



The Development of The Student Worksheets Based on Ethno Mathematics of Gordang Sambilan Musical Instrument on Conic Section Material of Class XI SMA Primbana Medan

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Abstract. This study discusses the development of student worksheets based on the ethno mathematics of Gordang Sambilan musical instrument on the conic section material of class XI SMA Primbana Medan. This research is a development research that aims to determine the process of the development of the student worksheets based on the ethno mathematics of Gordang Sambilan musical instrument on the conic section material of class XI SMA Primbana Medan which is valid, practical, and effective. The research and the development model used in this study is the ADDIE model with 5 stages. The stages in the ADDIE model are: 1) Analysis; 2) Design; 3) Development; 4) Implementation; 5) Evaluation. The instrument used to measure the validity of the developed student worksheet was an assessment questionnaire by two mathematics lecturers and one mathematics teacher, to measure the practicality of the instrument student worksheets which is used a student responses questionnaire and to measure the effectiveness of the instrument student worksheets which is used a test of student learning outcomes after using student worksheets. The averages validity result for student worksheets is 4.36, which means that the developed student worksheets fulfill the valid criteria. The practicality based on the student responses questionnaires obtained an average score of 4.07, which means that the developed student worksheets fulfill the practical criteria. The effectiveness of the developed student worksheets based on the student learning outcomes test of class XI SMA Primbana Medan, the percentage of the completeness of the student learning outcomes test is 83.333% which means it is very effective.

Keyword: Ethno mathematics, ADDIE, Student Worksheets

***Abstrak.** Penelitian ini membahas tentang pengembangan lembar kerja peserta didik berbasis etnomatematika alat musik Gordang Sambilan pada materi irisan kerucut kelas XI SMA Primbana Medan. Penelitian ini merupakan penelitian pengembangan yang bertujuan untuk mengetahui proses pengembangan lembar kerja peserta didik berbasis*

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etnomatematika alat musik Gordang Sambilan pada materi irisan kerucut kelas XI SMA Primbana Medan yang valid, praktis dan efektif. Model penelitian dan pengembangan yang digunakan pada penelitian ini adalah model ADDIE dengan 5 tahapan. Tahapan pada model ADDIE yaitu: 1) Analisa (analysis); 2) Perancangan (design); 3) Pengembangan (development); 4) Implementasi (implementation); 5) Evaluasi (evaluation). Instrumen yang digunakan untuk mengukur kevalidan lembar kerja peserta didik yang dikembangkan adalah angket penilaian oleh dua dosen matematika dan satu guru matematika, untuk mengukur kepraktisan lembar kerja peserta didik instrumen yang digunakan adalah angket respon peserta didik dan untuk mengukur keefektifan lembar kerja peserta didik instrumen yang digunakan adalah tes hasil belajar peserta didik setelah menggunakan lembar kerja peserta didik. Hasil rata-rata validitas untuk lembar kerja peserta didik yaitu 4,36 yang berarti lembar kerja peserta didik yang dikembangkan memenuhi kriteria valid. Kepraktisan berdasarkan angket respon peserta didik diperoleh rata-rata skor 4,07 yang berarti lembar kerja peserta didik yang dikembangkan memenuhi kriteria praktis. Keefektifan lembar kerja peserta didik yang dikembangkan berdasarkan tes hasil belajar peserta didik kelas XI SMA Primbana Medan persentase ketuntasan tes hasil belajar peserta didik yaitu 83,333% yang berarti sangat efektif .

Kata Kunci: *Etnomatematika, ADDIE, Lembar Kerja Peserta Didik*

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1 Introduction

The curriculum wants learning in Indonesia to be meaningful learning. The 2013 curriculum demands cultural involvement in learning in schools with the aim that students become human with character and preserve the nation's culture [1]. Thus, the teacher has a very important role in the teaching and learning process. Teachers are required to choose appropriate learning strategies and in accordance with the classroom atmosphere. Teachers must be able to manage the class, one of which is a cultural approach called Ethnomathematics. Ethnomathematics is very important as a means to motivate, stimulate students, can overcome boredom and give new nuances to learning mathematics. Mathematics and culture are a unified and comprehensive unit that applies in society, while mathematics is knowledge that is used by humans in solving everyday problems. [2] in [3] state that culture-based learning is a strategy for creating learning environments and designing learning experiences that integrate culture as part of the learning process. The culture in question is the Mandailing Batak culture. Mandailing is the name of the tribe as well as the region in Mandailing Natal Regency, North Sumatra" [4]. Mandailing culture has customs, heritage or traditions that must be maintained and preserved by the current generation [5]. Some of the Mandailing cultures are the traditional house of Bagas Godang and Sopo Godang [6], Gordang Sambilan musical instrument [7], the Mandailing script writing system, traditional woven cloth, Ulos/Abit Godang, and Markobar Adat Speech [4].

