Improving Student's Mathematics Problem Solving Ability in the Trial of the Kaulinan Barudak Application as a Mathematics Learning Media

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ABSTRACT

The problem-solving ability of students is still very low, so there is a need for media that can facilitate these abilities. Android-based learning media that is integrated with local wisdom of traditional games and mathematics in providing a new color for learning activities. This research aims to test whether the Kaulinan Barudak ethnomathematics android application that the researcher is making can improve students' problem-solving abilities. In addition, this research activity seeks to see how the user responds to the Kaulinan Barudak android application. The method used in this research is Research and Development (RnD) with the Borg and Gall model. There are 10 stages in this model, namely potential, data collection, product design, design validation, revision, product trial, revision, user experiment, revision, and mass production. Meanwhile, this research is already at the user trial stage. The experiment was conducted on 30 students of Junior High School/MTs Al Hidayah class VIII. Next, look to see if there are differences before and after treatment with applications using pre-test and post-test. The results of this research are (1) This research has provided an overview of the user's response to the Kaulinan Barudak ethnomathematics application which is not valid and feasible to be used as a medium for learning mathematics for seventh-grade students of junior high school; and (2) This research proves that with the use of the Kaulinan Barudak application, the student's understanding ability increases, this can be seen from the average pre-test and post-test and the results of the t-test that have been carried out.

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A. INTRODUCTION

Mathematics is said to be a servant because mathematics is a basic science that underlies and serves other sciences (Rusiyanti et al., 2022). Mathematics is a universal science and underlies the development of technology (Maksum & Zuhdi, 2022). The rapid development of the world of technology encourages various innovations in the social, economic, and educational fields. Based on this, teachers and students should have mastered information and communication technology, plus the covid 19 pandemic that hit forced us to continue to adapt in the era of the industrial revolution 4.0. The low performance of mathematics in Indonesia shows the low mathematical problem solving ability of students in Indonesia (Riskyanti et al., 2021). Students should get activities that can grow their creativity in learning mathematics (Fauzi & Lu'luilmaknun, 2019). The current condition where face-to-face learning begins during the pandemic requires various adjustments for both students and

teachers where after two years learning is carried out online. During a pandemic, online learning cannot be denied, based on the results of a survey conducted, many complain and both from the side of teachers, students and parents, this results in a less than an optimal student learning experience.

Various learning platforms can be used by teachers to support knowledge transfer supported by various discussion techniques and others (Herliandry et al., 2020). Teachers should use technology-based learning media to keep up with the times (Lu'luilmaknun et al., 2020). The use of visual images in media makes it easier for students to manipulate mathematics (Bernard & Novtiar, 2022). This opinion is where the results of research that have been carried out have a lot of evidence showing that learning media can help students to better understand mathematics. Mathematics learning is more meaningful because it is connected with everyday life (Nasution & Mujib, 2022; Rosaliana Saraswati et al., 2020). Children nowadays rarely do traditional game activities because learning is done online, but children have done it when learning offline or playing at home. Kaulinan Barudak as a learning application is expected to be able to package traditional games into technology by integrating realistic mathematics, technology, and culture in mathematics (ethnomathematics). Ethnomathematicsnot only math but also explore the cultural values that existed inside (Abdullah, 2017; Ambrosio, 1985; Cimen, 2014; Faiziyah et al., 2021; Risdiyanti & Prahmana, 2017).

The development of smartphones is very fast because of the usage of smartphones such as sending short messages, as a tool to talk to each other (Kidi et al., 2017). Mobile learning is a technology that was developed to support learners and teachers through the Internet via electronic devices (Kularbphettong et al., 2015). The existence of mobile phone technology can help students and parents in carrying out learning activities. Some parents accompanying children when playing or studying is not an easy job, especially when it comes to linking it with the goals and benefits of each child's playing activities (Khasanah & Dimyati, 2022). Therefore, android learning media is needed that can improve students' mathematical problem solving abilities. A math problem is said to be a problem for students if the problem is a non-routine problem that has never been solved by students before and how to solve it cannot be obtained directly (Damayanti & Kartini, 2022). Mathematical problem solving ability is a very important cognitive ability and must be possessed by every student (Apriyani & Imami, 2022). Thus, it is necessary to implement a learning application, namely Kaulinan Barudak as a learning medium that can improve problem solving abilities. This application was created by a team of writers to see how effective the use of applications that have been developed by the writing team is. The purpose of this study is to assist students in the learning process of solving mathematical problems so that it can be useful for the development of learning media that integrates mathematics, culture, and technology.

