

Development of Student Worksheets by Using the Context of Riau Traditional Houses on Quadrilaterals and Triangles

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ABSTRACT

This study aims to produce teaching materials in the form of student worksheets by using the context of Riau traditional house on the material of quadrilaterals and triangles for class VII of Junior High School. This developmental research uses Plomp model which consists of a preliminary analysis stage, development stage, and assessment stage. The test subjects in this study were seventh grade students of SMP N 2 Kampar Utara which consisted of 18 students and one mathematics teacher. The subjects of this research were seventh grade students of SMP N 2 Kampar Utara which consisted of 18 students and one Mathematics teacher. The result of this study is to produce student worksheets by using Riau traditional house context on valid, practical, and effective quadrilateral and triangle material. It can be seen that based on the results of the validation of content experts, an average of 3.42 was obtained in the very valid category, the results of the validation of linguists and cultural experts obtained an average of 3.25 which was included in the very valid category. The results of the practicality of student worksheets at the One-to-One and Small Group stages are 87.6% which are included in the very practical category, and the results of the practicality of student worksheets by the teacher are 87.5% in the very practical category. Furthermore, based on the results of effectiveness, it was found that student worksheets using the context of the Riau traditional house were very effective and suitable for use in the classroom.

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1. INTRODUCTION

Education is a form of a learning process that seeks students to be active in developing themselves so that they have knowledge that can change educated attitudes and behaviour and increase competitiveness. One of the fields of science that plays important role in the world of education is Mathematics Kamarullah (2017). Mathematics is an exact science that is the basis of all knowledge studied. Mathematics plays an important role in the world of education and technological development Wandari et al. (2018). Mathematics has an important role in everyday life, where almost everything around us is related to mathematics, including community culture Rewatus et al., (2020).

Realizing the importance of the role of mathematics, optimizing student learning outcomes in mathematics at every level of education needs serious attention so that national education goals can be achieved Astuti & Sari (2017).

Mathematics learning is more lively and fun when there is a new innovation in it. One aspect that can be developed for this learning innovation is local culture or also known as local wisdom. Culture or local wisdom as part of Indonesian culture, which is rich in diversity and pluralism, whose existence is currently being questioned Zulfah & Insani (2020). By the influence of culture from outside, slowly they begin to forget their own culture which should be developed. The reality today, many Indonesian people prefer a culture that they consider more interesting or more unique and practical. Many local cultures have faded as a result of the lack of young generations who have an interest in learning and inheriting it Nahak (2019).

One contributing factor is that classroom learning remains predominantly teacher-centered. This occurs partly due to students' limited understanding of the many cultural and practical benefits of mathematics. To address this issue, the teacher's role becomes crucial in the learning process. Educators need to design and provide effective learning media that align well with the lesson content and the students' needs, such as through the use of appropriate teaching materials. Rewatus et al., (2020) state that the ways that teachers can do is developing teaching materials that using an approach in the process of developing teaching materials, which is in accordance with the material to be delivered. One of the teaching materials that can be developed by teachers is student worksheet.

Student worksheet is one of the printed teaching materials that can be used to make it easier for students to understand the material given Astuti (2021). By student worksheets, students can also be guided to rediscover a concept. student worksheets can make it easier for teachers to carry out the learning process Zulfah (2020). Student worksheets not only contain questions but also material, descriptions, and exercises that must be done by students Wandari et al. (2018). The development of student worksheets is very necessary in the world of education. Student worksheets are expected to meet the characteristics of the 2013 curriculum, namely increasing equality between the development of spiritual and social attitudes, curiosity, creativity, cooperation with intellectual and psychomotor abilities.

Student worksheets based on the context of the Riau traditional house are designed by integrating the various forms found in the Riau traditional house into subjects to introduce students to the forms of Riau traditional houses that must be preserved. According to Ayunda & Jelita (2020), the values contained in student worksheets can be a basis for developing a learning process. However, nowadays there are still very few schools that apply learning by using a cultural context, therefore, many students do not know the culture that exists in their area.