The linkage of cultural and mathematical activities can be done by developing a learning tool that can help students in facilitating the learning of mathematical concepts, to support the achievement of learning objectives, a learning device is needed. One form or type of learning tool that is often used by teachers in teaching in the classroom is the Student Worksheet (LKPD). According to [8] the Student Worksheet (LKPD) does not only contain questions but a collection

of activities in the learning process. So, it can be summarized that the student worksheet is a sheet that contains material, descriptions, work steps, and exercises that must be done by students.

Based on interviews conducted by the author with one of the teachers in the field of mathematics studies, it was stated that students were not much involved in the learning process, and only received information that was conveyed in the direction of the teacher. Thus, students tend to be passive in learning activities, learning is less interesting and still having difficulties in understanding the material. Learning resources used by students only use textbooks provided by the school. The textbook used only contains material, sample questions, and practice questions that are still monotonous. The appearance of the pictures and the color of the package book is less attractive and colorless, the work instructions or workmanship are less clear and difficult for students to understand. In addition, the textbook lacks examples of real applications of mathematics in everyday life, one of which is that the textbook has not been linked to the culture that exists and develops in society. Thus, innovation is needed so that mathematics learning is more fun, meaningful and can increase students' enthusiasm for learning. [9] say that there is a need for an activity that can connect mathematics with culture, which is called Ethnomathematics.

Ethnomathematics is a method used to learn mathematics by involving activities or local culture so that culture-based learning makes learning meaningful, interesting and fun and makes it easier for students to understand the material itself. The development of student worksheets based on ethnomathematics, the author utilizes aspects of the Mandailing Batak culture because the Mandailing Batak culture is an example of a culture that has aspects in everyday life that can be used as illustrations of problems. Taking the Mandailing Batak culture because the Mandailing Batak culture is a culture that lives and develops around the author's environment, so the author is interested in introducing the Mandailing Batak culture to be better known and preserved. The student worksheets produced by the author are designed based on the Batak Mandailing culture. The selected traditional Batak Mandailing musical instrument is Gordang Sambilan because it has various mathematical concepts such as the concept of geometry in the conic section material. The author hopes to teaching and learning activities in the classroom become more meaningful, fun, make it easier for students to understand the material itself, and increase student interest in learning, and students are expected to know, appreciate and take part in preserving the culture. Based on the description above, the problem to be studied in this research is how the process of developing student worksheets based on the ethnomathematics of the Gordang Sambilan musical instrument on the conical section of class XI SMA Primbana Medan is valid, practical, and effective.

2 Literature Review

The method used in this research is research and development of Research and Development (R&D) ADDIE model. Research and Development is a type of research that aims to

produce/develop certain products, and test the quality of these products [10]. The steps of development research in this study are described as follows:

a. Analysis

The analysis stage is the initial stage of planning, namely thinking about the new product to be developed. According to [11] the purpose of this analysis stage is to identify possible causes of the gaps that occur. Stages of analysis carried out are curriculum analysis, work analysis, student analysis, and teacher analysis.

b. Design

At the design stage, the scheme is chosen according to the purpose of developing ethnomathematical-based student worksheets. The results at this stage are in the form of an ethnomathematics-based student worksheet design. At this stage the researcher also designed the validation of the Student Worksheet (LKPD).

c. Development

Development is the process of making a design a reality. The development stage in the development of ethnomathematical-based student worksheets includes several stages, namely: the initial product which is revised by media experts, then the product is revised by material experts, then the product is implemented to students who have been developed, validated by the validator according to their field of expertise. Validation was carried out by 1 (one) mathematics teacher who taught in the class and also 2 (two) mathematics lecturers. then the product is implemented to students who have been developed

d. Implementation

This implementation stage is the stage where the product is tested to find out and collect data on the quality of ethnomathematical-based LKPD to achieve valid, practical and effective mathematics learning objectives. Product trials were conducted to see the feasibility of LKPD as teaching materials in mathematics learning. Trials were also carried out to see student responses to the results of LKPD development products developed through filling out questionnaires.

e. Evaluation (Evaluation)

At this evaluation stage, the authors make improvements to the product if it has not reached the valid, practical, and effective criteria. This improvement was made based on comments/suggestions from the validator. This is so that the resulting product can be used by schools.

