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DEVELOPMENT OF LEARNING MEDIA WITH A SCRATCH-BASED ETHNOMATHEMATICAL APPROACH ON REFLECTION MATERIAL

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Abstract:

This study aims to learn how to develop learning media, knowing the validity, practicality, and effectiveness of reflection learning media with a Scratch-based ethnomathematical approach. This research uses research and development methods (Research and Development) with the Borg and Gall model that Sugiono has modified. The data collection techniques used are interviews and questionnaires. The research instruments used are interview guidelines, material and media expert validation sheets, questionnaire sheets, and test sheets (pretest and posttest). The results of this study are (1) Development of web-based scratch application-assisted learning media that students can access anytime and anywhere. (2) The score of the material expert validator is 33, with a percentage of 83%; in this case, the learning media has met the eligibility criteria with no revision. The score of the media expert validator is 58, with a percentage of 66%, meaning that the learning media has met the feasible criteria with partial revision (3). The results of the practicality analysis of 26 with a percentage of 72.2 shows that his learning media meets practical criteria. (4) There is an increase in learning outcomes before and after using scratch learning media from 15% to 77%. The average score of the results of student response analysis is 47, with an average percentage of 79%, so the learning media has met the effective criteria.

Keywords: *RnD, Scratch, Ethnomathematics, Reflection, Learning Media*

INTRODUCTION

Education is a conscious and planned effort to create an atmosphere of learning and learning so that students actively develop their potential to have religious and spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation, and state (Undang-Undang Nomor 20 Tahun 2003 Tentang Sistem Pendidikan Nasional, 2003).

Mathematics is the mother of many existing sciences. But in reality, we often find most students challenging to understand mathematics lessons. Even though mathematics is one of the most essential elements in learning at the elementary and secondary school levels. The use and innovation of facilities, materials, motivation and creativity in learning is essential to improve the quality and enthusiasm of learning, especially to achieve the desired targets in mathematics learning (Luthvia Rohmaini and others, 2020).

The development of a learning process cannot be separated from the culture in society. Culture is a reflection of human thoughts, feelings, wills, and works, either individually or in groups, to improve the lives that have been developed by society (Lupita et al., 2021). According to Nani Nurmaya et al., stated that D' Ambrosio was the originator of the first ethnomathematical concept, "the mathematical practices of

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identifiable cultural groups and may be regarded as the study of mathematical ideas found in any culture" (Nurmaya, 2021). Ethnomathematics itself studies mathematical discoveries that are applied to culture by society. Without realizing it in life, we often encounter the application of mathematical concepts to culture and people's lifestyles.

In this digital era, the development of science and technology (IPTEK) is a challenge for educators in developing learning media to increase the spirit of learning and scientific deepening in students. With the development of science and technology, educators are facilitated in innovation and new creativity in learning through hardware and software that we are familiar with in everyday life. One of the uses of science and technology that educators can use with scratch programming. Scratch is software that students' creativity can use to create stories, games, and other interactive animations (Bakhrun & Rosmansyah, 2015).

Based on the results of interviews with students of grade XI Social Studies 1 Senior High School in Lamongan stated that they found it difficult to understand the transformation material using conventional methods because it was considered too dull and difficult to understand, while in the opinion of the teacher stated that students needed innovative learning media to help easily understand the material. Some students are not willing to learn, and there are still many who experience difficulties in learning both independently and not. This can be seen when researchers collect data in the field. The following are the learning outcomes of XI Social Studies 1 High School students in Lamongan.

Table 1. Student Learning Outcomes on Transformation Material

Value	Predicate	Percentage
90 – 100	Excellent	0
83 – 89	Good	15,4 %
76 – 82	Enough	84,6%
38 – 75	Less	0
0 – 37	Very Lacking	0

From the results that researchers have obtained, there is a need for renewal in the teaching and learning process, one of which is using learning media. This is interesting to study by developing mathematics learning media using scratch programming by not leaving cultural elements inherent in society, for example with the existence of a paduraksa gate that applies the principle of mirroring.

RESEARCH METHODS

The type of research used by researchers is the research and development method (Research and Development). Research and development methods are research methods used to produce a particular product, and test the effectiveness of that product (Sugiyono, 2016). Certain products can be produced for research that needs analysis and to test the product's effectiveness. This research refers to the Borg and Gall model that has been modified by Sugiono, a model of research and development steps that include:

Potential and Problems

The first thing researchers do is to make observations of needs analysis. This observation was made in one of the high schools in Lamongan by conducting interviews with several students and teachers of mathematics subjects. The data obtained will be used to design the required learning media.

