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Effectiveness The Cooperative Problem Based Learning (CPBL) and Learning Motivation on Mathematical Literacy Abilities and Collaboration Skills

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Abstract: This type of research is quantitative research using a quasi-experimental design. The research method is conducted using a 3 x 2 factorial design since there are two independent variables. The research sample of 87 students was taken by random sampling technique from MTs Unggulan Amanatul Ummah Surabaya. The aims of the study were to test differences in mathematical literacy abilities and collaboration skills based on learning motivation levels and learning models. Data collection techniques using pretest, posttest, questionnaires and observation. Data analysis used a two-way ANOVA statistical test with SPSS software. The results showed that F result > F table and the probability value (Sig.) < ∝ = 0,05. It means that there were differences in mathematical literacy abilities and collaboration skills based on the level of learning motivation and learning models.

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Introduction

The fact that students perceive mathematics as a rather boring or even intimidating subject is still frequently encountered in the field. Therefore, understanding how students think in the learning process is crucial in order to connect new materials with the previously acquired knowledge and understanding. Thus, based on this objective, a description of students' learning mindsets in specific mathematical domains or related lines of conjecture needs to be conceptualized in the form of a series of structured tasks. Mathematical literacy is a person's ability to formulate, interpret, apply and evaluate mathematics in various problems in everyday life. Sari (2015) believes that mathematical literacy skills are very important because they are closely related to real life. Apart from that, according to Masjaya & Wardono (2018) also stated that mathematical literacy skills can improve human resources. Mathematical literacy prioritizes students' ability to analyze, provide reasons and be able to communicate ideas in solving mathematical problems that they find effectively (OECD, 2009).

The evolving field of information technology and communication is intricately linked to the essential role of mathematics because a person proficient in mathematics possesses the capacity to reason before making accurate decisions and exhibits a systematic thought process. Moreover, possessing mathematical skills equips an individual to be meticulous, innovative, creative, and deeply curious. Hence, the discipline of mathematics serves as a

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foundational support for other fields of knowledge such as economics, social sciences, and natural sciences. Fundamentally, mathematics is not just a discipline of calculation; it also encompasses statements of truth and falsehood, the pursuit of evidence, and the drawing of conclusions from statements that require reasoning. The PISA study indicates that the literacy in reading, mathematics, and science of fifteen-year-old students remains low. In 2012, Indonesia was ranked 64th out of 65 participating countries (OECD, 2013a). The results of PISA demonstrate that the ability of Indonesian middle school students to formulate, apply, and interpret mathematical events across various contexts still significantly lags behind the average of OECD countries (OECD, 2013a).

The motivation for learning in students is closely intertwined with their mathematical literacy skills, as mathematical literacy plays a pivotal role in daily life. It is imperative to develop mathematical literacy skills in tandem with students' learning motivation. The realistic mathematics education approach is one way to enhance students' mathematical literacy skills. In this context, the application of the Cooperative Problem Based Learning (CPBL) model is employed. CPBL is an amalgamation of Cooperative Learning (CL) and Problem Based Learning (PBL) models. In line with the findings of Uswatun Hasanah's research (2015), the implementation of the Cooperative Problem Based Learning (CPBL) model can improve learning outcomes and foster students' character development. Furthermore, Anita Amelia's study (2020) demonstrates that the mathematical computational thinking abilities of learners utilizing the cooperative problem-based learning model are higher compared to those using conventional teaching methods. The research outcomes are expected to contribute to the enhancement and improvement of the quality of education through the application of the cooperative problem-based learning model in developing mathematical computational thinking abilities.

Motivation to learn is essentially part of motivation in general. In the process of teaching and learning activities, it is known that there is a learning motivation, namely the motivation that students or students have in the world of education. According to Sardiman (2016) learning motivation is very necessary in learning which will later support increasingly optimal student learning outcomes. The accuracy of the motivation given to students will determine the success of the learning process. So motivation can determine the intensity of learning efforts for students. According to Aunurrahman (2010:36), a student's learning motivation will be seen from the student's seriousness when participating in teaching and learning activities, such as students will appear more active in asking questions, expressing opinions, giving conclusions on the material received, making notes or resumes. apply the knowledge gained, carry out assignments, exercises and evaluations in accordance with learning demands.