The research instrument used is the LKPD validity sheet which includes:

1. Media Expert Validation Sheet

This instrument is used to assess and collect data on the feasibility of the resulting product as a learning medium in terms of the feasibility of construction aspects (accuracy in using language, paying attention to students' abilities, and usefulness) and technical (accuracy in the use of writing, pictures/illustrations, and attractiveness of the layout).

2. Material Expert Validation Sheet

This instrument includes: the suitability of indicators with Core Competencies (KI) and Basic Competencies (KD) which includes aspects of the feasibility of content/material, presentation, and language.

The data analysis techniques used are:

a. Analysis of Student Worksheet Validity

The measurement scale in this study uses a Likert scale. Likert scale is a measurement scale developed by [12]. The Likert scale has four or more questions or statements that are combined to form a score/value that represents individual traits, such as knowledge, attitudes, and behavior. The following is presented in Table 3 scoring guidelines for the results of the assessment using a Likert Scale of 1-5.

Table 1: Scoring Guidelines for LKPD Assessment Results

Criteria	Score
Very Good	5
Good	4
Fair	3
Inadequate	2
Inacceptable	1

Source: Kuntarto in [13]

b. Practical Analysis of Student Worksheets

Practicality data is obtained based on student responses through filling out a practicality questionnaire sheet. This analytical technique is used to measure the level of practicality in using the student worksheets. All data obtained from student responses are then

tabulated and the average score is calculated. The Student Worksheet (LKPD) will be said to be valid if the minimum validity criteria obtained are good. Then, to calculate the mean score of the instrument, the following formula is used:

$$\bar{X} = \frac{\sum X}{n} \quad (1)$$

Table 2: Guidelines for LKPD Practical Criteria

Interval Average Score	Criteria
$\bar{x} > 4,2$	Very Good
$3,4 < \bar{x} \leq 4,2$	Good
$2,6 < \bar{x} \leq 3,4$	Fair
$1,8 < \bar{x} \leq 2,6$	Inadequate
$\bar{x} \leq 1,8$	Inacceptable

Source: Noprinda in [14]

c. Analysis of the Effectiveness of Student Worksheets

The instrument used to analyze the effectiveness of the ethnomathematics-based LKPD is the completeness test of student learning outcomes. The maximum score in this test is 100 with the KKM is 75 and the classical completeness criteria are 75%. The percentage of students' complete learning outcomes can be calculated by the formula:

$$Completeness = \frac{\text{number of students who completed}}{\text{the number of students}} \times 100 \% \quad (2)$$

The effectiveness of the LKPD is obtained from the average completeness value of student learning outcomes which is shown in table 3 Criteria for the effectiveness of the LKPD.

Table 3: LKPD Effectiveness Criteria

Score (%)	Criteria
76 – 100	Very effective
56 – 75	Effective
50 – 55	Less effective
0 – 49	Very Less Effective

Source: Rohaeti in [15]

3 Result and Discussion

1. Research result

The stages of this research use the ADDIE model which consists of 5 stages, namely: (1) Analysis (analysis); (2) Design (design); (3) Develop (development); (4) Implementation (implementation); (5) Evaluation (evaluation).