Some researches discussed that there is contribution of culture in Mathematic learning. Wandari et al., (2018) state that by incorporating culture into mathematics learning, students can understand mathematics learning in a fun and easy way. Students can find out more about the culture of their own region. In addition, student worksheets based on culture are feasible to use and get a positive response from students and increase student learning outcomes. Disnawati & Nahak (2019) Culture-based student worksheets can improve students' understanding; the developed student worksheets also received positive responses from students where they are more motivated to learn mathematics because there is a cultural element in it. Furthermore, Rewatus et al., (2020) stated that the difficulty for students in connecting mathematics with real life becomes the main factor in the importance of culture-based learning. The development of culture-based student worksheets is appropriate for students to use in the learning process and is expected to increase student activity in learning mathematics. In this case, education and culture are an inseparable unit. Culture-based learning is learning that allows teachers and students to actively participate based on what they already know, so that optimal learning outcomes are obtained. In addition, culture-based learning will certainly provide an introduction and understanding for students about the culture that exists in

the surrounding environment so that it can have a positive influence on the cultivation of the character of students who have a noble culture Ayuningtyas & Setiana (2019).

Based on the results of interviews and observations conducted on April 5th, 2021 at SMP N 2 Kampar Utara to mathematics teachers, there are still many students who do not like learning mathematics because they feel learning mathematics is very difficult and boring. In addition, information was also obtained that students' understanding of mathematical concepts was still low in the quadrilateral and triangle material. This happens because there are no practical and effective teaching materials from the teacher as a guide for students in learning mathematics. The teaching materials used in learning are math textbooks that can only be borrowed from schools in limited quantities. Another problem faced is about working on student worksheets that must be guided by the teacher. Meanwhile, the K13 curriculum has been decided to be a reference in learning, but it is not fully used because it sees the suitability and condition of students. Student worksheets still depend on textbooks in which there are questions that are difficult to do and to understand so that many students do not do the assignments given. During the observation, information was also obtained that there were no student worksheets that were used in a cultural context. Therefore, the student worksheets that were developed by researchers are student worksheets-based Riau cultural context in the quadrilateral and triangle material at class VII SMP. Riau cultural context which was taken and related to the material of the quadrilateral and triangle is the cultural context of the Riau Traditional House.

There are still many students at the junior high school level who do not know the surrounding cultures. To know culture, students get it from cultural arts subjects Astuti, Zulfah, & Rian (2021). The existence of student worksheets with a cultural context is one form of introducing culture. In this study, the culture taken is the cultural context of traditional houses in Riau. The cultural context of Riau Traditional House is taken because the traditional house is one of Riau's cultural identities that must be preserved. In traditional house buildings, there are mathematical concepts that are in accordance with the material of Quadrilateral and Triangle including, Square, Triangle, Trapezoid, Rectangle and others. As for some parts of the shape of the building, namely the shape of the front roof rafters in the form of a triangle and a trapezoid, the shape of the roof on the left and right is in the form of a parallelogram, the door is in the shape of a rectangle, and the windows of a traditional house are in the shape of a square and a rectangle. From the various forms of the traditional house, it can be concluded that Riau Traditional House building can be associated with quadrilateral and triangular materials in mathematic learning.

2. METHODS

This type of research is research and development (Research and Development). According to Sugiyono (2017), research and development methods are research methods used to produce certain products and test the effectiveness of these products. In this study, the development model used was adapted from the model developed by Plomp. The Plomp model consists of three stages, namely the preliminary analysis phase (Preliminary Research), the development or prototype phase (Development or Prototyping Phase), and the assessment phase (Assessment Phase) Plomp & Nieveen (2013). In the prototype development phase (Prototyping Phase), a series of prototypes are developed. The prototype is evaluated with reference to formative evaluation. Formative evaluation has several stages or layers which are illustrated in Figure 1.

