assessment group large in table 5, can concluded that from aspect appearance, aspect programming, aspects learning, and aspects multimedia language learning interactive based on ethnomathematics with android application stated practical for used as a learning medium with results presentation by 93%. Students No give criticism and suggestions from the media being tested try it

Next, the average ability think creative mathematical student with using Bayutrago media more from BTA of 65, the proportion completeness classical more from 75%, average score posttest class experiment more from class control, proportion class experiment more from proportion class control, and the maximum and minimum N-gain values of the class experiment more from the maximum and minimum N-gain class control. In line with opinion expressed by Sakinah dan Hendriana (2022) that is seen from average N-Gain result obtained can made into reject measuring the effectiveness of the learning media created.

How to download and install Bayutrago media application that is: (1) Please download application via the following link <https://bit.ly/bayutrago>. (2) After download finished, please install the application. (3) If it appears, select set and give permission installation application. (4) After permission given, install the application and application Ready used.

Product development after done implementation in learning obtained good results, namely effective used in learning. With the results of the validity, practicality and effectiveness tests are good. Therefore that, can concluded that Bayutrago media products that have been developed fulfil criteria worthy For used as a learning medium. Obstacles that arise moment do study is a number of student experience difficulty for install application because of poor internet connection stable.

The results of media validation tests carried out by material experts, media experts and education experts, namely Bayutrago learning media, are said to be very valid and suitable for use as learning media. This is because Bayutrago media contains interesting visuals such as text, images and animations which can increase interest and motivation in learning and understanding the material. In line with the opinion of Makransky and Petersen in the book (Frederik and Ingo, 2022) that learning activities that combine with technology can influence six psychological factors, namely interest that arises from contextual conditions, intrinsic motivation, self-efficacy, sensory experience, information obtained by the human brain, and self-

strengthening. In connection with the use of Bayutrago media which can be installed on Android smartphones, according to Cahyono dan Ludwig 2019) the idea of outdoor learning supported by mobile technology is still hot in discussion. This idea is facilitated by the fact that in recent years, the development of mobile technology and the use of mobile phones has increased significantly.

The results of practical tests carried out by students in small group trials monitored directly by mathematics teachers obtained very practical and usable criteria. Skills in using this product are certainly not difficult because the researchers themselves designed and made it. Apart from that, in terms of target grouping, this media is specifically for junior high school students and the equivalent, especially class IX who live around the Indramayu area. In line with this, according to Nieveen Nieveen (Cahyono, 2018), practicality is fulfilled when experts and practitioners state that the prototype can be used and when the prototype can actually be used. Learning that utilizes technology, especially smartphones, can be carried out anywhere and at any time. This is in line with the opinion of Wijers, et al (Cahyono *et al.*, 2024) that the integration of mobile devices offers valuable opportunities to combine practical learning elements, including interesting content, collaborative work and authentic scenarios.

The results of the effectiveness test of learning media showed that after being given learning using ethnomathematics-based interactive multimedia learning with an Android application, the average mathematical creative thinking ability of students who used ethnomathematics-based interactive multimedia learning with an Android application was more than BTA and the number of students had reached the limit. completion has exceeded the specified criteria. In addition, the average value of students' mathematical creative thinking ability who used ethnomathematics-based interactive multimedia learning with Android applications was higher than the average mathematical creative thinking ability of students who did not use ethnomathematics-based interactive multimedia learning with Android applications and the proportion of students who

completed using multimedia ethnomathematics-based interactive learning with Android applications is more than the proportion of students who do not use ethnomathematics-based interactive multimedia learning with Android applications.

Furthermore, the average N-gain score for the experimental class was higher than the average N-gain score for the control class. This means that the use of Bayutrago media can help students to improve their mathematical creative thinking abilities compared to the learning process without the help of Bayutrago media. Therefore, it can be concluded that Bayutrago media is effective and can be used as a learning medium. In line with this opinion, according to Wulandari, *et al* (2023) the use of learning media will really help the effectiveness of the learning process and the delivery of messages and content of learning materials. Media is one means of improving learning process activities. Strengthened by Wijers' opinion (Cahyono & Ludwig, 2019) that mobile devices have the potential to integrate effective learning characteristics, such as appropriate realistic learning, motivational power, and teamwork. Therefore, according to Frederik dan Ingo (2022), considering the rapid development of technology in the digital era, teachers need to prepare themselves for the effective use of new technology in teaching mathematics.

CONCLUSION

The resulting interactive multimedia learning based on ethnomathematics with Android is called Bayutrago media. Bayutrago media is to facilitate creative mathematical thinking skills with the main material of transformation geometry for class IX students. The characteristics or features of the Bayutrago media developed in this research include being practical in use, directing students to practice creative thinking, and providing variety in learning.

Ethnomathematics-based interactive learning multimedia products with Android applications were developed following the ADDIE model development stages. The ethnomathematics-based interactive learning

multimedia product with an Android application has gone through the validity and practicality testing stage, the results of which show that the ethnomathematics-based interactive learning multimedia product with an Android application that has been developed meets the criteria of being very valid and very practical so that the ethnomathematics-based interactive learning multimedia with an Android application has good category and suitable for use as learning media.

Effectiveness was obtained by the average result of students who completed the experimental class achieving BTA and classical completion. The average posttest score of the experimental class was more than the control class, the proportion of the experimental class was more than the proportion of the control class, and the maximum N-Gain and minimum N-Gain values of the experimental class were more than the maximum N-Gain and minimum N-Gain values of the control class.

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