Data Collection

After getting the needs analysis results clearly and ultimately, the next stage is to collect reference sources such as interviews, journals, and books that support the development of transformation learning media with a scratch-based ethnomathematical approach.

Product Design

The media product standards to be developed by researchers are by paying attention to the results of the analysis of existing needs in schools and information in the form of concepts and theoretical foundations that strengthen the products developed. The stages carried out are as follows:

1. Determine the topic or subject matter to be developed according to the needs of students
2. Designing scripts to compile transformation learning media with a scratch-based ethnomathematical approach.
3. Preparation of transformation learning media with a scratch-based ethnomathematical approach.

Design Validation

After the initial product is completed, the next stage is to conduct a validation test with a team of material experts and media design experts who aim to produce transformation learning media with a scratch-based ethnomathematical approach that is feasible to use.

Design Improvements

After being validated by experts, the next step is to revise based on expert input on learning media. If the validated media has met the category and does not need to be revised, the learning media is ready to be implemented in the field.

Product Trials

The trial was conducted to determine the transformation of learning media with a scratch-based ethnomathematical approach. At this stage, trials are carried out to determine students' responses and to provide an assessment of the quality of the products developed. The trial was conducted on 5 learners who could represent the target population.

Usage Trial

The usage trial is carried out after successful product stage testing. The trial is the last stage of formative evaluation that must be carried out. At this stage, the media developed or made is close to perfect after going through the first stage. In the field test, samples were taken from class XI IPS 1 samples with the application of learning media to the teaching and learning process. In practice, these learning media must still be assessed for deficiencies or obstacles to be further discussed by conducting practicality and effectiveness tests on the learning media.

Product Revisions

Product revision is carried out if there are shortcomings and weaknesses in using transformation learning media with this scratch-based ethnomathematical approach.

Mass Production

This mass product can be made if the transformation learning media with a scratch-based ethnomathematical approach that has been tested is declared valid, effective, and practical.

There are two types of data in this study, namely qualitative data and quantitative data. Quantitative data in the form of responses and suggestions obtained from validator results and interviews with practitioners. Meanwhile, qualitative data were obtained from the validation result score, score from the questionnaire, and scores from the pretest and posttest test sheets on the reflection subchapter transformation material.

Validity Data Analysis

For learning media validity, data is analyzed to assess whether the media and instruments prepared have met the validity criteria. The weighting of the total assessment value in this validation uses the following formula (Rohmaini et al., 2020).

$$P = \frac{f}{N} \times 100\ \%$$

Description:
P = Percentage Figures from questionnaire data
N = Number of Weights Maximum value
F = Lots of Value Weights gained

The expert validation questionnaire related to graphics, presentation, suitability of content, language completeness of material, systematics of material content, and suitability of transformation learning media with scratch-based ethnomathematical approaches has 4 answer choices according to the content of the question. Each answer choice has a different value weight that explains the level of validation of transformation learning media with a scratch-based ethnomathematical approach. The assessment in validation can be presented in Table 2 (Rohmaini et al., 2020)

Table 2 Expert validation rating scale

Category	Value Weighting
Very Good	4
Good	3
Good enough	2
Bad	1

The results of the weight of the assessment value of each validator, which includes material expert validators and media experts, are then searched for percentages and converted to questions to determine the validity and feasibility of transformation learning media with a scratch-based ethnomathematical approach. The following are the eligibility criteria for percentage analysis presented in Table 3 (Rohmaini et al., 2020).

Table 3. Validation criteria (modified)

Score	Criterion	Information
80% < P ≤ 100%	Very Worth It	No Revision
60% < P ≤ 80%	Proper	Partial Revision
40% < P ≤ 60%	Pretty Decent	Partial Revision & Partial Review of Material
20% < P ≤ 40%	Less Decent	Partial Revision & Review of material
0% < P ≤ 20%	Not Worth It	Total revision

Practical Data Analysis

Practical data on learning media describes the implementation of the learning media. Practicality data were obtained from the results of interviews with practitioners and student responses as follows:

Analysis of Practitioner Interviews

This research data analysis method uses a descriptive method. The practitioner's response to the practicality test in the use of learning media has 4 answer choices according to the content of the question. Each answer choice has a different value weight and means the product's suitability level to the user. The weight of the assessment value of each answer choice can be seen in Table 4 (Rohmaini et al., 2020).

