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## **Ethnomathematical Student Worksheets: Design Traditional Game Engklek Indonesia**

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### **ABSTRACT**

*Indonesia is known for its traditional games, one of the most popular traditional games for children is engklek. Integrating traditional games into mathematics learning such as providing learning activities into student worksheets will be more interesting for students. This research aims to determine the effectiveness of the traditional game to improve learning outcomes in the affective and cognitive domains of students. This research is an R&D research with the ADDIE development model (Analyze, Design, Development, Implementation, and Evaluation), with the subject of 12 junior high school seventh grade students. The data collection techniques used were observation, questionnaire, and test. Data analysis using descriptive statistics averaged and paired sample t-test for hypothesis testing. The result of this research indicates that the final prototype of student worksheets contains two learning activities, that is, the introduction of flat shapes and calculating the area and perimeter of flat shapes. The worksheet fulfilled the criteria of being very valid and the trial results also fulfilled the criteria of being very practical. The character values obtained from the crank game are cooperation, honesty, fair play, high spirits, and patience, while the cognitive is able to improve math learning outcomes.*

**Keywords:** Engklek, Ethnomathematics, Student Worksheet

## INTRODUCTION

Traditional games are a valuable aspect of a society's cultural heritage. They have existed and been played for many years, handed over from generation to generation. These reflect the values, beliefs and cultural identity of a community (Trajkovik et al., 2018). In fact, traditional games have been forgotten or less popular in this technological era caused by several factors, such as first, lifestyle changes, children are more interested in games on gadgets, video games, and other digital activities (Risdiyanti et al., 2019). Second, globalization and the impact of foreign cultures that dominate the entertainment business have also affected the popularity of traditional games (Kawuryan et al., 2018). Third, lack of cultural maintenance, lack of consciousness about traditional games and efforts to preserve and sustain cultural traditions (Trimaryana & Retinofa, 2016). Therefore, it is important to preserve the culture by integrating traditional games such as the game of *engklek*, which is one of the famous traditional games in Indonesia, into the learning process, especially mathematics.

There have been many studies on ethnomathematics of traditional games used in learning recently. Roza (2019) research described on game exploration which led to the usage of these games for various mathematical concepts of Algebra, Geometry, and Statistics to enhance mathematics learning in secondary schools. Based on FGDs with users it can be concluded that this Math Learning Design assists teachers in conveying relevant topics and is recommended for use by secondary school teachers. This research result is in accordance with the research conducted by Toharudin (2021) who developed a learning method using the traditional Sundanese game of *Bebentengan*, the results indicated that the learning method using local wisdom was effective enough to improve student learning outcomes. Meanwhile, Romanvican (2020) research described on the achievement of tolerance attitude in physics learning by using learning media based on traditional game *engklek*. Based on the previous researches, the game of *engklek* in mathematics learning has not been assessed in depth.

There are several objectives of this research, such as (1) to determine the final prototype of the ethnomathematics worksheet based on the traditional game *engklek*; (2) to determine the validity and practicality of the worksheet that has been developed; and (3) to examine the value of attitudes and cognitive abilities achieved in the ethnomathematics worksheet based on the traditional game *engklek*. The results of the research are expected to provide a comprehensive understanding of the traditional game of *engklek* which is implemented in worksheets to be used as a reference for more enjoyable mathematics learning.

This research is based on the argument that Indonesia is known for its wealth of traditional games from various tribes and regions, traditional games often convey moral messages and teach values to the players. It teaches about cooperation, fair play, honesty, patience, and other positive attitudes. All of them assist in the

character and social development of the players. The game of *engklek* is a traditional game that involves players jumping over patterns drawn on the ground using one foot. This game activity will be adapted into an ethnomathematics worksheet.