Based on the researcher's observations and discussions within the Subject Teacher Meeting forum, mathematics teachers at MTs Unggulan Amanatul Ummah tend to predominantly employ conventional teaching methods and teacher-centered approaches that are focused solely on conceptual understanding. As a result, students exhibit weaknesses in solving literacy-based mathematics problems. Additionally, learning motivation plays a determining role in the success of students, especially among MTs Unggulan Amanatul Ummah's 3-Year Semester Credit System program students. They perceive their academic abilities as being below the average of students in the 2-Year Semester Credit System program. The dense schedule of learning activities, both at school and in the boarding house (pesantren), further complicates the situation. Therefore, the researcher undertakes a study on the mathematics teaching model in 7th-grade classes, specifically focusing on the topic of

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statistics. In this research, the researcher implements the Cooperative Problem Based Learning (CPBL) model while concurrently assessing students' learning motivation. The aim is to effectively enhance mathematical literacy skills and collaborative abilities among 7th-grade students at MTs Unggulan Amanatul Ummah.

Similar research has been conducted by Suharta (2013) proves that the Cooperative Problem Based Learning (CPBL) model is able to improve student learning outcomes significantly and can foster students' good character. In line with Hamid and Abbas's (2012) research, it shows that the CPBL model is very effective in developing students' character positively. Apart from that, Yusof, et al (2010) also proved that the use of the CPBL model was able to increase students' learning motivation and involvement in the learning process. Furthermore, the research results of Sabil et al. (2018) shows that there are differences in student learning outcomes between classes taught with the problem based learning model and classes taught with think pair share type cooperative learning. The problem based learning model is more effective than cooperative learning. This is proven based on the increase in the average learning outcomes for the problem based learning model of 31,70, while the increase in learning outcomes for the cooperative learning model is 27,18.

Research Method

This study is a quantitative research employing a "pretest-post-test non-equivalent group design" quasi-experimental design (Cohen, L., Manion, L., & Morrison, 2007). The research is conducted using a 3 x 2 factorial design since there are two independent variables. The first independent variable, the teaching model, has two dimensions: Cooperative Learning (CL) and Cooperative Problem Based Learning (CPBL). The second independent variable, learning motivation, has three dimensions: high, moderate, and low. The dependent variables are the mathematical literacy abilities and collaborative skills of 7th-grade students at MTs Unggulan Amanatul Ummah Surabaya. The research sample consists of 87 students selected through random sampling from MTs Unggulan Amanatul Ummah Surabaya.

The factorial design used in this research is depicted in table 1 below.

Table 1. 3 x 2 Factorial Design

Research Variables		Learning Model (B)	
		B1	B2
Learning Motivation (A)	A1	Y1	Y1
		Y2	Y2
	A2	Y1	Y1
		Y2	Y2
	A3	Y1	Y1
		Y2	Y2

Description:
A1 : High motivation
A2 : Moderate motivation
A3 : Low motivation
B1 : Cooperative Learning (CL) in experimental class 1
B2 : Cooperative Problem Based Learning (CPBL) in experimental class 2
Y1 : Mathematical literacy abilities
Y2 : Collaboration skills

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Data collection methods include pretests, posttests, questionnaires, and observations. The validity and reliability of the instruments are assessed through validity and reliability tests. Questionnaire validity is tested using SPSS software, while observation sheet and test validity are validated by subject-matter experts. The reliability of the instruments is evaluated using Cronbach's Alpha, yielding a reliability correlation coefficient of 0,969. The data analysis follows two stages: preliminary tests and the application of the Two-Way ANOVA statistical test. Preliminary tests consist of assessing normality, homogeneity, and initial abilities. Normality is examined using the One-Sample Kolmogorov-Smirnov test, indicating that all data groups have a normal distribution. Homogeneity is assessed through Levene's test, showing that the variance of all data groups is homogeneous. Initial abilities are compared using the two independent sample t-test, demonstrating that both groups have similar initial abilities. Subsequently, hypothesis testing employs the Two-Way ANOVA statistical test using SPSS software.

Result and Discussion

Based on the conducted observation in the 7th-grade class at MTs Unggulan Amanatul Ummah, it was found that there were 39 students who participated in the Cooperative Learning (CL) teaching model and 48 students who were involved in the Cooperative Problem Based Learning (CPBL) model. After gathering data from students participating in each teaching model, questionnaires were administered to measure the level of students' learning motivation. Additionally, a post-test was administered at the end of the study, consisting of 5 open-ended questions, to assess mathematical literacy skills. Furthermore, observations were carried out during group discussions to assess collaborative abilities. Following data collection, the questionnaire responses were processed and categorized into three levels of learning motivation: high, moderate, and low.

