RANGE : Jurnal Pendidikan Matematika

Implementation of the Collaborative Character in Learning Basic Concepts of Plane Figures Through the Kweritop Game

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ABSTRACT

This research investigates the impact of the traditional game Kweritop on fostering students' collaborative character while learning the basic geometry concepts of plane figures in junior high schools in Merauke Regency. Utilizing an experimental design, the study compared the effectiveness of collaborative character through the Kweritop game with conventional teaching methods. The findings analyzed using SPSS, reveal a significant improvement in the cooperative character of the experimental group compared to the control group. The Mann-Whitney U test yielded a U value of 260.000 and a Z statistic of -3.938, with a p-value < 0.001, confirming the statistically significant difference between the two groups. These results demonstrate that the Kweritop game effectively enhances student engagement, teamwork, and understanding of geometric concepts. The study's novelty lies in integrating the indigenous Papuan game Kweritop into mathematics education, aligning with local cultural values while advancing cooperative learning strategies. This research underscores the effectiveness of culturally relevant educational tools and contributes to preserving and valuing local traditions in educational practices. These insights offer valuable implications for educators and curriculum developers seeking innovative and culturally responsive approaches to teaching mathematics.

Keywords: Traditional Games, Kweritop, Collaborative Characters, Geometry**.**

Introduction

Understanding mathematical concepts is a crucial element in the mathematics learning process (Sipayung, 2018). Students need to have a deep understanding of basic mathematical concepts to be able to solve problems effectively and apply them in real-life situations (Pauweni et al., 2019). Lack of adequate understanding of these concepts can cause obstacles in solving mathematical problems (Agusta, 2023). Moreover, students who only rely on memorizing formulas without understanding the underlying concepts will have difficulty determining the right formula to use (Nurleha, et al., 2024). Geometry, as a key area in mathematics, plays a crucial role in enhancing students' understanding of mathematical concepts, particularly in the study of plane geometry and spatial geometry (Olsson & Granberg, 2022).

Flat geometry involves flat shapes such as quadrilaterals, triangles, and circles (Nurmeidina, 2019). The initial process that is expected is the student's ability to recognize and identify the characteristics of flat shapes, group them, and differentiate between these shapes. Next, students are expected to be able to

understand more advanced concepts, namely the perimeter and area of flat shapes (Morgan & Sfard, 2016). However, even though this material should have been studied at the elementary school level, in reality, the learning outcomes of students in class VII show a low ability to understand the concept of flat shapes. Based on initial observations, the criteria for student completeness only reached 46%, which shows that less than 50% of students still do not understand this basic concept. Handayani et al. (2021) stated the lack of students' understanding of mathematical concepts is influenced by several factors, such as a learning approach that focuses solely on outcomes, limited student engagement in the learning process, and intrinsic factors within the students themselves.

The lack of student involvement in learning can be overcome by creating a supportive learning environment, which can increase student comfort in the learning process (Herawaty & Widada, n.d.). One effective approach is cooperative learning, which not only strengthens the character of cooperation but also motivates students to be more enthusiastic about learning through collaboration with classmates (Reynaldi et al., 2022). This character-based learning encourages students to work together to find ideas regarding the concept of flat shapes (Mulyana et al., 2018)(Rohmawaty et al., 2022). Apart from that, Wulandari (2020) stated learning is designed to accommodate students' cognitive and affective aspects, and paying attention to students' character as learning objects, is also very important.

In Papua, where students are very close to the surrounding culture and nature, the learning environment needs to be designed taking into account the richness of local culture. The goal of learning is not only to achieve specified competencies but also to preserve a local culture which is increasingly marginalized (Purwanti et al., 2021).

Figure 1. *Kweritop Games*

The traditional game Kweritop, originating from Merauke and Boven Digoel, is one of the local cultural elements that can be integrated into learning. This game involves creating various patterns with ropes on the fingers and can be enjoyed by both children and adults. It serves as a tool to foster cooperation, making it relevant for enhancing the understanding of mathematical concepts, especially plane geometry (Munfarikhatin et al., 2023).

Table 1. Steps of the Kweritop Game for Plane Figures

Steps	Students' Activities
1.	Students are divided into heterogeneous groups, with each group having an equal number of members.
2.	Each group is given 1 (one) piece of genemo string and a worksheet for plane figures (square, rectangle, rhombus, and trapezoid).
3.	Before the game starts, students are instructed to check the string and the provided worksheets.
4.	Students are instructed to quickly form one of the mentioned plane figures, and the group that can form the figure the fastest and correctly earns 1 point.
5.	The rules for the second and subsequent plane figures are the same as for point 4, and the player must be changed for each turn.
6.	The group with the highest score is declared the winner of the game.
7.	Each group must complete the worksheet regarding the elements of the plane figures within the specified time limit.