## LITERATURE REVIEW

### Ethnomathematics

Ethnomathematics is an area that combines ethnography, or the study of culture and society, with mathematics (Fernandes, 2022). The main purpose of ethnomathematics is to examine the relationships between how different cultures around the world use, understand, and develop mathematical concepts (Zaenuri & Dwidayati, 2018). Ethnomathematics acknowledges that mathematics is not only a universally discovered discipline, but is also formed and affected by culture and social context. Different cultures have their own ways of using mathematics in everyday life, such as in trade practices, measurement, or solving other practical problems (Patri, 2021). The study of ethnomathematics includes research on number systems, traditional counting methods, cultural geometry, the use of math in mythology and folklore, and the role of math in art, music and dance. This field also involves research on how mathematical concepts are taught and learned in specific cultural contexts (Zhang, 2021). Ethnomathematics provides valuable insights into the diversity of thinking and understanding mathematics across different cultures in the world. It can also assist in improving mathematics learning in schools by integrating students' cultural contexts into teaching (Munahefi, 2021).

### Student Worksheet

A student worksheet is a document given to students as a tool to conduct learning tasks or activities (Ismail, 2020). Student worksheets contain instructions, questions, or exercises that must be completed by students in order to achieve certain learning objectives. The student worksheets can be questions, multiple choice, fill-in-the-blank, discussion questions, or other formats that are appropriate to the learning material being learned (Munir et al., 2021). Student worksheets are usually prepared by teachers as part of classroom teaching. The purpose is to provide opportunities for students to practice, apply concepts they have learned, develop skills, or deepen their understanding of a topic (Syafina & Suparman, 2019). Student worksheets can also be used as an evaluation tool to determine students' understanding and ability in achieving learning objectives.

### Engklek Game

*Engklek* is one of the most popular traditional games in Indonesia. Engklek game, commonly known as *Sunda Manda*, is believed to have originated from the Dutch term, that is, *Zondag Mandag*. The game used to be very popular among girls in Europe during World War II (Unnisa, 2021). This game is usually played by children with at least two participants (Hariyono et al., 2022; Sari et al., 2019).

*Engklek* requires speed, agility and concentration to play. *Engklek* is played by jumping on a square carved into the ground or placed on a flat surface. The square is divided into several adjacent squares. Players must jump over the squares with predetermined rules (Kamid et al., 2021). In the beginning of the game, players throw a stone into the first box and try to retrieve the stone by jumping over the box with one foot and jumping over the other boxes with the same foot (Sukoyo, 2021). If it succeeds, the player must throw the stone to the second square and so on. When a player manages to pass through all the squares without making a mistake, he/she is entitled to draw certain patterns on the ground or surface used as a playground. After that, the player can return to playing the game with the patterns that have been added on the playing surface (Romanvican et al., 2020).

## RESEARCH METHODOLOGY

This research is a Research and Development, with the ADDIE development method (Analyze, Design, Development, Implementation, and Evaluation). ADDIE is an instructional design system centered on individual learning, has immediate and long-term phases, systematic, and uses a systems approach about knowledge and human learning (Hidayat & Nizar, 2021). The ADDIE learning model is based on an effective and efficient systems approach; and the process is interactive between students, teachers and the environment. The results of evaluating each learning step can lead to the development of learning in the next step (Rosdiana et al., 2023).

**Table 1.** The Development Procedure

The Development Steps	Activities
Analysis Step	1. Need Analysis
	2. Material Analysis
Design Step	Develop initial prototype of ethnomathematics worksheet of <i>engklek</i> game
Development Step	1. Expert Validations
	2. The second prototype of ethnomathematics worksheet of <i>engklek</i>
Implementation Step	Large group trial of seventh grade
Evaluation Step	1. Formative Evaluation
	2. Summative Evaluation

This research was implemented on seventh grade students of SMP Negeri 1 Malangke Barat consisting of 12 students. The data collection techniques of this research, such as (1) observation; (2) validity and practicality questionnaire; (3) learning outcomes test.

**Table 2.** Research Instruments

Instrument	Indicator
Observation Sheet	Affective
Validity Questionnaire	Student Worksheet Format
	Student Worksheet Material Content
Practicality Questionnaire	Effective
	Efficient
	Interesting
	Interactive
	Creative
Learning Outcome Test	Find out the types of plane figures
	Calculating the length and perimeter of plane figures

The data analysis technique used is the average score with the formula such following below:

$$Percentage = \frac{\text{Total of Score Item}}{\text{Total of Maximal Score}} \times 100\%$$

The valid and practical criteria can be reviewed in Table 3.