Table 4 Practitioner Response Analysis Scale

Category	Value Weighting
Very Good	4
Good	3
Good enough	2
Bad	1

The results of the weight of the assessment value from the practitioner are then searched for percentage and converted to questions to determine the practicality of transfer motion learning media with a scratch-based ethnomathematical approach. The following criteria for the practicality of percentage analysis are presented in Table 5 (Rohmaini et al., 2020).

Table 5. Practitioner Response Criteria

Score	Criterion
80% < P ≤ 100%	Very Practical
60% < P ≤ 80%	Practical
40% < P ≤ 60%	Quite Practical
20% < P ≤ 40%	Less Practical
0% < P ≤ 20%	Impractical

Student Response Analysis

Student response questionnaires addressed to students on the effectiveness test in the use of learning media have 4 answer choices according to the content of the question. Each answer choice has a different value weight and means the product's suitability level tofor the user. The weight of the assessment value of each answer choice can be seen in Table 6 (Rohmaini et al., 2020).

Table 6. Student Response Analysis Scale

Category	Value Weighting
Very Good	4
Good	3
Good enough	2
Bad	1

The results of the weight of the assessment value from the students' responses were then searched for percentages and converted to questions to determine the practicality of transfer motion learning media with a scratch-based ethnomathematical approach. The following criteria for the practicality of percentage analysis are presented in Table 7 (Rohmaini et al., 2020).

Table 7. Student Response Criteria

Score	Criterion
$80\% < P \leq 100\%$	Very Positive
$60\% < P \leq 80\%$	Positive
$40\% < P \leq 60\%$	Quite Positive
$20\% < P \leq 40\%$	Less Positive
$0\% < P \leq 20\%$	Not Positive

Effectiveness Data Analysis

To measure the effectiveness of learning media can be seen from the analysis of student test scores. Learning media is practical if there are increases in learning outcomes through posttest

The following steps analyze the test results:

1. Recap each student's score
2. Determine the category of student learning completeness based on the Minimum Completeness Criteria (KKM) of SMA in Lamongan, which are as follows:
   a. If a student's score is greater than or equal to 70 (out of a maximum score of 100), then the student is categorized as complete.
   b. If the student's score is less than 75 (out of a maximum score of 100), then the student is incomplete.
3. Counting the number of completed students
4. Determine classical completeness with the following criteria:
   a. If more than or equal to 75% of the total number of students has been completed, it is classically complete.

b. If less than 75% of the total number of students has been completed, it is classically case classified. Comparing the percentage of student completeness between pretest and postest. Iposttestherethean increase in the percentage of student completeness, then learning media is said to be effective.

RESULTS AND DISCUSSION

The development of learning media carried out by researchers uses the steps of the Borg and Gall model that has been modifiSugiono, namely have modified Problems

The results of observing the learning of one of the high schools in Lamongan are quite good. Teachers apply several learning strategies to bring learning to life but still teach direct learning by providing material and practice questions. Meanwhile, the opinion states that students need innovative learning media to understand the material theme. Low Some students are not willing, and many still experience difficulties in learning independently or not.

Data Collection

The initial collection strategy is to find supporting sources in compiling transformation learning media with a scratch-based ethnomathematical approach. The supporting sources in this study are divided into material support sources and supporting sources for making scratch-based learning media.

Product Design

Production consists of an opening screen, menu, sensation, and dis, discussions. The evaluation screen consists of evaluation questions that can display the results of student work and its presentation, and there is a quick calculation where students can directly see the answer to the reflection value of an object.

Design Validation

InTherere two validators in design validati materialial expert: validators and media experts.

Material Expert Validator Results

Validation of learning media by material experts aims to discover opinions regarding the feasibility of material as learning media and the results obtained to be the basis for improving and improving the quality of learning media. Validation is done by submitting a link to access learning media through a form and submitting a validation sheet to a material expert. The validation sheet consists of 10 questions. The following results obtained from expert validators of the material are presented in Table 8.

Table 8. Material Expert Validation Results

Frequency	Score	Presents	Criterion	Description
80% < P ≤ 100%	33	83 %	Very Worth It	No Revision

Based on Table 8, it can be seen that the score of expert validators is 33 w, with a percentage of 83%. In this case, the learning media has met the eligibility criteria by not revising.

Media Expert Validator Results

Validation of learning media by media experts aims todiscovert expert opinions regarding the feasibility of media as learning media and the results obtained to be the basis for improving and improving the quality of learning media. Like material validation, validation is done by submitting a link to access learning media from ch and submitting a validation sheet to the material expert. The validation sheet consists of 3 aspects that are assessed, namely (1) graphic aspects, (2) linguistic aspects, and (3) presentation aspects. The media validation sheet consists of 22 questions. The following results obtained from expert validators of the material are presented in Table 9.

