Mathematical process skills and cooperation character of elementary school students on simple flat building materials

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Abstract

This research was conducted to look at differences in mathematical process skills and the cooperative character of students and the influence between process skills and the character of cooperation. This research was conducted using mixed methods. The instruments in this study were interview sheets and questionnaires to determine process skills and the character of cooperation. Quantitative data was analyzed using the statistical analysis software application and qualitative data using Miles and Huberman. The sample used was 40 students with 20 students in each class. From the results obtained, there is no significant difference between students' mathematical processing skills. It was also found that there was an influence between the nature of collaboration and students' processing abilities. It can be concluded that there is an influence of process skills on the character of student cooperation.

Keywords: Building; building material; mathematics; process skills; simple flat

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1. Introduction

Mathematics is one of the sciences that is universal or can be said to influence all aspects of life. Mathematics learning is taught at the lowest level to the highest level including the elementary school level (Ernawati et al., 2021; Kurniawan et al., 2022; Kurniawan et al., 2021; Karakolidis et al., 2021). Learning mathematics in elementary schools is a tool and means for students to achieve competency (Evi & Indarini, 2021; Utami & Puspaningtyas, 2021; Wiryanto, 2020;). The achievement of this competence is a prerequisite for students to learn mathematics at the next level (Kamid et al., 2021; Leniati & Indarini, 2021; Rudyanto et al., 2019). At the elementary school level, students will be taught basic concepts and materials that help students hone their math processing skills (Anitra, 2021; Fauzi et al., 2020; Ruli & Indarini, 2022; Dumas et al., 2019).

Process skills can be interpreted as the character of students in carrying out the process of thinking and reasoning activities (Suárez-Pellicioni et al. 2019). Process skills are one of the efforts to obtain optimal student success (Firdaus, 2018; Tyera et al., 2022; Ulya & Rahayu, 2021). In learning mathematics, process skills will make it easier for students to solve the problems they face (Ernawati et al., 2022; Mulyati & Evendi, 2020; Septaria et al., 2019). Process skills are also the basis for students to develop a scientific attitude towards themselves (Kamid et al., 2021; Syapal et al., 2022; Yantoro et al., 2022). Through the process skills approach, it is hoped that students will be scientific in understanding a problem (Vogel & De Smedt 2021).

As with process skills, the character of working together with students is no less important in learning mathematics. One of the goals of mathematics subjects in elementary school education is for students to have the character to work together (Azizah & Mashar, 2021; Ernawati et al., 2022; Melinda & Zainil, 2020; Rozgonjuk et al., 2020). Collaborative character can develop students so they can know, and carry out collaborative activities for common goals (Parhusip & Hardini, 2020; Warsini, 2020; Yantoro et al., 2021). Therefore, educators must be able to build the character of cooperation in students so that students gain success in school.

In learning mathematics, process skills must be owned by students. If students do not have process skills, this will hurt learning. Students who do not have a process character will fail to observe, classify, interpret, predict, implement, plan, and communicate a problem (Anggriani et al., 2019; Royani et al., 2018; Suwandari et al., 2018). Students who do not have process skills will also result in not forming a basis for applying the scientific method (Candra & Hidayati, 2020; Nurjanah, Cahyana, & Nurjanah, 2021; Wiratman et al., 2021).

The character of cooperation is no less important than the character of the learner's process. Collaborative character is expected to be owned by all students and applied in everyday life. Learning mathematics has a function as a means to develop the character of working together (Suprihatiningsih et al., 2020). The character of gotong royong is one of the educational characteristics that is interpreted as helping each other, working together, and solidarity (Kholis, 2022; Muhajir, 2022; Rosala & Budiman, 2020). So that learning mathematics can improve the character of cooperation because students can help each other in doing assignments.

1.1. Purpose of study

Based on what has been said, this study aims to find out the differences in the character of process skills and the character of student cooperation. This research aims to find out the effect of process skills and the character of student cooperation.