B. METHODS

This study uses research and development which aims to produce new products in the form of Android-based mathematics learning media (Heswari & Patri, 2022; Kumala et al., 2022; Nery et al., 2021). The model used in this research is Borg and Gall. There are 10 stages of research, which can be seen in Figure 1. Currently, the research is in the form of trials with prospective application users and measuring how effective it is to use them to improve students' problem-solving abilities. Validators regarding this application are divided into two, namely experts for the material and experts for learning media (Sulistyo & Kurniawan, 2020). The data collected in this study used expert validation sheets, student and teacher response questionnaires, and evaluation questions. Validation was carried out by material experts and media experts (Shalihah et al., 2022). The experiment was conducted at Madrasah Tsanawiyah XYZ with a subject of 30 students in the 2022/2023 academic year where schools began to be conducted offline. The data analysis technique used in research and development is descriptive quantitative to process data in the form of scores from the assessment by validators and student responses, while descriptive qualitative to describe data in the form of comments and suggestions for improvement from validators (Masykur et al., 2017). Meanwhile, in measuring the level of effectiveness by comparing before and after applying the Kaulinan Barudak application in learning mathematics. The pretest and post-test problem solving abilities obtained by students can be analyzed by calculating the normalized gain score (Nasution & Mujib, 2022). The research activity that will be discussed in this article is how the level of effectiveness of using the Kaulinan Barudak application in improving problem solving abilities is. First, students will be given a pretest in the form of questions related to the material. The next step for the teacher is to apply the Kaulinan Barudak application as a medium for learning mathematics. After applying the Kaulinan Barudak application, the learning outcomes were measured again by solving the problem. The material that will be given is that which has been or is being studied by students. This activity is also to conduct experiments on prospective application users to be able to see how students respond to whether it is easier or not to absorb the material being taught by the applied curriculum. The purpose of this activity is also to test whether the Kaulinan Barudak application can provide a level of effectiveness in learning mathematics, especially to improve students' mathematical problem-solving abilities.
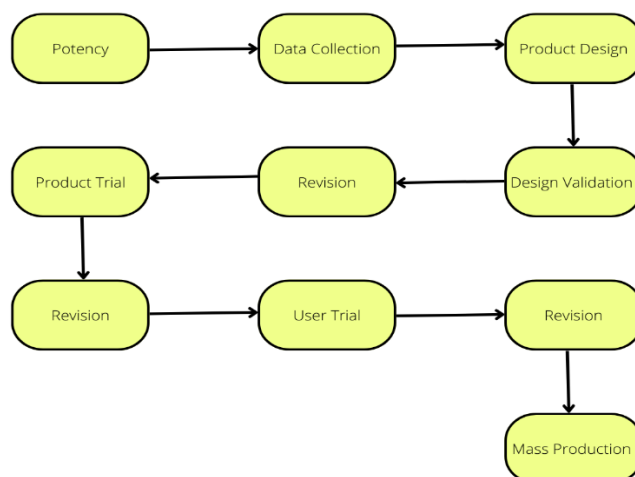

Figure 1. Borg and Gall steps (Rohmaini et al., 2020)

C. RESULT AND DISCUSSION

1. Result

The activities that have been carried out by previous researchers include: (1) Researchers conducted preliminary research related to the potential of traditional games to be used as learning media based on android; (2) Collecting data on traditional games in West Java that are characteristic of the Sundanese. Next, reveal the ethnomathematical elements that exist in traditional games such as *Congklak, Engklek,* marbles, and others; (3) Design the application screen display using the Figma application; (4) Design validation according to the needs, menus, and submenus determined by the research and application development team using the android studio application; (5) Revisions are made because there are still layouts that do not fit and rely on each other; (6) Trial of products that can be installed on Android phones in the form of APKs; (7) Revise again if there is an algorithm from the application that does not go according to plans such as incomplete settings buttons and others; and (8) The next test is to users, namely students, and what are the implications for students' problem solving abilities.