Several previous studies have shown that the use of traditional games in mathematics learning can help students recognize and understand cultural riches, make learning more interesting, and visualize abstract concepts into more concrete ones. Research conducted by (Munfarikhatin et al., 2020) found that traditional games give students a more real learning experience. Pitoyo et al. (2020) also revealed that the game method is effective in increasing students' understanding of mathematical concepts. Apart from that, traditional games can shape students' social and cultural character and help them understand mathematics more concretely (Wafiqoh et al., 2022). However, research regarding the use of traditional games in Papua is still very limited. Therefore, experimental research involving the Kweritop game as a learning method to measure the character of students' collaboration in understanding the concept of flat shapes needs to be carried out. The goal of this research is to examine students' collaborative character before and after the implementation of learning basic concepts of plane figures using the Kweritop game. It is hoped that this research can contribute to the development of learning methods that are more effective and relevant to local cultural characteristics.

Methods

The quantitative research method utilized collaborative questionnaires, which were designed based on a questionnaire framework and then transformed into specific questions for each item. The instrument used was a cooperative character observation questionnaire, which was piloted on a group of 34 students outside the research subjects, consisting of 16 questions. This pilot study tested the questionnaire's validity and reliability to ensure its feasibility as a research instrument, with analyses including correlation for validity and Cronbach's alpha for reliability. The validated questionnaire was then applied in the main study using a post-test-only control group design, where one group received the intervention, and another served as the control group. The research aimed to evaluate students' cooperative character, focusing on indicators such as collaboration, responsibility, and respect for others' opinions, using specific Likert scale-based questions to measure changes in behavior and teamwork skills. This approach ensured that the instrument was aligned with the research objectives and provided accurate data for assessing the intervention's effectiveness.

Table 2. Post-test only control group design

Group	Treatment	Post Test
Experimental	Traditional game Kweritop	Measured Outcome
Control	Traditional teaching method	Measured Outcome

This research was carried out at a junior high school in Merauke Regency with more than 70% of the students being native Papuans. The sampling criteria in this study used *purposive sampling* or sampling with several considerations, namely that the research subjects were native Papuan students who were already familiar with Kweritop playing techniques, and class VIII was chosen because students had studied the concept of flat shapes at that level. The purpose of implementing this design is to avoid pretest effects because they can influence student behavior or responses. Two groups of students will be compared: the experimental group, which uses the Kweritop game to enhance understanding of flat shape concepts, and the control group, which employs traditional lecture-based or conventional teaching methods. The statistical test applied is *Mann Whitney* with the prerequisite test being the normality test using the Shapiro Wilk test because the data tested is ordinal and the number of samples tested is small. The hypothesis for this normality test is as follows.

H_0 :   The distribution of data in both groups is the same

H_1 :   The distribution of data in both groups is different

The Shapiro-Wilk statistical test uses the following formula.

$$W = \frac{\left(\sum_{i=1}^{n} a_i x_{(i)}\right)^2}{(x_i - \bar{x})^2}$$

Notation Description:

W	:	Shapiro Wilk statistics whose value ranges between 0 and 1. The closer the value is to 1, the closer the data is to normal.
n	:	Sample size or amount of data
x_i	:	Data values that have been sorted (order statistics)
$\bar{x}$	:	Average (mean) of all data

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

a_i	:	Coefficients that depend on the covariance matrix of the normal distribution whose values are calculated based on a special table of the Shapiro-Wilk test

The W value that has been obtained is then compared with the p-value of 0,05 using acceptance criteria if the p-value then accepted it with the decision that the data is normally distributed. Conversely, if the p-value then refuses the decision that the data is not normally distributed. *Mann Whitney Test*

The Mann-Whitney test is needed to prove whether there is a significant difference between the experimental group and the control group because the data tested is in the ordinal data category. In this study, the two data compared were the results of the cooperative character questionnaire between the experimental group and the control group. The Mann-Whitney test formula for the experimental and control groups is as follows.

$$U_1 = n_1 . n_2 + \frac{n_1(n_1 + 1)}{2} - R_1$$

$$U_2 = n_1 . n_2 + \frac{n_2(n_2 + 1)}{2} - R_2$$

Notation Description:

n_1	:	Number of samples in group 1 (experimental)
n_2	:	Number of samples in group 2 (control)
R_1	:	Total ranking for group 1
R_2	:	Total ranking for group 2