2. Materials and Method

In this research method mixed methods. The mixed method used is a concurrent mixed method. The concurrent mixed method is a combination of quantitative and qualitative methods that are carried out simultaneously or at the same time (Little et al., 2002). Quantitative data is used for main data

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and qualitative data is used for supporting data. This mixed method was chosen because it was considered appropriate to this research, which aims to see the character of the process skills and the character of student cooperation and to see the effect of process skills and the character of student collaboration.

2.1. Participants

The population in this study were 60 students at MIN 4 Batanghari and MIN 2 Batanghari, with a sample of 40 students with details of 20 at MIN 2 and 20 at MIN 4 Batanghari. The technique used is purposive sampling, which is taking samples by selecting certain categories based on the research objectives (Noviati et al., 2019). The researcher chose this technique because it was considered appropriate for this study. After all, the criteria used by the researcher were fourth-grade students who had studied simple flat shapes.

2.2. Data collection tool

The instruments in this study were interview sheets and questionnaires to determine process skills and the character of cooperation. The Process Skills questionnaire consists of 19 questions, the grid of which is shown in Table 1 below.

Table 1

Process skills grid

Variable	Indicator	No. Statement
Process Skills	Communication	1,2,3,4,6,7
	Measure	8,9,10,11,12,13,14
	Laying Tables	15,16,17,18,19

On questionnaires, this study used a Likert scale with four categories: very poor, poor, good, and very good. The categories and intervals used are shown in Table 2.

Table 2

Process skill categories and intervals

Category	Intervals		
	Communication	Measure	Laying Tables
Very Poor	7 – 12,25	7 – 12,25	5 – 8,76
Poor	12,35 – 17, 5	12,35 – 17,5	8,85 – 12,5
Good	17,6 – 22,75	17,6 – 22,75	12,6 – 16,25
Very good	22,85 - 28	22,85 – 28	16,35 - 20

The number of statements used in the questionnaire on the nature of cooperation is 11 statements using the grid shown in Table 3.

Table 3

Cooperation Character Grid

Variable	Indicator	No. Statement
Cooperation	Using Time Effectively	1,2,3,4
	Make Preparation Before Learning	5,6,7,8,9,10,11

On questionnaires, this study used a Likert scale with five categories: very poor, poor, enough, good, and very good. The categories and intervals used can be seen in Table 4. Table 5 displays the interview grid.

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Table 4
Categories and intervals of cooperation characters

| Category	Intervals	
	Using Time Effectively	Make Preparation Before Learning
Very Poor	4 – 7,2	7 – 12,6
Poor	7,3 – 10,4	12,7 – 18,2
Enough	10,5 – 13,6	19,2 – 23,8
Good	13,7 – 16,8	23,9 – 29,4
Very good	16,9 – 20	29,5 – 35

Table 5
Interview Grid

Indicator	Question
Share responsibility in completing work	1. I ask and discuss with my group mates when something is not clear. 2. I do the group assignments given to completion. 3. I understand the purpose of joint learning activities in group activities. 4. I always listen to friends' opinions in group activities. 5. I compile a report together with a group of friends.
Contribute to each other in groups	6. I participate in discussions with a group of friends who complete the task actively. 7. I participate in making presentations in front of the class together with the group.

2.3. Procedure

The research procedure begins with school observations to obtain accurate and complete information. After the full information was collected, researchers distributed questionnaires to students and interviewed students and educators to collect additional responses. The data obtained will be collected for analysis. After analyzing the data, the researchers conclude this study. More simply, the investigation procedure is shown in Figure 1.