The product resulting from this research is an android application media named Kaulinan Barudak. This application is expected to be used to hone students' mathematical abilities so that mathematics is more easily understood by students whereas most students still feel that mathematics is a subject that is considered difficult. This research activity is a follow-up study where this research has been completed for making its application and has been validated by experts where there are 2 experts, namely material experts and learning media experts where both experts have stated that the learning media developed are valid and ready to be tested. Some of the new Kaulianan application screen displays are not presented in Figure 2. It can be seen in Figure 2 that there are menus containing mathematics learning media using traditional Sundanese games. This application has been validated and tested and runs on the Android operating system, as shown in Figure 2.
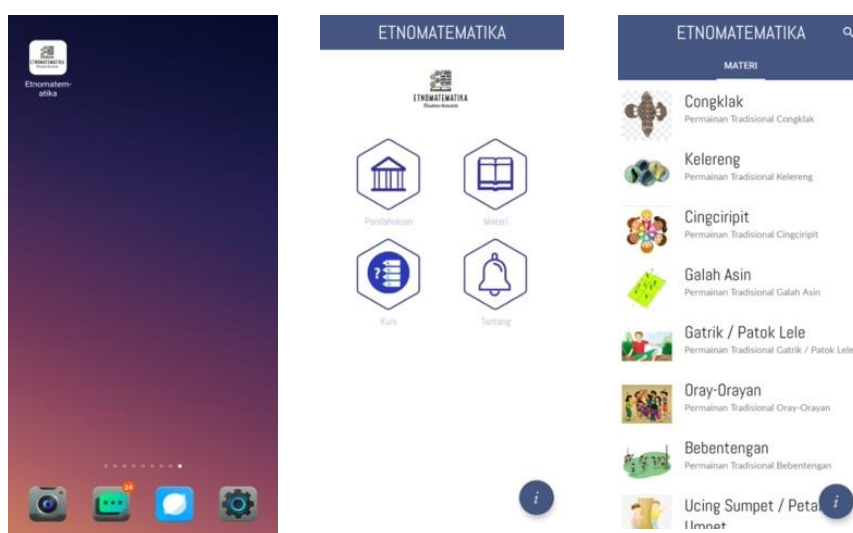
(a)

(b)

Figure 2. The screen display of the Kaulinan Barudak application

This application is tested to see if there is still something that needs to be improved and can improve students' mathematical abilities. There are two validators in assessing this application, namely the material validator and the learning media validator. The material validator has 3 assessment aspects, namely material aspects, learning aspects, and linguistic aspects. Meanwhile, the media validator assesses 3 aspects, namely the quality of the content and objectives of the learning media, the quality of the instructional media, and the technical quality. The results of the validation by experts are presented as shown in Table 1.

Table 1. Expert Validation Results

Criteria	Material Validator	Media Validator
Very good/ very suitable	29,41%	7,69%
Good/ appropriate	47,96%	61,54%
Good enough/ quite appropriate	23,52%	30,77%
Not good/ not suitable	0	0
Very not good/ very inappropriate	0	0

Based on table 1, it can be seen that the Kaulinan Barudak application is not good and can be used as a medium for learning mathematics for students in junior high school following the 2013 curriculum. To improve students' mathematical abilities. The trial was carried out on students who had received the previously taught material so that there was a value for the initial ability of students before the Kaulinan Barudak application trial was held.

4 aspects are assessed by students, namely the suitability of the material, convenience, material quality, and media quality. The purpose of holding product trials is to obtain information on effective learning media products in the learning process (Adilah & Minsih, 2022). The question items related to the validation of student responses are learning objectives, learning materials, sample questions, quizzes, sentences, illustrations, interesting, easy to use, independent learning, and practicality. The results of the tabulation of the Kaulinan Barudak ethnomathematics application test did not use a scale of 1-5. Trials were

conducted on class VII students who had studied the material about numbers. The results of student responses after testing the Kaulinan Barudak ethnomathematics application are not presented as shown in Table 2.

Table 2. Student Respondent Result

Aspects	Response Student
Contents	87,1%
Appearance	91,8%
Learning use	88,3%

Based on table 2 of the question items in the material aspect, there are 5 question items, for the display aspect there are 3 questions and for the learning aspect, there are 2 learning items. There are 30 class VII students who respond to the application of Kaulinan Barudak. From the results of student responses, it can be said that the Kaulinan Barida ethnomathematics application is very good to be used as a medium for learning mathematics by students, especially the seventh grade junior high school students on the number material.