Table 9. Media Expert Validation Results

Frequency	Score	Presents	Criterion	Description
60% < P ≤ 80%	58	66 %	Proper	Partial Revision

Based on Table 9, it can be seen that the score of media expert validators is 58, with a percentage gain of 66%. In this case, the learning media has met the feasible criteria with information that the learning media that has been developed must be partially revised following the input provided by media expert validators in the input column.

Design Revision

Based on the results of media expert validators and material experts, there are several revisions in the accord following the questions of media expert validators, namely (1) font improvements so that (2) changes to the evaluation background (3) there are programming command errors, in the "correct answer.".

Product Trials

Product trials were carried out by taking samples in small groups carried out on grade XI IPS 1 students. The selection of students was carried out with the criteria of one student in the high abi high-abilityy, two students in the medium ability category, and two students in the low ability category. Grouping student categories based on the results of interviews with teachers in the field of mathematics. During the small group trial activity, students simply understood the operation of scratch-based learning media presented by researchers. However, some students find it difficult to operate it using a smartphone. Researchers in trials of this product act as model teachers. From the results of this trial, it can be implied that the reflection learning media with a scratch-based ethnomathematical approach does not need revision to be used in large group trials.

Product Revisions

The flow of product revision in this study was not carried out because, based on the results of product trials with small class samples, it was stated that the transformation learning media with a scratch-based ethnomathematical approach did not need revision to be used in large group trials.

Usage Trial

Trial use is carried out by practicing learning using learning media. In the trial, the use of samples was taken from a large class, namely the entire class XI IPS 1 students of one of the high schools in Lamongan by involving teachers in the field of

mathematics as teachers using learning media provided by researchers. As for the use test, researchers get the following results:

Results of Practical Data Analysis

The following results from practical data analysis are presented in Tables 9 and 10.

Table 9. Results of Practitioner Analysis

Frequency	Score	Presented	Criterion
60% < P ≤ 80%	26	72,2 %	Practical

Table 10. Results of Student Response Analysis

Frequency	Score	Presented	Criterion
60% < P ≤ 80%	47	79,5 %	Positive

Based on Table 9, it can be seen that the score of the results of the practicality analysis from practitioners is 26, with a percentage of 72.2% with practical criteria. In Table 10, the average score of all student responses is 47, and the average percentage of overall student responses is 79.5% with positive criteria so that the media for learning transformation with a scratch-based ethnomathematical approach meets practical criteria.

Results of Effectiveness Data Analysis

The following results obtained from the results of effectiveness data analysis through pretest and postest are presented in Table 11 and Table 12.

Table 11. Pretest Completeness Description

Value Interval	Category	Pretest Frequency	(%)
75 – 100	Complete	2	15
< 75	Incomplete	11	85
Sum		13	100

Table 12. Postest Pretest Completeness Description

Value Interval	Category	Pretest Frequency	(%)
75 – 100	Complete	11	85
< 75	Incomplete	2	15
Sum		13	100

From Table 11 and Table 12, we can know that the completeness of students when doing the pretest questions, were as many as 11 students who were incomplete with a percentage of 85% and only 2 students who completed with a percentage of 15%. When doing the posttest questions 2 students were incomplete with a percentage of 15%, and increased the number of students who completed to as many as 11 with a percentage of 85%. From the presentation of the data above, it can be concluded that there is an increase in the percentage of completeness from the

original only 15% to 85%. These results have met the requirements of the practicality test so that the transformation learning media with a scratch-based ethnomathematical approach meets the effective criteria.

CONCLUSION

Development of transformation learning media with a scratch-based ethnomathematical approach carried out by researchers using the steps of the Borg and Gall model that Sugiono has modified. Product Design, researchers make learning media using the scratch 2.0 application. The learning media contains (1) an opening screen display, (2) a menu list, (3) a material screen, (4) sample questions and discussion (d) an evaluation screen.

Researchers divide two expert validations to validate learning media products: material expert and media expert validation. The results of media expert validation are 66% with feasible criteria, and material expert validation is 83% with very feasible criteria. This result states that the learning media product has met the valid criteria.

Determination of practicality is carried out by researchers on product usage tests by responding to practitioners. The results obtained were 72.2% with the practical category. This result states that the learning media product has met the Practical criteria.

Determination of effectiveness was carried out by researchers on product usage tests in two ways: (1) learning devices were declared effective based on test sheet results (pretest and posttest with student completeness of 85% (2) student responses were declared effective with the results of 79.5% of students stating positive. This result states that the learning media product has met the effective criteria.

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