Development of Android Media with Ethnomathematics Nuances to Improve Students' Numeracy Skills

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ABSTRACT

Media is a tool that helps teachers convey messages to students. In this case the message is in the form of material studied. The material presented should be related to students' real lives. One of the things related to student life is culture. Learning mathematics with cultural nuances is called ethnomathematics. Numeracy is a mathematical ability which can be interpreted as a process of translation and solving everyday problems. So ethnomathematics is related to numeracy. In other words, Android media with ethnomathematics nuances can be used as support in carrying out mathematics learning which can improve students' numeracy. This research aims to determine the validity and practicality of the media being developed. This type of research is research and development (R&D) with the ADDIE development model (analyze, design, development, implementation, evaluation). The subjects used in this research were teachers and students of class V at SD Negeri Tonjong 01 Brebes, totaling 64 students. Data collection techniques in this research are questionnaires, interviews, observation, and documentation. The data analysis technique used is quantitative analysis. Quantitative analysis was carried out using descriptive statistics.

The research results show that, (1) the assessment results from the three media validators obtained an average score, including material experts of 3.33, media experts of 3.9 and language experts of 3.69 on very appropriate criteria., (2) The practicality of Android media with ethnomathematics nuances based on teacher responses got an average score of 3.78 on very practical criteria, (3) the practicality of Android media with ethnomathematics nuances based on students' responses got a percentage of 100% on very practical criteria. Based on the data analysis carried out, it can be concluded that Android media with an ethnomathematics nuance in the problem-based learning (PBL) model has proven to be feasible and practical for increasing student numeracy.

Keyword: Android Media, Ethnomathematics, Problem Based Learning (PBL), Numeracy

INTRODUCTION
Success in teaching is not only determined based on the material provider and recipient of the material, but is also determined by an effective learning process. Learning media are tools that can be used to convey messages and stimulate the learning process, so that they can clarify the meaning conveyed to students in acquiring knowledge, skills or attitudes. In this way, learning objectives can be achieved well and perfectly (Kustandi et al, 2011).

Mathematics learning is not only focused on improving students' numeracy skills, but also developing abilities in dealing with daily life problems by applying mathematics (Maulidina, 2019). This ability is called numeracy. Johar (2012) stated that numeracy is a person's ability to formulate, use and interpret mathematics in various contexts,

including reasoning mathematically and using concepts, procedures, facts and mathematical tools to explain and predict phenomena.

Most students and teachers have utilized Android-based mobile device technology to carry out learning. This is in line with Anofrizen & Fadlan's (2015) statement that mobile device technology is developing rapidly, supported by the various operating systems used in them, the Android operating system is one of the most popular among people today. The development of smartphone technology is not only carried out by users as a communication medium, but can also be used as a medium for learning (Bustomi, 2010). Based on this explanation, the provision of Android-based learning media can be used as support in implementing mathematics learning.

Apart from using learning media, it is necessary to use learning methods that are more concrete and closer to students, which link mathematical material to the culture of students' daily lives. Learning mathematics with cultural nuances (Ethnomathematics) is one way that is perceived to be able to make mathematics learning more meaningful and contextual which is closely related to cultural communities. Culture-based mathematics learning will be an interesting, fun and innovative learning alternative because it allows contextual meaning to occur. based on students' experiences as members of a society (Fajriyah, 2018). So, to better understand mathematics learning, a context is needed that links the material to the culture of students' daily lives, one of which is by providing ethnomathematics-oriented learning.

Ethnomathematics as a method of applying ideas, practices and procedures in mathematics by utilizing contexts that are relevant to society. Ethnomathematics learning can help students become enthusiastic about learning because a particular subject is studied from their own culture (Rosa & Orey, 2016). It can also be easier to increase students' understanding of a concept because the subject is closely related to their own habits, which are carried out in the community environment (Mahendra, 2017). Therefore, ethnomathematics-oriented learning through a context that is close to the surrounding culture can generate students' conceptual understanding.

According to students, mathematical material is difficult to understand, one of which is geometric shapes. (Nursyamsiah, 2020) in the results of field research stated that it was found that many students' grades in spatial geometry material were still lacking and had to be improved. Apart from that, (Hernaeny, 2021) in his research found that students' ability to understand concepts in building materials was still very low. So learning geometry is very important for students to understand in learning mathematics.

Based on the explanation above, a method is needed to improve the quality of learning, especially spatial building material which can increase students' understanding. One way is ethnomathematics-oriented learning, which is adapted to the surrounding cultural context.