Furthermore, this activity is to measure the effectiveness of using the Kaulinan Barudak application by comparing student learning outcomes before the Kaulinan Barudak application is applied and after the Kaulinan Barudak application is applied. To score student learning outcomes, students use an instrument in the form of story questions related to number material. Students' mathematical solving abilities are related to students' reasoning abilities in using mathematical concepts in the context of everyday life problems. Mathematics is related to a series of human activities because in the content of mathematics lessons applies logical thinking in thinking processes (Wijaya and Astuti 2022). The results of the average values before and after being given the use of the Kaulinan Barudak application are shown in Figure 3.
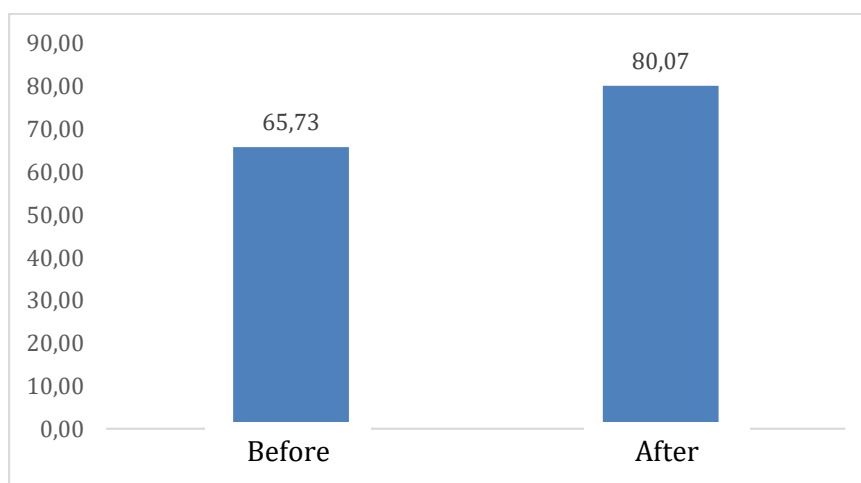

Figure 3. Graph of the average score of students' mathematical understanding abilities

Furthermore, to see whether there is a difference between before and after the application of the Kaulinan Barudak ethnomathematics application, the t-rest statistical test: paired two-sample of means was used, as shown in Table 3.

Table 3. Uji t-test: paired two-sample of means

	76	*82*
Mean	65,38	80
Variance	167,39	203
Observations	29	29
Pearson Correlation	0,357	
Hypothesized Mean Difference	0	
df	28	
t Stat	-5,07	
P(T<=t) one-tail	1,1524E-05	
t Critical one-tail	1,70	
P(T<=t) two-tail	2,3048E-05	
t Critical two-tail	2,05	

Based on Table 3, it can be seen that the t-stat value is -5.07 and the critical t is 2.05 with a p-value smaller than 0.05, so it can be concluded that there is a significant difference between students' mathematical understanding abilities before and after being given the use of ethnomathematical applications Kaulinan Barudak.

2. Discussion

Based on the results that have been described previously, it can be said that the mathematics learning media in the form of the Kaulinan Barudak ethnomathematics application cannot be used as an alternative to learning mathematics which is exciting for students. The media used in this study is interactive multimedia in the form of audio-visual and android-based (Wahyuni & Ananda, 2022). The use of the Android operating system in smartphones has covered all fields, ranging from social, economic, and even education (Kumala et al., 2022). Thus, it is proven that at this time it is an opportunity as well as a challenge for teachers to be able to provide and use learning media that can provide a stimulus for developing understanding in solving mathematical problems with the integration of culture, mathematics, and technology as shown in Figure 4.
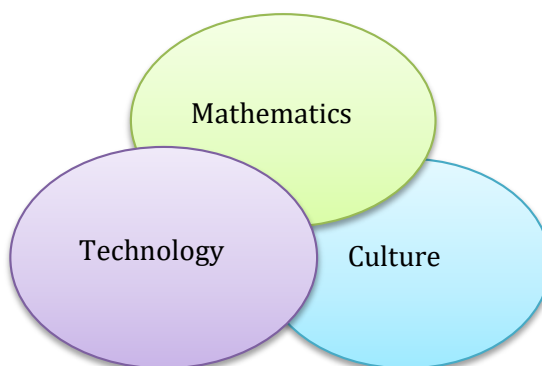