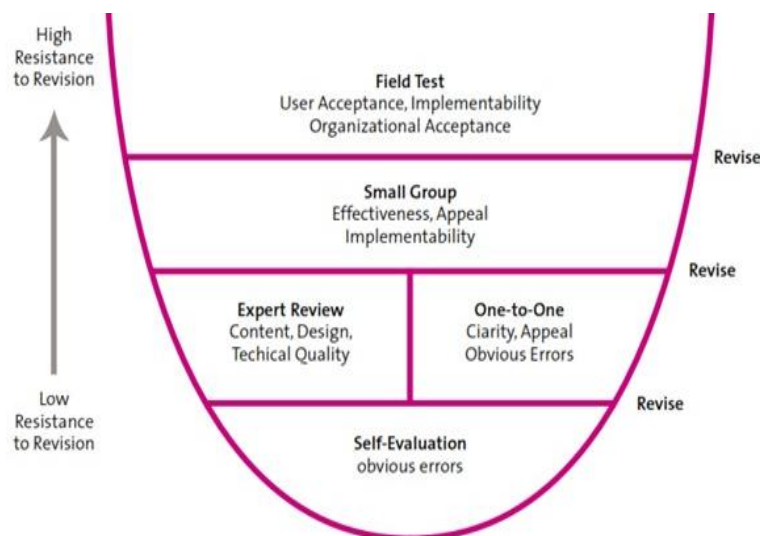


Figure 1. Layers of Formative Evaluation of Plomp (Gravemeijer & Cobb, 2013)

This research was conducted at SMP N 2 Kampar Utara. The time of this research was carried out in the even semester of the 2020/2021 academic year starting from February-June 2021. This research was carried out in class VII SMP N 2 Kampar Utara. The research procedure contains a description of the steps taken in the research. This research procedure consists of three stages, namely the preliminary analysis phase, the development or prototype-making phase, and the assessment phase. The research procedure can be seen in Table 1

Table 1. Procedure of the Research

Phase	Criteria	Description of Activity	Instrument
<i>Preliminary Research</i>	Emphasis on content validity	Needs analysis, curriculum analysis, student analysis, concept analysis and analysis of existing teaching materials	<i>Check list</i>
<i>Development/ Prototyping Phase</i>	Focus on validity and practicality	Evaluation of the prototype in terms of validity, which is carried out through Self-Evaluation and Expert Review. After being revised according to the standard of validity, it is continued with a practical assessment of student worksheets which is carried out through One-to-one Evaluation and Small Group Evaluation.	Validation sheets, questionnaires and interviews.
<i>Assessment Phase</i>	Practicality and effectiveness	Assess whether the product has been practical and effective through the field test stage (Field Test)	Questionnaires, guidelines, interviews, student worksheets

Resource: Zulfah (2020)

The technique of collecting data in this research is by doing observation and distributing questionnaires. The data analysis technique used a qualitative descriptive analysis technique. The results of data analysis are used as the basis for revising the developed product. For assessment guidelines, see Table 2.

Table 2. Student Worksheet Validation Score

No	Option	Score
1	Strongly agree	4
2	Agree	3
3	Don't agree	2
4	Strongly Disagree	1

The score given is one to four for strongly disagree, disagree, agree, and strongly agree. The interval data can be analyzed by calculating the average score based on the answers of the experts. To determine the value of data analysis can be calculated by the following formula:

$$R = \frac{\sum_{i=1}^m \sum_{j=1}^n V_{ij}}{mn}$$

Information:

R = Average assessment results from experts/practitioners

V_{ij} = Score of the jth expert/practitioner scores against the ith criteria

n = Number of experts who judged

m = number of criteria

The criteria for obtaining the level of validity of student worksheets can be seen in Table 3.

Table 3. Criteria for Validity of Student Worksheets

Average Rating	Interpretation
R > 3.20	Very Valid
2.40 < R ≤ 3.20	Valid
1.60 < R ≤ 2.40	Quite Valid
0.80 < R ≤ 1.60	Less Valid
R ≤ 0.80	Invalid

Resources: (Mulyardi dalam (Zulfah, 2020)

The teacher and student response questionnaires are arranged in the form of a Likert scale. This scale is arranged in a positive category so that positive statements get the weight according to what Arikunto stated in Zulfah (2020). For practicality assessment guidelines can be seen in Table 4.