Mark U_1 and U_2 complementarity and value U The value chosen is the smallest.

$$U = \min (U_1, U_2)$$

Mark U the selected value is then compared with the critical value U_{crit} based on the Mann-Whitney distribution table for significance levels $\alpha = 0.05$. The p-value is the key to determining whether the difference between the two groups is significant or not. If the value of $p \leq \alpha = 0,05$, then there is a significant difference between the two groups. If the value of $p > \alpha = 0.05$ then there is no significant difference between the two groups.

Instrument Validity and Reliability Test Results

The questionnaire items developed are based on four dimensions, namely active participation, group

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responsibility, communication, and respect for group members. There were 16 questionnaire items developed in this research.

Table 3. Questionnaire to Measure Student Cooperation

Dimensions	Questionnaire Items
A. Active participation	1. I always participate in completing the group assignments given.
	2. I actively provide ideas when discussing flat shapes.
	3. I am excited to participate in every Kweritop game that is played.
	4. I help other group members when they have difficulty with a task.
B. Group responsibility	5. I feel responsible for the results of the group work.
	6. I complete the tasks that are part of my responsibility on time.
	7. I ensure our group assignments are in line with the learning objectives.
	8. I don't rely on friends to complete all group assignments.
C. Communication	9. I listen to my friends' opinions carefully when discussing things.
	10. I give my opinion with polite to group members.
	11. I appreciate suggestions and input from friends in the group.
	12. I don't hesitate to ask if there is something I don't understand regarding plane figures.
D. Respect for group members	13. I appreciate the differences of opinion that arise within the group.
	14. I don't blame my friends when something goes wrong in a group assignment.
	15. I give appreciation to friends who have completed their assignments.
	16. I maintain good relations with all group members during the activity.

Table 4. Pearson Correlation Value for Each Item

Question Items	Mark Correlation	Question Items	Mark Correlation
Q1	0,335	Q9	0,844
Q2	0,447	Q10	0,875
Q3	0,458	Q11	0,916
Q4	0,305	Q12	0,847
Q5	0,377	Q13	0,817
Q6	0,435	Q14	0,435
Q7	0,371	Q15	0,887
Q8	0,383	Q16	0,699

The correlation values in items Q9, Q10, Q11, Q12, Q13, and Q15 have a very strong correlation $(r > 0,8)$ with a total score so that it can be stated that these items contribute greatly to the measurement of the variable. Items Q2, Q3, Q6, and Q14 correlate with the good category $(r > 0,8)$ and it can be stated that the item is valid and can be maintained. Meanwhile, items Q1, Q4, Q5, Q7, Q8, and Q16 correlate with the good category $(0,30 \leq r < 0,04)$ so that these items are still suitable for use. Next, an instrument reliability test was carried out which served to determine the consistency of the student collaboration

questionnaire and ensure whether the instrument could provide stable and consistent results if used on respondents with similar characteristics by looking at the Cronbach Alpha value. The reliability results using Cronbach's Alpha were $0.802 > 0,7$ then, it can be stated that the collaboration questionnaire instrument met the reliability criteria.

Table 5. Cronbach's Alpha value

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.774	.802	16

Results and Discussion

Normality Test Results

Collaborative character questionnaire data that had been implemented to groups of students who applied the Kweritop game and control groups who applied the lecture method learning were tested for normality using the Shapiro-Wilk test because the sample tested was relatively small $(n < 50)$. The results of the normality test for the two data are shown in Tables 4 and 5 below.

Table 6. Experimental Group Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Experiment	Statistic	df	Sig.	Statistic	df	Sig.
	.138	34	.099	.964	34	.327

Sig. value the experimental group was $0.327 > 0.05$, which means that the student collaboration questionnaire data in the experimental class had a normal distribution. Meanwhile, in the control group, the sig value. amounting to $0.465 > 0.05$, which means the data in the control group also has a normal distribution.

Mann Whitney Test Results

Table 7. Control Group Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Control	Statistic	df	Sig.	Statistic	df	Sig.
	.141	34	.084	.970	34	.465

The results of descriptive statistics show that the number of respondents in the experimental and control groups was 68 people. The average score for the data variable was 487.647 with a standard deviation of 295.295, indicating that there was quite a large variation in scores between respondents. The minimum value for this variable is 41.00, while the maximum value reaches 54.00. Meanwhile, the group variable representing the groups (experiment = 1, control = 2) has a mean of 15,000 with a standard deviation of 0.50372, indicating a fairly uniform group distribution. The range of values for this variable is between 1.00 and 2.00, corresponding to the coding of the experimental and control groups.