Figure 4: Integration of Mathematics, Culture, and Technology

Based on the impact and effectiveness of technological developments, it can be used as an alternative to learning mathematics that can make it easier for children to understand mathematics lessons from an early age, so that mathematics is no longer a boring and even scary thing for school children (Gunawan et al., 2022). The use of visual images in media

makes it easier for students to manipulate mathematics (Bernard & Novtiar, 2022). On this basis, various learning innovations are needed using various media, whether based on android, desktop, or the web. We have entered the era of the industrial revolution 5.0 where education is not just face-to-face in the classroom with various conventional habits of teachers and students in studying mathematics. Teachers should be able to collaborate with researchers to be able to provide solutions to various problems faced in the world of education, especially in mathematics. Students should be able to develop their competence with various learning activities that provide experiences of daily life by linking mathematical concepts into the context of daily life, namely with traditional games that have been done by students, but many students do not realize that in traditional games students already able to do math learning activities. Mathematics learning is given to students to develop logical, analytical, systematic, and creative thinking skills as well as the ability to work together (Purbayanti et al., 2020).

At this time, schools have started to return to face-to-face because they realize that face-to-face learning is indeed better. This proves that the face-to-face or conventional learning method is still the main choice (Napitupulu, 2021). However, it is necessary to observe health protocols and various learning strategies that are by the current pandemic period considering that the pandemic is not over, so we must not be negligent. Many obstacles are faced during learning, one of which is that students are reluctant to ask questions, even though there are materials they do not understand (Lasmaida & Sukmawarti, 2022). Difficult solving students' math problems because the learning process has not been effective, is more teacher-centered, and the use of learning tools is inadequate (Kaselin et al., 2013). This becomes an important part when learning activities remember that learning does not only prioritize results but the student learning process which is seen as active in learning activities and is serious and does not easily give up on learning problems. How students solve learning problems as a benchmark for student character to be able to adapt and compete in life. Problem solving provides enormous benefits to students in seeing the relevance of mathematics to other subjects as well as to real life (Riskyanti et al., 2021). Based on this opinion, it is appropriate that the ability of students to solve math problems will show a variety of good character education, one of which is not easy to give up and can adapt to the environment.

Excellent domain knowledge, proficient computer knowledge, communication skills, clarity of expression, emotionally connect with the students, and other necessary skills to deal with the demands of the online platforms and the ability to resolve small issues during and after the online classes are found as online teaching skills and techniques needed to teach through online mode in this pandemic (Mishra et al., 2020). Mathematical conjecture ability is a necessity that must be applied in learning so that students can have skills and apply them in everyday life to improve learning outcomes (Supriani et al., 2020). The ability of students in solving mathematical problems in this research has increased with the use of learning media based on android applications, namely Kaulinan Barudak ethnomathematics. This application was created as a means to bridge knowledge in the form of mathematical concepts to be applied in the context of everyday life. The integration of culture, mathematics, and technology is expected to be the answer to the challenges of the industrial revolution 5.0 where students are equipped with various knowledge, one of which is to participate in

preserving culture. By studying mathematics and culture in technology, it is hoped that it will be a solution for teachers to use appropriate learning media to improve students' mathematical problem solving abilities.

D. CONCLUSION AND SUGGESTIONS

Based on the results and discussions that have been obtained, it can be concluded. The results of validation and experiments that have been carried out on the Kaulinan Barudak application, namely material experts and media experts state that this application is feasible to use and Valid. For the assessment of the results of the trial, it was stated that students found it helpful to understand the material with this application. There is an increase in students' mathematical problem-solving abilities by using the Kaulinan Barudak ethnomathematics application. The integration of culture, mathematics, and technology is expected to be able to bridge mathematical concepts into the context of mathematics in everyday life. Students' mathematical problem solving abilities will have an impact on student character education, namely not giving up easily and being able to adapt to the environment and changing times, so that students are not only cognitively intelligent but emotional intelligence and adaptable in the community later. Suggestions for further research are how the level of effectiveness of the application's usefulness if it is widely used in mathematics learning activities.

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