The spatial geometry that is studied is oriented towards the ethnomathematics of Brebes culture, namely the typical Brebes food, sticky rice pencok. This is because pencok sticky rice resembles (cubes and blocks). Sticky rice pencok can be studied using cube and block geometric shapes because they are related to geometric shapes and are closely related to the cultural environment around students.

The ethnomathematics-oriented spatial geometry material is implied with Android-based learning media, because it looks interesting and easy to understand. Using learning media with an ethnomathematics approach is also effective in learning (Nida, 2017). Meanwhile, Ratnaningsih, (2021) in his research showed that Android-based learning media taught through an ethnomathematics approach provided very good student responses. From the description presented above, the research that the researchers developed was Android-based

learning media on ethnomathematics-oriented spatial material to improve the mathematical numeracy of class V students. This research aims to determine the validity and practicality of Android-based learning media on ethnomathematics-oriented spatial material to improve the numeracy of class V students.

LITERATURE REVIEW
1. Android Learning Media
Android learning media is media that uses the Android operating system. The form of Android learning media is multimedia. According to Novaliendry, et al (2020) multimedia is the integration of various media such as text, numbers, graphics, images, video, animation and sound in a digital environment. The media in this research was made using *Construct 3. Construct 3* is a 2D game maker application that is made in such a way that it is easy to operate. *Contruct 3* runs through a browser and the files can be stored online or offline.

2. Ethnomathematics
Marsigit (2019) states that ethnomathematics is a science that combines mathematics and culture and explores the relationship between the two.

In ethnomathematics, teachers can contextualize mathematics teaching and learning by connecting mathematical content with students' sociocultural experiences. Ethnomathematics is an innovation in mathematics learning which aims to make students love mathematics, be motivated, and increase creativity in doing mathematics (Marsigit & Mauluah, 2019).

3. Numbering
According to Cockroft in Goos (2011), numeracy is the ability to solve practical problems by using numbers. Numeracy ability is the ability to apply the concept of numbers, calculation operation skills and the ability to explain information found around us (Han, et al. (2017). In short, numeracy is referred to as the ability to understand and use mathematics in various contexts with the aim of being able to solve problems and able to explain information to others using mathematics.

MATERIALS & METHODS
In this research and development, there are several stages that must be carried out. The stages of developing Android media with ethnomathematics nuances refer to development research procedures, namely the ADDIE development model developed by Dick and Carry (1996) which consists of five stages which include analysis, design, development, implementation.) and evaluation (Mulyatiningsih, 2019: 200).

The analysis stage is analyzing the need for developing new learning media and analyzing the feasibility and conditions for developing new learning media (Mulyatiningsih. 2019: 200). This analysis aims to collect information in the field to obtain the product to be developed. The analysis was carried out by knowing the state of learning in the fifth grade Mathematics subject at SDN Tonjong 01.

Level*design* namely designing the media being developed is described in the stages of preparing the learning media framework, media content design, and media appearance design.

Level*development*, The product design that has been prepared is developed based on the following stages:

a. Researchers realize the media design that has been created. Next, the product is ready for validation.

b. Create product validation questionnaires for media experts and material experts, questionnaires for teacher and student responses.

c. The validation stage is carried out to obtain assessments, suggestions and input that can be used as a basis for revising and perfecting learning media. The validators consist of 1 lecturer as a material expert, 1 lecturer as a media expert and 1 lecturer as a language expert.

d. Improvements to learning media are based on suggestions for improvements provided by experts (validators). If a

product has been revised and received a good rating, the product will proceed to the next stage, namely the implementation stage

In the implementation stage, products that have been developed and validated by experts will be implemented. Implementation of products that have been developed is carried out in actual conditions. Evaluation of Android Media with Ethnomathematics Nuances is carried out at the product testing stage. First, evaluation by an expert validator. Second, it was carried out in small group implementation by providing a practicality questionnaire. The third is carried out in large groups.

Relating to place, time and research subject. The research locations chosen for this research were at SD Negeri Tonjong 01 and SD Negeri Kutamendala 01. The research time was in the even semester of the 2022/2023 academic year. The research time was chosen in the even semester because the material for building space in class V is in this semester. The research subjects in this study are people involved in obtaining quality learning media. Research subjects are experts, students and teachers. Experts (validators) play a role in assessing the validity of learning media content. The validators are one Mathematics Education lecturer, one Educational Technology lecturer and one Indonesian Language Education lecturer. The selection of experts is based on the expertise possessed by each expert.