Table 4. Practicality Assessment Score

No	Options	Score
1	Strongly agree	4
2	Agree	3
3	Don't agree	2
4	Strongly Disagree	1

The practicality questionnaire of the student worksheets was described using the data frequency analysis technique with the formula below.

$$P = \frac{R}{SM} \times 100\%$$

Information:

P = Practicality score

R = Score obtained

SM = Maximum Score

(Purwanto, 2012)

The criteria for obtaining practical results can be seen in Table 5.

Table 5. Practical criteria for student worksheets

Achievement Rate (%)	Percentage Range
$85 \leq p \leq 100$	Very Practical
$75 \leq p < 85$	Practical
$60 \leq p < 75$	Practical Enough
$55 \leq p < 65$	Less Practical
$0 \leq p < 55$	Not Practical



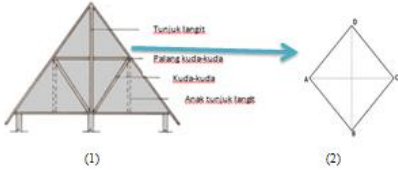
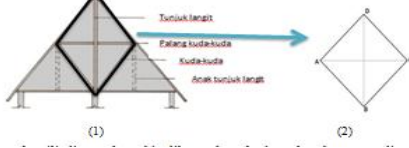


Resource:(Purwanto, 2012)

3. FINDINGS AND DISCUSSION

Before developing student worksheets based on the context of Riau traditional house on the Quadrilateral and Triangle materials for Class VII SMP, a preliminary study or needs analysis was carried out by conducting observations and interviews with several class VII students and Mathematics teachers at SMP Negeri 2 Kampar Utara. The results of the development research on the Quadrilateral and Triangle Materials for Class VII SMP can be seen from the results of the preliminary analysis (Preliminary Research), the results of the development phase (Prototyping Phase), and the results of the assessment phase (Assessment Phase). In the Preliminary Research analysis activities, needs analysis, student analysis, curriculum analysis, and concept analysis were carried out. From this activity, it is concluded that students need a teaching material in the form of student worksheets that can help them in the learning process. Student worksheets are expected to be related to real life and guide students to be able to solve the problems given correctly.

In the development stage (Prototyping Phase), student worksheets by using the context of the Riau traditional house are designed based on core competencies and basic competencies in order to achieve optimal learning objectives. Student worksheets using the context of Riau traditional house which was developed according to the criteria set both in terms of content as well as language and culture. At this stage of development, a self-evaluation stage will be carried out which will produce prototype 1. After conducting self-evaluation and revising the student worksheets, the student worksheet will be validated by an expert (Expert Review). Validation of student worksheets is carried out to determine the feasibility of a product being developed. Validation of student worksheets was carried out by 8 experts consisting of 5 mathematics lecturers and 3 language and culture lecturers. Based on the results of the validation, there are some comments and suggestions from the validator regarding revising the student worksheets, as shown in Table 6 below.

Table 6. Validator's Comments and Suggestions on Student Worksheets based on the Context of Riau Traditional House on the Materials of Quadrilaterals and Triangles

No.	Suggestions	Revision
Content and Graphic Aspects		
1.	Fix the location of the context used on the cover, don't put it at the bottom, place it at the top to make it more visible what context is used.	Revisions were made to the layout of the title on the cover.
		
2.	Make the steps in the image used	Revise the stages of the image used
3.	If using a picture, make a line according to the flat shape used.	Revising the sequence of images by marking them in the form of colored lines to make it more visible what is being presented.
		
Language and Cultural Aspects		
1.	Fix spelling mistakes	Corrected the writing that is still wrong
2.	Pay attention to good and correct spelling	Corrected spelling
3.	Inconsistent typeface and layout	Improvements were made to the typeface and letter layout
4.	Complete the incomplete sentences, for example the sentence in question number one.	Do the addition of the right sentence in question number one and in the other sentences.
	<ul style="list-style-type: none"> Jawablah soal-soal berikut dengan jawaban yang tepat! <p>1) Perhatikan gambar!</p>	<ul style="list-style-type: none"> Jawablah soal-soal berikut dengan jawaban yang tepat! <p>1) Perhatikan gambar di bawah ini!</p>
		

Based on the suggestions above, revisions were made to the student worksheets. After the revision, the validators then gave an assessment of the validity of the student worksheets based on the context of Riau traditional houses.