From the test results, it was found that a total of 19 students fell into the category of having high learning motivation. Among these, 8 students (9,2%) were following the CL teaching model, and 11 students (12,64%) were participating in the CPBL teaching model. Additionally, there were 48 students categorized with moderate learning motivation. Of these, 22 students (25,29%) were in the CL group, and 26 students (29,89%) were in the CPBL group. Furthermore, 20 students were classified as having low learning motivation, with 11 students (12,64%) in the CL group and 9 students (10,34%) in the CPBL group. Consequently, it can be inferred that the average learning motivation level for students participating in both the CL and CPBL teaching models falls into the having moderate learning motivation category, accounting for 55,18% of the students.

The following are the results of testing the first, second and third hypotheses for the dependent variable mathematical literacy ability which can be seen in the SPSS output of the Two Way ANOVA test results in table 2 below.

Table 2. Two-Way ANOVA Test Results

Tests of Between-Subjects Effects

Dependent Variable: Mathematical Literacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3547.289[a]	5	709.458	17.733	.000
Intercept	395255.530	1	395255.530	9879.361	.000
Motivasi	1952.618	2	976.309	24.403	.000

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Model	1102.504	1	1102.504	27.557	.000
Motivasi * Model	395.992	2	197.996	4.949	.009
Error	3240.665	81	40.008		
Total	487799.000	87			
Corrected Total	6787.954	86			

a. R Squared = .523 (Adjusted R Squared = .493)

From the results of the two-way ANOVA test for the first hypothesis, it was found that F_1 = 24,403 > Ftable = 3,11 and the probability value (Sig.) = 0,000 < ∝ = 0,05, which is even less than 0,01. This leads to the conclusion that there is a highly significant difference in mathematical literacy abilities among students in 7th grade at MTs Unggulan Amanatul Ummah Surabaya based on their levels of high, moderate, and low learning motivation. The findings of this research are supported by Fatchurrahman's study (2022), which establishes a strong relationship between learning motivation and mathematical literacy at 72,9%, indicating that learning motivation significantly influences mathematical literacy at 53,1%. Within the low learning motivation group, the average mathematical literacy score is 47,50. In the moderate learning motivation group, the average mathematical literacy score is 71,39, while the high learning motivation group exhibits an average mathematical literacy score of 90,00. The ANOVA analysis results further confirm that there are differences in mathematical literacy among students belonging to the low, moderate, and high learning motivation groups. Therefore, the role of learning motivation is crucial in enhancing students' mathematical literacy.

In testing the second hypothesis, it was found that F_2 = 27,557 > Ftable = 3,96 and the probability value (Sig.) = 0,000 < 0,05, which is even less than 0,01. This leads to the conclusion that there is a highly significant difference in mathematical literacy abilities between the classes that implemented the CL model and the CPBL model among 7th-grade students at MTs Unggulan Amanatul Ummah Surabaya. These research findings align with Effy Irmawati's study (2017), which suggests that the collaboration of Problem Based Learning (PBL) with the cooperative Student Team Achievement Divisions (STAD) approach influences learning outcomes in economics classes for 10th-grade students at SMA Kartikatama, Metro Lampung. The statistical data presentation from the control and experimental groups indicates that there is an effect on the class implementing the collaborative PBL and STAD cooperative model compared to the class solely using the PBL model. This is because the Sig. value of 0,067 is greater than 0,05. Thus, it can be concluded that there is a significant influence on learning outcomes between classes 10A and 10D.

In testing the third hypothesis, it was found that F_3 = 4,949 > Ftable = 3,11 and the probability value (Sig.) = 0,009 < ∝ = 0,05, which is even less than 0,01. Thus, it can be concluded that there is a highly significant interaction effect between the levels of learning motivation and teaching models on mathematical literacy abilities among 7th-grade students at MTs Unggulan Amanatul Ummah Surabaya. These research findings are supported by Rizki Amalia et al.'s study (2018) titled "Implementation of Problem Based Learning Combined with Team Games Tournament to Improve Learning Motivation and Mathematical Literacy Skills of Students in SMP Negeri 1 Langsa." The analysis of mathematical literacy test data indicates that the average class score in the first cycle was 64,14 and increased to 84,14 in the second cycle. Additionally, students' learning motivation in the first cycle was 54,17% and improved to 70,83% in the second cycle. This signifies that mathematics

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instruction utilizing Problem Based Learning (PBL) combined with Team Games Tournament (TGT) can enhance learning motivation and mathematical literacy abilities among 7th-grade students in SMP Negeri 1 Langsa.

The following are the results of testing the first, second and third hypotheses for the dependent variable collaboration skills which can be seen in the SPSS output of the Two Way ANOVA test results in table 3 below.