Figure 1
Research Procedure
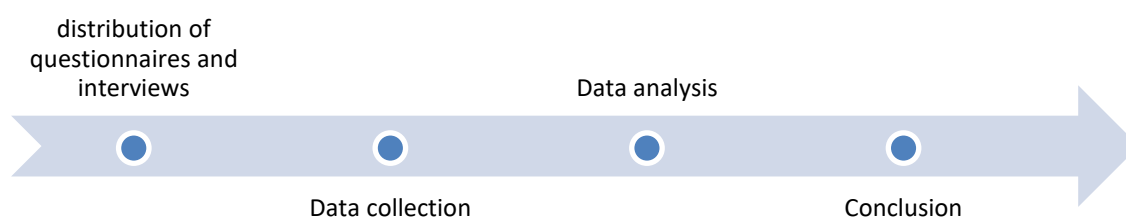
2.4. Data analysis

Quantitative data were analyzed using the SPSS application by highlighting descriptive statistics and assumption tests in the form of normality tests and homogeneity tests. After testing, the researcher tested the hypothesis in the form of a t-test to find out the differences in the character education of cooperation and mathematical process skills in each school and the correlation to see the relationship between the variables of the character of cooperation and mathematical process skills. The qualitative data were analyzed using the Miles and Huberman data analysis method. Analysis using the mailing

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list and Huberman technique is an activity in qualitative data analysis that is carried out interactively and continues continuously until complete so that the data is saturated (Abdiyani et al., 2019). The stages in the Miles and Huberman technique consist of data collection, data reduction, data presentation, and conclusion.

3. Results

In the following, the researcher describes the results of the data acquisition that the researcher has analyzed using SPSS. The results of the analysis are in the form of descriptive statistical tables of students' process skills characters, descriptive statistics tables of students' collaboration characters, assumption test tables, and hypothesis tests.

The results of the descriptive statistical analysis of the character of the students' process skills can be seen in Table 5 below

Table 5
Descriptive Statistics of Students' Process Skill Characters

School	Indicator	Category	Interval	F	%	Mean	Me	Min	Max
MIN 2	Communication	Very Poor	7 – 12,25	6	30.0	10.27	10	6.0	12.0
		Poor	12,35 – 17, 5	8	40.0				
		Good	17,6 – 22,75	4	20.0				
		Very good	22,85 – 28	2	10.0				
	Measure	Very Poor	7 – 12,25	8	40.0	10.50	10	6.0	12.0
		Poor	12,35 – 17, 5	4	20.0				
		Good	17,6 – 22,75	5	25.0				
		Very good	22,85 – 28	3	15.0				
	Laying Tables	Very Poor	5 – 8,76	7	35.0	10.50	10	5.5	11.0
		Poor	8,85 – 12,5	9	45.0				
		Good	12,6 – 16,25	2	10.0				
		Very good	16,35 – 20	2	10.0				
MIN 4	Communication	Very Poor	7 – 12,25	5	25.0	10.37	10	6.0	12.0
		Poor	12,35 – 17, 5	10	50.0				
		Good	17,6 – 22,75	3	15.0				
		Very good	22,85 – 28	2	10.0				
	Measure	Very Poor	7 – 12,25	6	30.0	10.37	10	6.0	12.0
		Poor	12,35 – 17, 5	6	30.0				
		Good	17,6 – 22,75	4	20.0				
		Very good	22,85 – 28	4	20.0				
	Laying Tables	Very Poor	5 – 8,76	7	35.0	10.67	10	5.5	11.0
		Poor	8,85 – 12,5	4	20.0				
		Good	12,6 – 16,25	5	25.0				
		Very good	16,35 – 20	4	20.0				

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Based on the results of the descriptive statistical analysis in Table 5, it is known that the process skills possessed by students are quite good. But it needs to be improved again and this is the task of educators to improve students' process skills.

Furthermore, the results of descriptive statistical analysis about the characteristics of student collaboration. This is shown in Table 6 below.