**Table 3.** Valid and Practical Criteria

Interval Score	Criteria
0-20	Invalid/impractical
21-40	Less valid/less practical
41-60	Quite valid/quite practical
61-80	Valid/practical
81-100	Highly valid/very practical

Data analysis for the learning outcome test is t test with hypothesis such following below:

$$H_0: \mu_1 \leq \mu_2$$

or

$$H_1: \mu_1 > \mu_2$$

Description:

$H_0$  = Students' learning outcomes are not improved after the application of ethnomathematical worksheet of traditional *engklek* game

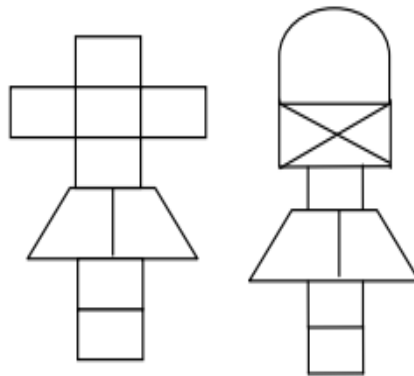
$H_1$  = Student learning outcomes are improved after the application of ethnomathematical worksheets of the traditional *engklek* game.

## RESULT AND DISCUSSION

The results of ethnomathematics worksheet development of traditional *engklek* games are arranged in 2 (two) activities such following below:

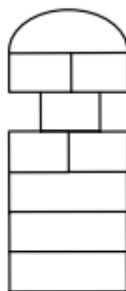
Activity I: Find out the Types of Plane Figures

Preparation: Draw a shape using chalk in the pattern below, then number each the shapes. Each shape has questions about types of plane figures.



Activity II: Calculating the Length and Perimeter of Plane Figures

Preparation: Draw a shape using chalk in the pattern below, then number each the shapes. Each shape has questions about calculating the length and perimeter of plane figures

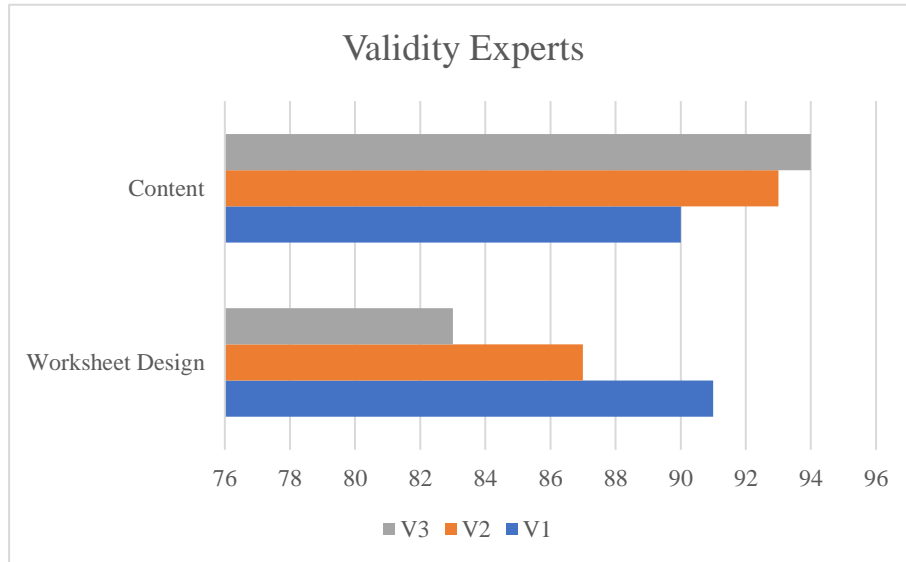


How to play traditional *engklek* games will describe as following below:

1. Students are divided into 2 groups;
2. Students from group representatives throw stones in sequence of numbers. Then the other students take the question and read it to the thrower;
3. Students jump with one foot on the other boxes while answering the questions they get, from the bottom to the top and then back down. then avoid the box with the stone;
4. This continues until all the boxes are hit with stones.

Rules: The players should not fall down or step on the line, if it happens then it must be replaced by another group member. The group that finishes fastest wins.