Characteristics of Student Worksheets by Using the Context of a Valid Riau Traditional House

Student worksheets resulted by using Riau traditional house context have been declared valid based on the content aspect. It is reasonable because it has been designed according to competency standards; therefore the objectives of learning mathematics are increased. In the presentation/graphic aspect based on the validation results by the validator, the student worksheets were valid and accordance with the predetermined graphic aspects. In the next aspect, namely the language and cultural aspects, the students' worksheets were obtained by using the context of the Riau traditional house which was in accordance with the provisions of the linguistic aspect. Through the improvements based on the results of validation with the validator, the student worksheets have been obtained in accordance with the provisions of the Enhanced Spelling and in accordance with the cultural aspects presented. The student worksheets by using the context of the Riau traditional house are in accordance with the rules of writing terms, symbols, and mathematical equations.

Based on the assessment of 8 expert validators, namely 5 content and graphic expert validators and 3 linguistic and cultural expert validators, the results obtained that in general the entire student worksheet by using the context of the Riau traditional house was declared very valid with an average validity of the content aspect of 3.42 with a very valid category. The results of expert validation can be seen in Table 7.

Table 7. Results of Content and Graphic Expert Validation

Aspect	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Score	Value
Content and Graphics	3.45	3.05	3.60	3.40	3.60	17.1	3.42

Based on table 7, it can be seen that the results of the validation of content and graphic experts on student worksheets using the context of the Riau traditional house obtained a value of 3.42 with a very valid category. Furthermore, the results of the validation of linguists and cultural experts can be seen in table 8.

Table 8. Validation Results of Language and Cultural Experts

Aspect	Expert 1	Expert 2	Expert 3	Score	Value
Content and Graphics	3.50	3.25	3.00	9.25	3.25

Based on table 8, it can be seen that the validation results of language and cultural experts, namely 3.25 are included in the very valid category.

Characteristics of Student Worksheets by Using the Practical Context of Riau Traditional Houses

Tests on the practicality of student worksheets using the context of the Riau traditional house were carried out on students consisting of 3 students at the One-to-One Evaluation stage and 6 students at the Small Group Evaluation stage and practicality by one mathematics teacher. Based on the results of the evaluation in the One-to-One stage, the percentage value was 87.5% with a very practical category. The results of the evaluation at the one-to-one stage can be seen in Table 8.

Table 8. The average results of the practicality of student worksheets using the context of the Riau Traditional House by all students in the One-to-One Stage

No	Material	Practicality Percentage
1	Quadrilaterals	88.3%
2	Triangles	86.7%
Average Percentage		87.5%
Category		SP

After conducting the evaluation at the one-to-one stage, then an evaluation was carried out at the small group stage which got a percentage value of 87.6% with a very practical category which can be seen in Table 9.

Table 9. Average Practicality of Student Worksheets Using the Context of Riau Traditional Houses by all Students in the Small Group Stage

No	Material	Practicality Percentage
1	Quadrilaterals	87.3%
2	Triangles	87.8%
Average Percentage		87.6%
Category		SP

After conducting evaluation at one-to-one and small group stages, an evaluation of the mathematics teacher was then carried out. In the results of the questionnaire assessment by the teacher, the percentage results were 87.5% with a very practical category. The results of the evaluation of mathematics teachers can be seen in Table 10.

Table 10. Practical results of student worksheets by Mathematics teachers

No	Statement	Score
1	The display of the cover page of the student worksheet by using the context of Riau traditional house is interesting.	4
2	Each student worksheet title by using the context of Riau traditional house is displayed clearly so that it can describe the contents of the student worksheet.	4
3	The placement of the layout (title, subtitle, text, image, page number) of the student worksheet is consistent according to a certain pattern.	3
4	Student worksheets by using the context of Riau traditional house used easy-to-understand language	4
5	Student worksheets by using the context of Riau traditional house used simple sentences and easy for students to understand	3
6	Instructions for student activities in the student worksheets are clear and can make it easier for students to carry out the activities contained in the student worksheets.	3
7	The presentation of culture on student worksheets is in accordance with the Quadrilateral and Triangle material.	4
8	The material presented in student worksheets by using the context of Riau traditional house is in accordance with the level of students' abilities	4

