

# The Effects of Puppet Ethnomathematics Applications as Mathematics Teaching Materials for Character Education-Based

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## ABSTRACT

Character and cultural education has an important role in growing and developing the noble values of a nation. Character education in school can be a means of civilizing and humanizing so that the goals of character education can be achieved. One of the links between culture and character education is ethnomathematics. However, there is still a lack of relevant teaching materials and it is not optimal. Therefore, the implementation of cultural and educational linkages can be developed in a teaching material. The purpose of this research was to determine students' responses to the ethnomathematics of puppet teaching materials as part of the stages of character education-based development. The type of the research is descriptive quantitative. The population of the research is junior high school students in Yogyakarta, Indonesia. The number of samples used were 260 students in which the criteria for 130 students are low learning achievements (Group 1) and the other 130 students are good learning achievements (Group 2). The instruments used in this research were application of ethnomathematical and student response through questionnaires. The results showed that in G1 with the low performance, the material in the application was very easy to learn and very useful. In addition, they are also satisfied with the use of the application. Meanwhile, G2 with good learning achievement feel that the application is very useful, very easy to learn and they are very satisfied with the application. Then based on the results of statistical tests, it was obtained that G1 and G2 showed that differences in learning achievement did not affect student responses to the learning process through Puppet ethnomathematics android application based on character education. All the Puppet characters have religious, disciplined, hard work, passion, and love for the homeland.

**Keywords:** ethnomathematics; teaching materials; character education

## INTRODUCTION

The global outbreak of the COVID-19 pandemic has spread all over the world and caused extreme disruption of panic and drastic changes in education systems around the world (Donnelly & Patrions, 2021; Ritonga et al., 2022). One of the most prominent of these crises is the closure of all education sectors in most countries in the world (Ayasrah et al., 2022). This issue impacts the teaching and learning process as it is unable to be done by face-to-face so relying on technology is one of a way to stay involved in learning (Nayci, 2021). However, not all students have sufficient knowledge, skills, and resources to conduct online learning (Pokhrel & Chhetri, 2021). Therefore, if online learning takes too long, it can cause students experiencing the learning loss (Budi et al., 2021; Maulyda et al., 2021). Learning loss is when educational attainment does not occur at the same level when it compared to the previous years (Pier et al., 2021). The government, principals, and teachers are certainly worried about the learning loss that students may experience due to the Covid-19 pandemic (Zhao, 2021).

Students experience learning loss when learning outcomes fall and there is a degradation of character education. One indication is the changing of eastern cultural values (Cahyaningsih et al., 2020). This makes the value of character education underestimated and the average academic only pursues cognitive, material, and degree values without

balancing with a noble character (Abbad, 2021). The core of the character education movement concerns are the teaching of moral values and virtues (Sivo et al., 2017). In the current millennial era, the influence of character education degradation is increasingly changed and has an impact on the decrease of cultural values. Whereas education is a process of cultural transfiguration that leads to changes in the culture of society and the nation (Marzam et al., 2022). Cultural values play an important role as a set of beliefs that influence individual attitudes and behavior in community life

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(Hindaryatiningsih, 2016). Therefore, if the value of character and cultural education is ignored, it can lead to a decline in the nation's civilization (Suyitno, 2012).

Character and cultural education have an important role in growing and developing the noble values of a nation that have an impact on character building (Wahyuni et al., 2013; Syarif et al., 2016). However, currently the Indonesian nation is still faced with a number of problems, especially those related to the negative character (Julaeha, 2019). This problem has been widely reported in various media and can be said to exceed the reasonable limit (Unayah & Sabarisman, 2015). As we know, on television stations, many problems have been broadcast, such as cheating during exams, drinking, smoking, drugs, promiscuity and free sex, brawls between students, distributing of pornographic videos among students as well as criminal acts and other brutal actions that demand to held the character education in schools (Munjiatun, 2018). Therefore, the application of character education in schools requires the involvement of all components of stakeholders, including curriculum content, learning and assessment processes, quality of relationships, school management, implementation of co-curricular activities, empowerment of infrastructure, financing, and work ethic (Arifin, 2017). Furthermore, efforts to encourage the revitalization movement for student character education require parental and community care (Arthur, 2016).