The second research subject is students. Students play a role in assessing the practicality of learning media. The students in question are class V students at SD Negeri Kutamendala 01 and SD Negeri Tonjong 01. The third research subject is the teacher. The teacher in question is a class V teacher at SD Negeri Tonjong 01. The teacher's role is to assess the practicality of learning media. Instruments to test the validity of learning media include: material validation sheets, media and language of learning media. The instruments for media practicality are student response questionnaires to media and teacher response questionnaires to learning media. The data collection methods used in this research are documentation, observation, interviews, questionnaires and tests. The data analysis technique used is data description. The data obtained was processed descriptively. Mathematics learning media is said to be of good quality if it meets the criteria of validity and practicality.

RESULT

1. Analysis
a. Observation
The data obtained from the observations made are as follows.
1) Instructional Media
   Teachers have not used learning media.
2) Learning model
   Teachers in learning activities apply lecture methods, question and answer, and giving assignments. The teacher provides a direct explanation of the material, writes the assignments that students must complete on the blackboard. The types of assignments are carried out in accordance with mathematics books so that there is no development by the teacher to hone students' numeracy skills. In the RPP the teacher has included the Problem Based Learning (PBL) learning model, but it is not implemented properly.
3) Students' Numeracy Ability
   Teachers have not familiarized students with activities that sharpen students' numeracy skills. If a student is faced with a mathematical problem that is linked in everyday life, they experience difficulties in solving it. So that students do not develop numeracy skills.
b. Interview
   The following results were obtained from the interview
1) Curriculum
   The curriculum used in class V at SD Negeri Tonjong 01 is the 2013 curriculum, because it is a high class, the separate mathematics subjects are not thematic.
2) Learning model

Teachers in learning activities apply lecture methods, question and answer, and giving assignments. In the 2013 curriculum the PBL model should be used in learning, but teachers have not implemented the PBL model properly, teachers have not implemented numeracy activities, apart from that there is no media used by teachers that supports numeracy activities. So, it requires the development of Android media with ethnomathematics nuances in the PBL model.

3) Learning conditions

Mathematics learning is carried out by lectures, questions and answers, and giving assignments. The level of student enthusiasm increases when learning involves students directly and is linked to students' daily lives.

4) Android Media Development with Ethnomathematics nuances

The development of this media aims to facilitate learning using the PBL model and numeracy activities for mathematics subjects that are not yet available. This media contains ethnomathematics numeration activities which help students understand mathematics so as to train students' numeration skills.

5) Required materials

The material included in making Android media with an ethnomathematics nuance is fifth semester mathematics about third powers and volumes of geometric shapes.

2. Design

The second stage of the ADDIE development model is the design stage. At this stage, researchers begin to design the Android learning media that will be developed. There are 3 steps at this design stage, including selecting and determining software, compiling *Storyboard*, compiling media evaluation instruments and compiling a learning implementation plan (RPP).

3. Development

The third stage of the ADDIE development model is the develop stage. This stage is the production stage in developing products in the form of learning media from design form to actual products according to the storyboard that has been designed. At this stage, a product will be produced in the form of learning media. The first activity carried out at this stage is collecting materials for making learning media, for example: pictures related to the material, music. The images and music for each scan are developed through the application *contruct 3*. All the materials that have been collected are then combined with the help of the application *contruct 3*.

After making the actual product, the next step is to carry out a feasibility or validity test with experts whose aim is to see how appropriate the existing learning media is designed. After receiving a feasibility assessment, the learning media is revised according to the validator's criticism and suggestions. The validator consisted of 3 expert lecturers; the following results were obtained.

Table 1. Expert Validation Data

Expert Validation	Score	Rate-Rata
Material	60	3,33
Media	78	3,9
Language	48	3,69

4. Implementation dan Evaluation

At this stage the activity carried out is implementing media. Media implementation is carried out after being declared suitable by experts to be tested. Some product implementations are as follows:

a. small group trials

This trial was carried out at SD Negeri Kutamendala 01 with a total of 15 students, obtained as follows.

Table 2. Data from Small Group Student Response Results

Aspect	$\sum x$	$\sum X_i$	P(%)
Understanding	30	30	100%
Media Interest	45	45	100%
Learning independence	30	30	100%
Activeness in learning	45	45	100%
Media Presentation	30	30	100%
Media Use	45	45	100%
Overall	225	225	100%

b. Large group trials
This trial was carried out at SD Negeri Tonjong 01 with 32 students and 1 class teacher, obtained as follows.