Table 6

Descriptive Statistics of Student Collaboration Characters

School	Indicator	Category	Interval	F	%	Mean	Me	Min	Max
MIN 2	Using Time Effectively	Very Poor	4 – 7,2	0	0	11.20	11	5.0	12.0
		Poor	7,3 – 10,4	2	10.0				
		Enough	10,5 – 13,6	6	30.0				
		Good	13,7 – 16,8	10	50.0				
		Very good	16,9 – 20	2	10.0				
	Make Preparation Before Learning	Very Poor	7 – 12,6	0	0	10.27	10	7.0	12.0
		Poor	12,7 – 18,2	3	15.0				
		Enough	19,2 – 23,8	7	35.0				
		Good	23,9 – 29,4	4	20.0				
		Very good	29,5 - 35	6	30.0				
MIN 4	Using Time Effectively	Very Poor	4 – 7,2	0	0	10.50	10	6.0	11.0
		Poor	7,3 – 10,4	3	15.0				
		Enough	10,5 – 13,6	6	30.0				
		Good	13,7 – 16,8	6	30.0				
		Very good	16,9 – 20	5	25.0				
	Make Preparation Before Learning	Very Poor	7 – 12,6	0	0	11.37	11	5.0	11.0
		Poor	12,7 – 18,2	2	10.0				
		Enough	19,2 – 23,8	8	40.0				
		Good	23,9 – 29,4	7	35.0				
		Very good	29,5 - 35	3	15.0				

From the analysis results in Table 6 above, we can see that students are very cooperative.

Below are the results of the normality test analysis, which can be found in Table 7 below.

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Table 7

Normality Test

Variable	School	Kolmogorov-Smirnov		
		Statistic	Df	Sig.
Process Skills		.083	40	.200*
		.123	40	.200
Cooperation	MIN 2 & 4 Batanghari	.092	40	.200
		.090	40	.200*

The results obtained with this normality test are the data used and are normally distributed. This is evidenced by the significance value obtained being greater than 0.05.

Then the researcher conducted a homogeneity test whose analysis results can be seen in Table 8 below:

Table 8

Homogeneity Test

Variable	School		Sig.	Distributed
Process Skills	MIN Batanghari	2	0.771	Homogen
	MIN Batanghari	4		
Cooperation	MIN Batanghari	2	0.393	Homogenous
	MIN Batanghari	4		

From the results of Table 8, it is found that the data used comes from a population with a variety of variants.

The results of the linearity test are presented in Table 9.

Table 9

Linearity Test

Interval	N	F	Sig.
Process Skills	40	0,157	0.391
Cooperation	40	0,158	0.392

From the results of Table 9, it is found that the data is linear in terms of the sig. The results of testing the hypothesis consisting of a t-test and a regression test were carried out as follows.

Table 10

T-Test

Independent Samples Test						
Levene's Test for Equality of Variances						
		F	Sig.	T	df	Sig. (2-tailed)
MIN 2 & 4 Batanghari	Process Skills	.158	.601	3.997	.40	.010
	Cooperation	.165	.669	2.419	40	.003

Table 10 shows that there is a difference between the nature of process capability and the nature of collaboration. This is represented by the resulting sig (2-tailed) value $<. 0.05$, which meets the specified requirements. Below (Table 11) are the results of regression tests performed as follows:

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Table 11

Hypothesis Regression Test with ANOVA the character of cooperation and mathematical process skills

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	4.658	2	4.617	4.802	.034
Residual	15.271	18	.765		
Total	19.929	20			

The table above is a table of the results of the ANOVA regression test on the character of cooperation and mathematical process skills. In the ANOVA regression test, there is a mutual influence between the ability to process skills and the ability to cooperate as evidenced by the sig value <0.05. Table 12 below shows the results of the regression test of the ability of cooperation and process skills as follows.

Table 12

Regression test of cooperation characters and mathematical process skills

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.365	.450	.182	.945

Based on the table above, the results of the regression test of the ability to cooperate and process skills are seen from the value of R square .450 x 100% = 45%. Then next is the regression test table (table 13) for the character of cooperation and process skills as follows.

Table 13

Regression test of cooperation characters and mathematical process skills

School	Model	B	T	Sig
MIN 2 Batanghari * MIN 4 Batanghari	Process Skills	0,437	4,4881	0.015
	(Constant)	20,420	13,421	0.000
	Cooperation	0,250	4,2749	0.023
	(Constant)	22,109	13,421	0.000

The regression test was carried out using the independent variable in the form of the ability to cooperate with the dependent variable, namely the process skills of students.