Character education in schools is expected to be a means of civilizing and humanizing so that the goals of character education can be achieved (Putri, 2011). One thing that can bridge the gap between culture and character education in schools is ethnomathematics (Putri, 2017; Rahmawati & Muchlian, 2019; Wahyuni, 2016). According to D'Ambrosio (1985) ethnomathematics is mathematics that is practiced among identifiable cultural groups such as ethnic groups, labor groups, children of a certain age, professional classes and so on. Ethnomathematics play role as a way of thinking mathematically in a society related to culture and can be integrated into the school curriculum (Lidinillah et al., 2022). Through the application of ethnomathematics, the students aims to be able to understand mathematics, understand culture, and it is easier for educators to embed cultural values which are part of the nation's character (Agustin, 2019; Finariyati et al., 2020; Astuti et al., 2021; Trisnawati & Wijaya, 2021).

According to UNESCO, there are six universal character dimensions, namely trustworthiness, respect, responsibility, fairness, caring, and citizenship (Rubini et al., 2018; Singh, 2019; Rabl et al., 2020; Dweich et al., 2022). Meanwhile, according to Kim et al (2019), character education in schools teaches respect, responsibility, and caring for family and community members. According to the Ministry of National Education (2010) in the 2013 curriculum there are 18 educational values sourced from religion, Pancasila, culture, and national goals, namely honesty, tolerance, discipline, hard work, creative, independent,

democratic, curiosity, national spirit, love for the homeland, appreciate achievement, friendly/communicative, love peace, love to read, care for the environment, care about social, responsibility, and religious to achieve ethnomathematical collaboration and mathematics character education.

In education in schools, the link between ethnomathematics and character education needs to be developed, for example with a teaching material. A good teaching materials must be able to make it easier for teachers to transfer material and knowledge (Imswatama & Lukman, 2018). In the development of teaching materials, it can be implemented through products in the form of print technology, audiovisual technology, computer-based technology or integrated technology (Cahyadi, 2019). During the last decade, many changes have occurred that have encouraged and supported teachers to adopt technology-based educational teaching materials (Iftakhar, 2016). Teaching materials made based on technology have advantages because they are dynamic, fast, and collaborative (Koparan, 2017).

Based on the results of interviews with mathematics teachers at SMP Negeri 2 Godean, Yogyakarta, Indonesia it is known that teachers do not have character education-based teaching materials. Whereas several studies have found that the use of teaching materials can improve student learning outcomes (Kamaludin et al., 2018; Marpaung et al., 2019; Lestari & Parmiti, 2020; Eliyarti et al., 2021; Rozhana & Anwar, 2022). The finding have an impact in improving student character education. The ethnomathematics teaching materials with character education developed by researchers are using punokawan puppet figures and in the form of an Android-based application. This is due to the students owned the mobile device so teachers need to explore these opportunities in combining mobile devices with collaborative learning environments to enhance learning (Heflin et al., 2017). Therefore, the purpose of this research was to determine student responses regarding the use of teaching materials based on ethnomathematical applications in learning mathematics which were examined from 18 character education values in puppet.