Table 3. Data from Large Group Teacher Response Results

No.	Aspect	Total score	Maximum score	Rate-rate
1.	Head	28	28	4
2.	Language/Communication	11	12	3,67
3.	Presentation	12	12	4
4.	Interactive learning	9	12	3
5.	Use of media	8	8	4
6.	The whole aspect	68	72	3,78

2) Results of student responses

Table 4. Large Group Student Response Data

Aspect	$\sum x$	$\sum X_i$	P (%)
Understanding	64	64	100%
Media Interest	96	96	100%
Learning independence	64	64	100%
Activeness in learning	96	96	100%
Media Presentation	64	64	100%
Media Use	96	96	100%
Overall	480	480	100%

1) Results of teacher responses

DISCUSSION

This application software with ethnomathematics nuances was developed with the concept of independent exploration to activate thinking skills and make learning more meaningful, so that students are enabled to learn independently using the application. This is in accordance with the development of class V elementary school students aged 10-11 years, at that age, according to Piaget, they are included in the concrete operational stage. Piaget stated that at the concrete operational stage, students will be able to think logically about concrete events and apply objects into different forms (Desmita, 2014: 101). Meanwhile, Buhler's opinion is that class V students are at the fourth stage (Sobur, 2010: 132).

At this stage it is explained that students achieve the highest objectivity. Students have a desire to investigate, try, experiment and explore themselves which is stimulated by great curiosity. So, at the age of class V, students have a strong sense of curiosity, because at this stage students' memory, imagination and thinking functions begin to develop. Thus, applications with ethnomathematics nuances can be used to achieve new understandings for students. As is the case with spatial construction material, some of the basic competencies contained are new knowledge for class V students.

The development of this Android application follows the ADDIE development model (*Analysis, Design, Development, Implementation,* and *Evaluation*). Each stage of development has been carried out according to development needs. At stage *development* namely creating an Android application and validating it by material experts, media experts and language experts. Objective Validation by experts is to obtain input, criticism and suggestions for improvements for the feasibility of the application being developed. Input from experts is used as a reference for improvement. Apart from that, the application was tested on students and teachers to find out responses to the application.

a. Media Validity or Appropriateness
This material expert validation is more focused on the correctness of the concepts presented in Android media. Material experts assess the suitability of the material to those

contained in Android media with KI, KD and indicators that must be met. From this assessment, input, criticism and suggestions for improvement are obtained so that the material displayed does not deviate from the correct concepts and competencies that users must master. This validation is carried out by consulting experts, then an evaluation is obtained from filling out the questionnaire by the expert. Subsequently, revisions were made according to input from experts. The evaluation data from filling out the questionnaire was analyzed to determine the validity of the media in terms of material.

Apart from input from experts, evaluation questionnaire data was also obtained to determine the validity or suitability of the media in terms of the correctness of the material and learning concepts. Based on table 1, it can be seen that Android media has been developed to reach a very feasible category with an average score of 3.33. The results of this assessment are also in line with the results of previous research conducted by Pratami (2018) which showed the results of achieving an average score of 3.62 in the very valid category by material experts. And Zukarnain's (2018) research for validation by material experts obtained an average value of 4.13, so this product can be said to be valid. As well as research conducted by Yuliana (2019) which shows the results of achieving an average score for material experts of 3.48 in the valid and appropriate category without any revisions. So, seen in terms of the truth/accuracy of the material concepts in Android media, Android media is worthy of being tested in the field.

Media expert validation focuses on the appearance or presentation seen from the media's point of view. This validation is carried out by consulting the media with experts, then an evaluation is obtained from filling out the questionnaire by the expert. Subsequently, revisions were made according to input from experts. The evaluation data from filling out the questionnaire is analyzed to determine the validity of the media from a media perspective.

Based on the results of media experts, it is known that the media that has been developed reaches the very feasible category with a score of 3.9. The results of this assessment are also in line with the results of previous research conducted by Yamasari (2010) which showed the results of achieving an average score of 3.08 in the valid category. And Batubara's research (2017) which shows that the results of expert, peer reviewer and elementary school teacher assessment of the product received a score of 434 and a percentage of 86.67%, very good. As well as Septiyani, E. & Apriyanto, M.T. (2019) which shows that the results of formative evaluation from media experts obtained an average score of 3.8 which is included in the "Very Decent" category. So, in terms of the quality of language/communication, presentation, interactive learning and display, it is worthy of being tested in the field.