The ethnomathematics worksheet of the traditional engklek game was then validated by 3 experts. The validation results can be viewed in Figure 1.



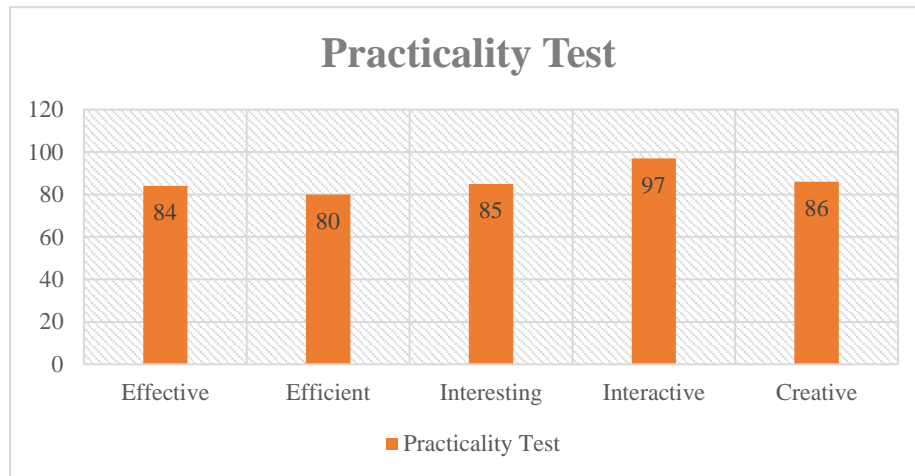
**Figure 1.** The Result of Validity Experts

Based on Table 3, the average validity of material and design experts is 89 with the category of very valid. Furthermore, it was implemented to seventh grade students, the results of activity 1 and 2 observations are presented in Table 4.

**Table 4.** The Observation Result of Character Value

Students Names	Cooperation	Honesty	Fair play	High Spirits	Patience
S1	✓	✓	✓	✓	✓
S2	✓	–	–	✓	✓
S3	✓	–	✓	✓	–
S4	✓	✓	✓	✓	✓
S5	–	✓	✓	✓	–
S6	✓	✓	✓	✓	✓
S7	–	✓	✓	✓	✓
S8	✓	✓	✓	✓	✓
S9	✓	✓	✓	✓	✓
S10	✓	✓	✓	✓	✓
S11	✓	✓	✓	✓	✓
S12	✓	✓	✓	✓	–

Meanwhile, the result of practicality test is presented in Figure 2.



**Figure 2.** The Result of Practicality Test

Based on Table 3, the average practicality test result is 86 with the category of very practical. Furthermore, the hypothesis test results from the learning outcomes test can be found in Table 5.

**Table 5.** Learning Outcomes Test

Paired Samples Test									
Paired Differences							t	df	Sig (2-tailed)
Learning Outcomes		Mean	Std. Deviation	Std Error Mean	95% Confidence Interval of The Difference				
					Lower	Upper			
		Pre-test	23.642	18.67375	4.99077	-34.42476	-	-4.737	13
	Post-test	86	12.8609						

Hypothesis testing using paired sample t test from Table 5. The sig value is  $0.000 < 0.005$ , then  $H_0$  is rejected and  $H_1$  is accepted, which means that the average student's mathematics learning outcomes increase after using the ethnomathematics worksheet of the traditional *engklek* game.

## CONCLUSION

This finding indicates that ethnomathematics is a subject that focuses on the relationship between mathematics and culture. The effort in rebuilding cultural consciousness by integrating it into learning tools, such as student worksheets that apply the *engklek* game into two activities, which are recognizing the types of plane figures, and calculating the length and perimeter of the plane figures. The student worksheets that have been designed have fulfilled the criteria of being very valid and very practical so they are suitable for use. The traditional *engklek* game is part of ethnomathematics not only playing but also has elements of character values in it, such as cooperation, honesty, fair play, high spirits, and patience. Meanwhile, the cognitive also increased students' mathematics learning outcomes. By learning



about cultural perspectives on mathematics, we can broaden our understanding of this discipline and appreciate the diversity of cultures in the world.

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