## METHOD

The type of research used is descriptive quantitative which aims to determine student responses to the use of wayang ethnomathematics applications in the learning process of character education. The population used is junior high school students in Yogyakarta, Indonesia. The number of samples used was 260 students. Where the criteria for 130 students are good learning achievements (group 1) and the other 130 students are good learning achievements (group 2). The learning media used in this research is the application of wayang ethnomathematics based on character education. The applications used in the research are assisted by the iSpring suite website and web 2 apk. This android-based application is compiled using power



Fig. 1: Application Development Steps

Table 1: Level of Achievement of Student Response Results

Presentage	Qualification Satisfaction	Qualification Material	Qualification Usability
81% - 100%	Very satisfied	Very easy	Very useful
61% - 80%	Satisfied	Easy	Useful
41% - 60%	Quite satisfied	Quite easy	Quite useful
21% - 40%	Not satisfied	Not easy	Useless
0% - 20%	Very dissatisfied	Very not easy	So useless

Based on Table 1, if the group obtains a mini

point which contains, material, ethnomathematics in wayang, character education in wayang, worksheets, and developer profiles. The application prototype developed is as shown in Figure 1 and the application development steps carried out by the researcher, namely (1) making a design in Microsoft Power Point; (2) the use of a web-based learning application, namely iSpring to change the presentation file from power point in the form of flash so that it is more interesting and interactive; (3) the use of web 2 apk to modify the website in the application with the android operating system; (4) Puppet ethnomathematics android application is based on finished character education and can be used in learning.

Furthermore, to obtain data on student responses to the learning process using the puppet ethnomathematics android application, a student response questionnaire was used. The scale used is a Likert scale from 1 to 5, where 1 is very poor, 2 is poor, 3 is adequate, 4 is good, and 5 is very good. Aspects measured by this questionnaire include satisfaction, content, and usefulness. At first, all the data that has been obtained through the usability questionnaire, are combined and then processed using the Microsoft office excel application to determine the overall score and group scores for each aspect measured. Then the results of the questionnaire responses from each aspect were analyzed using the percentage assessment obtained using the following formula.

$$\text{Percentage} = \frac{\text{Total score gain}}{\text{Total maximum score}} \times 100\%$$

Furthermore, to see the level of achievement in general and groups of each aspect assessed by percentage, the criteria for achieving student response questionnaires were determined based on Table 1.

Based on Table 1, if the group obtains a minimum presentation of 61%, then the android-based wayang ethnomathematics application is said to be practical to use, meaning that the application can be used in learning mathematics to stimulate students' character education knowledge.

After knowing the level of achievement of each, the data was then analyzed using the independent sample t-test statistical test assisted by SPSS. However, before the test is carried out, the prerequisites must be met, namely the Shapiro Wilk normality test. If the two data are normally distributed, then the homogeneity test is continued to find out the data comes from the same population. After that, the independent sample-t test was then carried out to determine whether there was an effect of learning achievement on student responses between groups with good and bad learning achievements. The significance level used is 0.05.

## RESULT AND DISCUSSION

Observations were made on students in Yogyakarta, Indonesia. The observation process was carried out by forming two sample groups, each containing 130 students with certain criteria. Group 1 (K1) is a group with criteria for students with poor learning achievement and group 2 (K2) is a group with criteria for students with good learning achievements. The research was carried out in December 2021 for mathematics learning. In practice, schools still use a limited learning system. The total number of students who use this application is 260 students. The process of using the researcher's tablet and cellphone-assisted application is because at the school students are not allowed to bring gadgets from home. Student documentation when using the application is presented in Figure 2.

In the developed application, the puppet characters used are Punokawan, namely Semar, Gareng, Petruk and Bagong. Punakawan comes from the word *pana* which means understanding, and *friend* which means friend. Punakawan is a puppet character created by a Javanese poet. There are six Punakawan people and are placed in two places, namely

Togok and Biling guarding the land opposite and four other figures guarding the land of Java. The four clown figures are Semar and his three children, namely Gareng, Petruk, and Bagong. The Punakawan are presented as a cheerful group with their trademark humors to lighten the mood. Apart from that, Punakawan also has their own character which of course deserves to be explored more deeply. The distinctive characteristic of Punokawan is to describe an unpretentious life because he serves his king, namely the Pandavas in Javanese wayang (Ponimin et al., 2020). The four figures of wayang punokawan are presented in Figure 3.