4. Discussion

From the results of the regression tests performed, the results are shown in Table 13. It turns out that we know the t-value for each dependent variable. Next, look up the values in the t table and get a value of 1.994. Then compare the t-scores calculated for each dependent variable with the values in the t table. We can see that there is a significant positive effect between the independent and dependent variables. This is evidenced by the high t-score compared to the t-table for the entire study sample. A positive effect results from having a positive t count and a larger value than the t count.

Furthermore, the influence between the two variables used in this study can also be observed through the significance value. As can be seen from the table, the significance value for each sample is lower than the significance value used, which is 0.05. This indicates that the ability to cooperate has a significant influence on the process skills of class IV students at MIN 2 Batanghari and MIN 4 Batanghari. Through the results of this analysis, the researchers explain the arguments of the research conducted. Based on the results of the data analysis, it was determined that the students had average good category process skills. However, some students have unsatisfactory process skills with very bad

categories. Therefore, an educator must fix this by tests and evaluations (Jensen et al., 2020). Because basically, process skills involve cognitive, manual, and social skills (Supandi, 2019). This shows that it is very important for a learner to have process skills within him.

Next is the character of student cooperation. Through the results of data analysis, satisfactory results were obtained, namely that there were no students who obtained very bad results on the cooperation character. The average student gets the results of the character of cooperation in the good category. This is a good thing. Because humans are social creatures who need the help of others (Aqobah et al., 2020). So, it is important to have good teamwork to make life easier and complete a job. In the mathematical process skills, the character of cooperation can be applied. One of them is holding small discussions when one of the students has difficulty working on the problem. Furthermore, the results of the analysis of the assumption test in the form of a normality test and homogeneity test show that the data obtained is normally distributed and homogeneous, and the researcher in the form of a linearity test can do hypothesis testing. From the results of the linearity test analysis, it is known that process skills affect student cooperativeness.

The character of cooperation has a close relationship with the character of the communication process skills. These close relationships are interrelated with each other (Darmaji et al., 2019; Guswita et al., 2018; Hardiyanti et al., 2018). The character of cooperation will help students to communicate well with others while the character of the communication process skills will help students to cooperate well (Ernawati et al., 2021; Marudut et al., 2020). This shows the relationship between the two (Fitria, 2021). For this reason, these two abilities must exist in students for optimal learning outcomes.

Next, it discusses the relationship between cooperation and students' communication skills. All children who can speak are not necessarily able to communicate well (Alpian et al., 2019). As educators, of course, we must be able to train students' communication skills and the ability to cooperate (Melinda & Zainil, 2020). Hal This is because, students who have good communication skills will also be able to work well together, and students with good cooperative skills will always try to communicate well with their friends (Widodo et al., 2020). Therefore, the ability to cooperate will be balanced if accompanied by the ability to communicate.

The research that the researchers did was different from previous research. This can be seen from the variables that the researchers discussed, namely the process skills and collaborative character variables. However, several studies are in line with this study, although not the same. As is the case with research conducted by Agusta & Noorhapizah, (2013) and Kamalodeen (2021) whose research is on outbound methods containing traditional games to develop the character of early childhood assimilation and cooperation. Another research conducted by Wijaya, (2020) regarding the development of 4C competencies and scientific process skills. It can be concluded that this study was not carried out by other studies and is certainly different from previous studies.

5. Conclusion

This study aimed to find out the differences in the character of process skills and the character of student cooperation, as well as their application of their mathematical skills. This research aimed to find out the effect of mathematical process skills and the character of student cooperation.

From the results and discussion of this study, it can be concluded that there is no significant difference between students' cooperativeness and process skills in the classes tested in each school. It was also found that there was an influence between the nature of collaboration and students' processing abilities. Based on this research, the researcher hopes that other researchers can expand this research by adding other variables.

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