The results of LKPD development are as follows:

1. Ethnomathematics-Based Student Worksheets

The final product of this development research is a student worksheet based on the ethnomathematics of the Gordang Sambilan musical instrument on the cone slice material as a teaching material for class XI high school students. The ethnomathematics-based worksheets developed are:

**Figure 1:** LKPD developed

2. Research Development Stages

The following are the stages of developing ethnomathematical-based LKPD:

a. Analysis

The analysis phase in this development research includes curriculum analysis, work analysis, student analysis, and teacher analysis.

b. Design

This stage is carried out as the first step in designing solutions to the problems found in the analysis stage. The author compiles the design of the developed student worksheet that presents the ethnomathematical object of the Gordang Sambilan musical instrument on the cone slice material. In addition, the author also compiled an instrument that would be used to assess the learning tools developed, then the instrument was validated by the instrument validator.

c. Development

This stage consists of the stage of product development and assessment. Product development is carried out according to a design that has been made by the author and then revised according to comments and suggestions from expert lecturers and mathematics teachers.

d. Implementation

LKPD that has been developed and declared valid then LKPD can be tested in learning activities. This trial was conducted on students of class XI IPA 1.

e. Evaluation (Evaluation)

The evaluation aims to determine the quality of the product developed based on the results of data collection obtained through the instrument that has been filled in. After seeing the results of the validity, practicality and effectiveness of the LKPD.

The explanation regarding this is as follows:

1) Validity

The LKPD developed was tested for content validity by 2 mathematics lecturers, and 1 mathematics teacher at the school. Lecturers who become validators are Syahlan, S.Pd, M.Pd as media experts, and Dhia Oktariani S.Pd, M.Si as material experts, and a mathematics teacher at the school is Leni Masta Uli Gea, S.Pd as experts Theory. The results of the LKPD validity test obtained an average total validity value of 4.36, according to the three validators, it can be said that the criteria are valid.

2) Practicality

In the research, the LKPD developed was tested for practicality by students using student response questionnaires. There were 18 students who became research respondents. The results of the analysis of the average score of 4.07 showed that in the practical category it was used.

3) Effectiveness

Data on student learning outcomes was obtained through the provision of learning outcomes tests in the form of 3 (three) essay questions to 18 students of class XI IPA-1 SMA Primbana Medan. Based on the results of the students' scores, there were about 15 students who completed 18 students with a KKM score of 75, with a completeness percentage of 83.333%, therefore according to the effectiveness criteria the LKPD developed was in the very effective category.

b. Discussion

Based on the results of the research described in the previous discussion, the validity, practicality, and effectiveness of LKPD can be described as follows:

1. Validity of LKPD

At this stage, the worksheets that have been developed are validated by material experts and media experts. The results of the validation are then analyzed and followed up according to comments and suggestions from material experts, and media experts before being tested in schools. Comments and suggestions aim to improve the products that have been produced. Validation is carried out until the LKPD is finally declared feasible to be implemented in learning activities.

2. Practicality of LKPD

Student worksheets based on the ethnomathematics of the Gordang Sambilan musical instrument that were developed can be seen in practicality from the results of student response questionnaires. Student response questionnaires were distributed at the last meeting. Student responses to the developed LKPD can be calculated using the formula: $\bar{X} = \frac{\sum X}{n}$. The results of the student responses showed that the product was developed practically with the percentage of students stating that they felt happy, interested, interested, understood, clear about the components and learning activities.

3. Effectiveness of LKPD

Data on student learning outcomes was obtained through the provision of learning outcomes tests in the form of 3 (three) essay questions to 18 students of class XI IPA-1

SMA Primbana Medan. Based on the results of the students' scores, there were about 15 students who completed from 18 students with a KKM score of 75.

4 Conclusion

The process of developing student worksheets based on the ethnomathematics of the Gordang Sambilan musical instrument uses the Research and Development (R&D) development of the ADDIE model, including: (1) curriculum analysis, work analysis, student analysis, and teacher analysis. (2) drafting ethnomathematics-based student worksheets. (3) validation of drafts by experts. (4) Revision based on input/suggestion from experts. (5) Product trials to students.

The results of the expert's assessment of the product developed have reached the valid criteria with a score of 4.36. The results of the student questionnaire with an average practicality value of 4.07 which means that the developed LKPD has a very good practicality category, and has reached the effective criteria based on the results of the percentage of students' learning outcomes test completion of 83.333%,

Recommendation

It is hoped that high school teachers will use this LKPD as an alternative in learning the cone slicing material, can develop further to analyze the questions on the conic section material so that students not only understand the concept of circles and ellipses based on the cutting plane of the Gordang Sambilan musical instrument, as well as cultural elements. that exist in the LKPD need to be expanded not only the culture in Mandailing, but the entire culture in Indonesia so that students gain knowledge about the culture that exists in Indonesia in learning.

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