Table 2 shows that each wayang character has a different character, but all the wayang characters have religious, disciplined, hard work, passion, and love for the homeland. This character education mapping of punokawan figures is included in the ethnomathematics application so that students can learn character education from cultural figures, namely wayang. Meanwhile, according to [Angkauspa \(2014\)](#) the character of Punokawan figures are:".

1. Semar has another name Hyang Ismaya is the caretaker of the Pandavas. Even though he has an ugly human form, Semar's magic is very high and even represents the gods.



Fig. 2: Research Implementation



Fig. 3: Puppet Punokawan figures (Semar, Gareng, Petruk, Bagong)

2. Gareng is the son of Semar which means idol or earned by worshipping. Has another name Nalagareng, a human who is not good at talking, whatever he says sometimes goes awry. However, Gareng is very funny and ridiculous.
3. Bagong means the shadow of Semar. When he first came down to the world, Dewa had told Semar that his shadow would be his friend, namely Bagong. He has a sassy nature and acts stupid but is very funny.
4. Petruk is the son of Semar who is sweet-faced, has a charming smile, is good at talking and is very funny. Petruk often satirizes the untruth with his jokes.

The characters in the punokawan figures are made in an android application that is used by students in learning mathematics. After students are given learning using the ethnomathematics application of wayang which contains character education, then students fill out a response questionnaire that has been made and then analyzed. From the process of analyzing student response questionnaires, the results are shown in Figure 4.

To clarify the presentation of the results of the analysis in Figure 3, the results of the analysis of student responses

are presented in Table 3 based on the presentation and qualifications of each category from the student response questionnaire.

In G1 it is found that the percentage level of usefulness is more than 81%. This means that the use of teaching materials with the help of the puppet ethnomathematics android application in the learning process in groups with poor performance is considered very useful. In addition, they also feel satisfied and easy to learn the material by using the application in the mathematics learning process.

While in G2, it was found that all aspects of content and usefulness were more than 81%. That is, in general, students

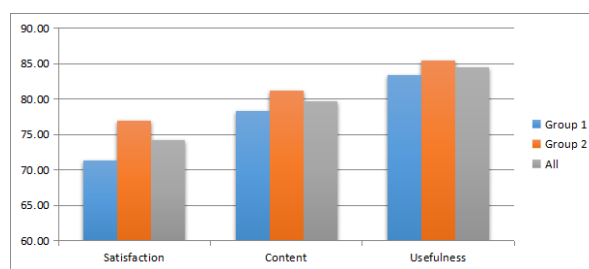


Fig. 4: Graph of Student Response Achievement

Table 2: Mapping Character Education with Punokawan

No	Character Education	Wayang – Punokawan			
		Semar	Gareng	Petruk	Bagong
1	Religious	V	V	V	V
2	Honest	V		V	V
3	Tolerance	V			V
4	Discipline	V	V	V	V
5	Hard work	V	V	V	V
6	Creative				V
7	Independent			V	V
8	Democratic	V		V	
9	Curiosity			V	
10	Spirit of nationality	V	V	V	V
11	Love the motherland	V	V	V	V
12	Appreciating achievement		V		
13	Friendly/ communicative	V		V	V
14	Love peace		V	V	
15	Like to read				
16	Enviromental care	V		V	
17	Social care	V		V	

Table 3. Results of Student Response Analysis

	Satisfaction		Content		Usefulness	
	Percentage	Qualification	Percentage	Qualification	Percentage	Qualification
G1	71,33%	Satisfied	78,29%	Easy	83,33%	Very useful
G2	77,00%	Satisfied	81,14%	Very easy	85,50%	Very useful
All	74,17%	Satisfied	79,72%	Easy	84,42%	Very useful

with good learning achievements give the opinion that the use of the character education-based ethnomathematics android application is very useful in the learning process, the application is very easy to learn. In addition, they are satisfied with the use of the application in the learning process. It can be seen from the data that G2 gives a more positive response than G1 for all aspects. This can provide an assumption that for children with good learning achievements, they are easier to learn the material in using applications during the learning process than children with poor learning achievements. Furthermore, both groups also felt that the application was very useful for learning mathematics, especially for studying character education from wayang figures.