9	Student worksheets by using the context of Riau traditional house can hone students' mathematical concept understanding skills.	3
10	This student worksheet by using the context of Riau traditional house encourages students to be enthusiastic on learning about the Quadrilateral and Triangle material	3
Final Score		35
Percentage		87.5 %
Category		SP

The student worksheet by using the context of Riau traditional house is stated to be practical without revision with comments and suggestions, which is quite good and easy to understand by students. So, it has been declared practical to use. Based on the results obtained from the small group stage with the practical to very practical category, the student worksheet by using the context of Riau traditional house has been declared practical and feasible to use.

The Effectiveness of Student Worksheets by Using the Context of Riau Traditional Houses

This research has produced an effective student worksheet by using the context of Riau traditional house that can have a positive impact on student learning outcomes in the material of quadrilaterals and triangles for class VII SMP. This product is declared effective if it has reached the field test stage. During the field test, student worksheets were given to a class whose students are in the one-to-one and small group stages. After being given student worksheets and used in the learning process, the next step is to give post-test questions to students, this is done to see if there is an effect from not using student worksheets after using student worksheets. If there is an effect then this student worksheet is declared effective. In this study, student worksheets developed in the context of the Riau traditional house have been declared effective, because the students' pretest and post test scores showed a significant influence on their learning outcomes. The effect of using student worksheets is seen from the results of the Man-Whitney test. Based on the results of the Man-Whitney test, it was obtained that the value of a symp. sig. (2-tailed) was 0.000. In this case, if the value of a symp. sig. (2-tailed) < 0.05 , it can be concluded that the hypothesis is accepted. Thus, it can be said that there is a difference in student learning outcomes between the experimental class that was treated using student worksheets using the context of the Riau traditional house and the control class that was not treated using student worksheets using the context of the Riau traditional house. It was concluded that student worksheets using the context of the Riau traditional house were effectively used to increase students' understanding of mathematical concepts.

Based on the explanation above, the results show that the students worksheet by using the context of Riau traditional house give contribution in teaching and learning mathematic. According to Widyastuti (2021), culture has important role in education. If there is high culture, there is high education. Wiest (2001) states that cultural context can be used for teaching and learning mathematic. Teaching mathematic can be adopted from multiple cultural perspective. Mathematic learning can be required through cultural knowledge. Traditional house as one part of culture has mathematic practice which can be used as the material in teaching and learning process. The student worksheets developed are very helpful for students to understand mathematical concepts so that they can improve student learning outcomes, the results of Talo's research in 2022 that with ethnomathematics-based student worksheets can improve learning outcomes for fourth grade elementary school students Talo et al. (2022).

The use of student worksheets in the context of the Riau traditional house has made a quality mathematics learning, students can focus their attention on student worksheets containing pictures of Riau traditional houses, so that their curiosity arises. Activities like this make students focus on learning so that they can make students understand the material presented. It is supported by

Acharya et al., (2021) who state that there is a positive perspective on cultural relevance of basic level mathematics. Quality mathematics learning must be supported by various aspects, one of which is a professional teacher who can utilize learning resources and develop teaching materials Friansyah & Luthfiana (2018) it is expected for teachers to be able to take advantage of the surrounding environment or culture to be teaching materials in learning mathematics. Mathematics grows and develops according to the local culture Marsigit (2016).

4. CONCLUSION

Research on the development of student worksheets using the context of the Riau traditional house on the quadrilateral and triangle material developed with the Plomp model aims to produce teaching materials in the form of valid, practical, and effective student worksheets. The results of this study indicate that the student worksheets developed are very valid by eight experts as validators, very practical by students and mathematics teachers. The developed student worksheets are also very effective for learning mathematics on quadrilaterals and triangles. By using this student worksheet, students can improve their mathematical concepts. This research only focuses on quadrilateral and triangle material. It is hoped that further research can develop student worksheets with other materials so that many student worksheets are developed to help students understand mathematical material.

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