Table 8. Descriptive Statistics

			Descriptive Statistics		
	N	Mean	Std. Deviation	Minimum	Maximum
Data	68	487.647	295.295	41.00	54.00
Group	68	15.000	.50372	1.00	2.00

Based on the results of the Mann-Whitney test, there were significant differences between the two experimental groups tested. The experimental group had a higher mean rating (43.85) compared to the control which had a mean rating of 25.15, indicating that participants in the experiment were higher in their overall ratings. The calculated U value is 260,000, and the Z statistic is -3.938 with a significance value (p-value) < 0.001 indicating that the difference between these two groups is very statistically significant. Therefore, we can conclude that the distribution of ratings between experiment and control groups is significantly different. So it can be concluded that the cooperative character of the experimental group is better than the control group.

Table 9. Ranks

		Ranks			
	Group	N	Mean Rank	Sum of Ranks	
Data	1.00	34	43.85	1491.00	
	2.00	34	25.15	855.00	
	Total	68			
	a Grouping Variable: Group				

The results of the Mann-Whitney test analysis indicated that the Kweritop game applied to the experimental group had a more effective influence on the students' collaborative character compared to the control group. The findings of this research highlight the significant impact of the Kweritop game on enhancing students' collaborative character, as evidenced by the results of the Mann-Whitney test. The experimental group that engaged with the Kweritop game demonstrated a more effective improvement in collaborative behaviors compared to the control group, as shown by the significantly different ranking distributions.

Table 10. Test Statistics

Test Statistics	
	Data
Mann-Whitney U	260.000
Wilcoxon W	855.000
WITH	-3.938
Asymp. Sig. (2-tailed)	<.001
a Grouping Variable: Group	

This outcome underscores the success of the intervention in fostering teamwork, responsibility, and mutual respect among students. These results align with previous studies, such as Jusmiana et al. (2020), which found that the use of audio-visual media during online mathematics learning significantly improved student learning outcomes, with the experimental group achieving a higher average post-test score (75.71) compared to the control group (65.60). Similarly, Lestari et al. (2021) showed that the Project-Based Learning (PJBL) model effectively enhanced students' creative thinking abilities, as reflected in the superior performance of the experimental group. This finding is also supported by research using manipulative media. Anawati (2020) revealed that students who used manipulative media had higher creative thinking abilities than students who used conventional PowerPoint-based learning. The average value of the experimental group (76,21) was higher than the control (68,00), and the results of statistical tests showed that there were significant differences between groups. Overall, these results confirm that innovative and interaction-based approaches can make a significant contribution to student learning outcomes and abilities.

This study has important implications for educators and curriculum designers, particularly in regions implementing innovative curriculum approaches like Kurikulum Merdeka. Incorporating interactive and collaborative activities, such as the Kweritop game, can significantly enhance students' social and teamwork skills, which are essential for 21st-century learning. These results suggest that traditional teaching methods might benefit from integrating more experiential and engaging strategies to promote active learning and collaboration.

This research contributes to the growing body of literature emphasizing the importance of innovative teaching tools in character education. It offers empirical evidence supporting the effectiveness of games and interactive methods in fostering collaboration among students. Additionally, it provides a practical framework for educators to implement similar interventions, particularly in culturally diverse or resource-limited educational contexts, thereby advancing both theoretical understanding and practical applications of collaborative learning models.

Conclusion

This study demonstrates that incorporating the traditional game Kweritop in mathematics instruction positively influences students' collaborative skills in grasping the concept of plane figures. The questionnaire instrument used in the study was found to be both valid and reliable, with a Cronbach's Alpha score that met the required reliability standards. Statistical analysis using the Mann-Whitney test revealed a significant difference between the experimental group, which used the Kweritop game, and the control group, which employed the traditional lecture method. The experimental group exhibited higher cooperation levels, suggesting that traditional games can enhance student engagement and collaboration in mathematics learning.

These findings align with prior research indicating that game-based, interaction-oriented approaches can boost both learning outcomes and social skills. Therefore, this research contributes significantly to the development of more effective teaching methods, particularly in culturally rich regions like Papua. Future studies could examine the application of similar approaches in other contexts to assess their impact on students' understanding of mathematical concepts and their social skills.

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