Table 3. Two-Way ANOVA Test Results

Tests of Between-Subjects Effects

Dependent Variable: Collaboration Skills

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2586.962[a]	5	517.392	9.514	.000
Intercept	393189.369	1	393189.369	7229.980	.000
Motivasi	1135.598	2	567.799	10.441	.000
Model	940.273	1	940.273	17.290	.000
Motivasi * Model	608.318	2	304.159	5.593	.005
Error	4405.038	81	54.383		
Total	483404.000	87			
Corrected Total	6992.000	86			

a. R Squared = .370 (Adjusted R Squared = .331)

In testing the fourth hypothesis, it was found that F_4 = 10,441 > Ftable = 3,11 and the probability value (Sig.) = 0,000 < ∝ =0,05, which is even less than 0,01. Consequently, H_0 is rejected, and H_1 is accepted. This means that there is a highly significant difference in collaborative abilities among students with high, moderate, and low learning motivation in the 7th-grade class at MTs Unggulan Amanatul Ummah Surabaya. These research findings are consistent with Amin Kiswoyowati's study (2011), which states that students' learning motivation influences their learning activities. One of the activities where this influence is evident is collaborative group discussions during classroom learning. This indicates that the higher the students' learning motivation, the higher their collaborative abilities in the classroom discussions.

In testing the fifth hypothesis, it was found that F_5 = 17,290 > Ftable = 3,96 and the probability value (Sig.) = 0,000 < 0,05, which is even less than 0,01. Thus, H_0 is rejected, and H_1 is accepted. This signifies that there is a highly significant difference in collaborative abilities between the classes that utilize the CL model and the CPBL model among 7th-grade students at MTs Unggulan Amanatul Ummah Surabaya. These research findings align with I Made Hendra Sukmayasa's study (2022), which concludes that there is a significant effect of the PBL teaching model on students' collaborative skills. The calculated F value is 56,812 with a significance level of 0,000, which is smaller than 0,05. This indicates a significant influence of the PBL teaching model on students' collaborative skills. Therefore, it can be inferred that the simultaneous effect of the PBL teaching model on students' collaborative skills is also significant, with a calculated Fvalue of 43,561 and a significance level of 0,000, which is smaller than 0,05.

In testing the sixth hypothesis, it was found that F_6 = 5,593 > Ftable = 3,11 and the probability value (Sig.) = 0,000 < ∝ = 0,05, which is even less than 0,01. Thus, it can be concluded that there is a highly significant interaction effect between the teaching model and the level of learning motivation on collaborative abilities among 7th-grade students at MTs Unggulan Amanatul Ummah Surabaya. These research findings are consistent with Slamet

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Suciati's study (2019), which concludes that there is an interaction effect between the use of teaching models and learning motivation on academic achievement in the subject of Biology for 10th-grade students at an SMA in Purwodadi. In that study, Fcount was greater than Ftable (6,271 > 4,00), indicating the existence of an interaction effect.

Conclusion

Based on the research findings, several conclusions can be drawn as follows: 1) The level of students' learning motivation significantly influences mathematical literacy abilities. The high motivation has a greater impact on mathematical literacy abilities compared to students with moderate or low motivation. 2) The implementation of the Cooperative Problem Based Learning (CPBL) model significantly affects mathematical literacy abilities. The application of the CPBL model has a higher impact than the Cooperative Learning (CL) model. 3) The interaction between learning motivation and teaching models significantly influences students' mathematical literacy abilities. 4) The level of students' learning motivation significantly influences their collaborative skills. The high motivation has a greater impact on collaborative skills compared to students with moderate or low motivation. 5) The implementation of the Cooperative Problem Based Learning (CPBL) model significantly affects collaborative skills. The application of the CPBL model has a higher impact than the Cooperative Learning (CL) model. 6) The interaction between learning motivation and teaching models significantly influences students' collaborative skills.

Suggestions

Based on the research findings, the researcher provides the following recommendations: 1) In teaching, educators are advised to implement the Cooperative Problem Based Learning (CPBL) model, as it has been proven to significantly facilitate the improvement of students' mathematical literacy abilities, particularly in mathematics education. 2) One crucial aspect to consider during the teaching process is students' learning motivation, as the level of learning motivation significantly influences students' mathematical literacy abilities. 3) It is recommended to identify other variables of students collectively with interactive teaching models that impact students' mathematical literacy abilities. 4) Both the Cooperative Learning (CL) and Cooperative Problem Based Learning (CPBL) models can serve as alternatives to enhance students' collaborative skills, given their proven significant effects. 5) The variable of learning motivation needs to be taken into account when developing students' collaborative skills, as learning motivation significantly impacts students' collaborative abilities. 6) It is advised to identify other variables related to students collectively with interactive teaching models that influence students' collaborative skills.

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