Based on these data, it can also be concluded that overall students are satisfied using the wayang ethnomathematics android application. Plus they also feel that the wayang ethnomathematics android application is easy to use and learn during the learning process. They also feel very satisfied with the use of the puppet ethnomathematics android application in the learning process. Because all aspects of student responses are at a minimum presentation of 61%, the application of android ethnomathematics wayang is said to be practical to use.

In the next section, independent statistical t-test was conducted on G1 and G2 to see the effect of student achievement on responses in each aspect of the questionnaire. However, the analysis prerequisites have been tested previously, namely the normality test and homogeneity test. The results of the normality test using the Shapiro-Wilk test are obtained:

Based on Table 4, it is shown that the Sig value  $> 0.05$  means that all data are said to be normal. Furthermore, the homogeneity test was carried out with the levena statistic test and obtained a value of 0.222 with a Sig value. 0.641. This means the value of sig.  $> 0.05$  so the data is said to be homogeneous. Because the data met the analysis prerequisite test, then the independent sample t-test was continued to determine whether there was an effect of learning achievement on student responses. These results are presented in Table 5.

The results of the independent t-test on all aspects showed a significance level of 0.239 for the satisfaction aspect, 0.442

for the content aspect, and 0.703 for the usefulness aspect. All of these values are greater than 0.05 which means there is no significant difference between the two groups. that is, differences in learning achievement do not affect student responses regarding the level of satisfaction in the use of the application, the ease of the material, and the usefulness of the application. In general, it can be said that evenly, between students who have good and poor learning achievements, give a positive response to the character education-based ethnomathematics application developed by the researcher, curiosity about the material also increases and they feel helped to learn related material. with ethnomathematics and character education.

In addition, they also responded well to the ease of the material presented, the complexity of the material, the existence of practice questions to train them in finding ethnomathematics in wayang and character education, plus material illustrations and case examples related to real life. Students feel that the application of ethnomathematics is easy to learn in its use, students are satisfied with learning to use the application, because it fosters their interest in learning. In a study conducted by Purwoko et al (2019), it was explained that the product of a mathematics learning model that combines the values of mathematics and the culture of Indonesian batik also shows positive student responses and better learning outcomes. This shows that the ethnomathematical basis used in learning model products and learning applications always gets a positive response from students.

## CONCLUSION

This study concludes that the use of teaching materials with the help of the puppet ethnomathematics android application in the learning process in the group with poor achievement (G1) is considered very useful. In addition, they also feel satisfied and easy to learn the material by using the application in the mathematics learning process. Meanwhile, students with good learning achievement (G2) gave the opinion that the use of the character education-based ethnomathematics android application is very useful in the learning process, the application is very easy to learn. In addition, they are satisfied with the use of the application in the learning process. It was also found that G2 gave a more positive response than G1 for all aspects. This can provide an assumption that for children with good learning achievements, they are easier to learn the material in using applications during the learning process than children with poor learning achievements. Furthermore, both groups also felt that the application was very useful for learning mathematics, especially for studying character education from wayang figures. Then based on the results of statistical tests, it was obtained that G1 and G2 did not have a significant average difference on student achievement with student re-

**Table 4:** Normality Test Results

	Sig.	Description
Grup 1	0,055	Normal
Grup 2	0,065	Normal

**Table 5:** Statistical Test Result Data

	P	5% significance level	
		Lower	Upper
Satisfaction	0,239	-3,06390	0,79723
Content	0,442	-3,63234	1,63234
Usefulness	0,703	-2,11754	1,45087

sponses in all aspects. This shows that differences in learning achievement do not affect student responses to the learning process using the character education-based ethnomathematics android application. Of course, the results of this study need to be developed on a larger scale considering the different characteristics of students in Indonesia.

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