Linguist validation focuses on language, reading texts, use of sentences in the media. Validation of language experts is carried out by consulting the media with experts, then an evaluation is obtained from filling out the questionnaire by the expert. Subsequently, revisions were made according to input from experts. The evaluation data from filling out the questionnaire was analyzed to determine the validity of the media in terms of language.

Based on the assessment analysis, it can be seen that the media that has been developed reaches the very feasible category with a score of 3.69. The results of this assessment are also in line with the results of previous research conducted by Pratami (2018) showing that the average score by media experts was 3.67, this is in the valid category. So from the communicative aspect, readability, straightforwardness, suitability to the level of development of students, consistency and integration of thought flow is very worthy of being tested in the field.

b. Media Practicality
This trial is to get an idea of the practicality of the learning media used.

The Android media trial on a class teacher as a user obtained results in the form of teacher response questionnaire data. The teacher response questionnaire consists of several aspects, including content aspects, language/communication aspects, presentation aspects, interactive learning aspects and media use aspects. The teacher response questionnaire uses a Likert scale rating, namely 1-4. From this data, each aspect and the teacher's responses were analyzed. Based on table 2, it can be seen that teachers' responses achieved an average score of 3.78. This shows that the use of Android media with ethnomathematics nuances is very well received by educators.

The results of this trial are also in line with the results of previous research conducted by Pratami (2018) which showed that teachers responded very positively with an average score of 3.45 in the very positive category. The teacher believes that the media created with the material presented can help students understand the concepts of learning material through media that is interesting, fun, the material is related to things close to the students, namely in this media typical Brebes food, so apart from being able to understand mathematical concepts, You can also get to know the characteristics of the region.

Apart from that, this is supported by previous research, that ethnomathematics learning as a learning resource is able to increase students' insight into the existence of mathematics in one of the cultural elements they have, is able to increase motivation in learning and facilitates students in connecting with the concepts they are studying. with real situations (Puspadewi & Putra, 2014).

Furthermore, testing Android media on students as Android media users obtained results in the form of student response questionnaire data. The student response questionnaire consists of several aspects including aspects of understanding, aspects of independent learning, aspects of activeness in learning, aspects of media presentation, and aspects of media use. From this data, each aspect and student responses were analyzed. Based on table 3, it can be seen that students' responses achieved a percentage of 100%. This shows that the use of Android media with ethnomathematics nuances is very well received by students. The fulfillment of the practical aspect in this research is in accordance with research conducted by Nida, Buchori, Nida (2017) which resulted in students' responses to ethnomathematics-based interactive learning media achieving very good or practical criteria and suitable for use. Apart from that, research conducted by Rohmah, Sari, Pangasta, & Deddiliawan (2019) produced 90% of student responses with very good criteria for media with ethnomathematics nuances.

The Final Learning Media Product developed in research is an Android application learning media with ethnomathematics nuances on the subject of building space in class V. In the initial display of the media there are several menus including media name, profile button, KD/I button, instructions button, music button, start button, and exit button, as in Figure 1.

The media content display includes the home button, music button, material menu options and quiz menu. The contents display will appear when the button starts to be clicked, as in Figure 2.

CONCLUSION

Based on research and discussion, the following conclusions can be drawn:

1. Android media with ethnomathematics nuances in the Problem Based Learning (PBL) Model for Mathematics produced is suitable for use.

The assessment of the feasibility of Android Media with Ethnomathematics nuances by material experts obtained a total score for all aspects of 60 out of the maximum score that must be achieved, namely 72, the average score was 3.33 so it was in the very feasible category. The assessment by media experts obtained a total score for all aspects of 78 out of the maximum score that must be achieved, namely 80, the average score was 3.9 so it was in the very feasible category. The assessment by linguists obtained a total score obtained from all aspects of 48 out of the maximum score that must be achieved,

namely 52, the average score was 3.69 so it was in the very feasible category.

2. Android media with ethnomathematics nuances in the Problem Based Learning (PBL) Model for Mathematics produced is practical to use according to the teacher's response.

The assessment of the practicality of Android Media with Ethnomathematics nuances based on teacher responses overall received an average score of 3.78 with a total score of 68 out of a maximum score of 72, included in the very good category, so that Android Media with ethnomathematics nuances based on teacher responses is very practical.

3. Android media with ethnomathematics nuances in the Problem Based Learning (PBL) Model for Mathematics produced is practical to use according to student responses.

The assessment of the practicality of Android Media with Ethnomathematics nuances based on student responses overall received a score of 480 out of a maximum score of 480, with a percentage of 100% included in the very good category, so that Android media with ethnomathematics nuances is very practical according to students' responses.

Declaration by Authors

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