Jurnal Cakrawala Pendas
Vol. 12 No. 2, April 2026
DOI: http://dx.doi.org/10.31949/jcp.v12i2.17695

p-ISSN: 2442-7470
e-ISSN: 2579-4442

IMPROVING NUMERACY LITERACY SKILLS THROUGH THE COLLABORATIVE LEARNING MODEL IN MATHEMATICS EDUCATION AT PRIMARY SCHOOLS

Muhamad Dias Adhipramana[1*], Titim Fatimah[2], Muhammad Rifqi Mahmud[3]
[1,2,3] Universitas Islam Negeri Sunan Gunung Djati Bandung
[1]diasmuhammad021@gmail.com

Abstract

This study was conducted to compare the application of collaborative learning and direct instruction models in improving numeracy skills among Year 5 primary school pupils. The research employed a quantitative approach using a quasi-experimental method and a pretest–posttest control group design. The research subjects were 40 Year 5 pupils at SDN 274 Cempaka Arum, Bandung, comprising 20 pupils in the experimental class and 20 in the control class. The results of the analysis showed that the pre-test mean scores for each class, as determined by the Mann-Whitney test, indicated no significant difference, as evidenced by the Asymp. Sig. value of 0.383 > 0.05. However, the N-Gain results revealed a significant difference between the classes. The results of the N-Gain calculation for the experimental class yielded an average of 0.71, falling into the high category. Meanwhile, the control class's average was 0.39, falling into the moderate category. Inferential statistical analysis was then conducted, beginning with a normality test; however, as one dataset was not normally distributed, the Mann-Whitney test was used instead, yielding a significance value (one-tailed) of 0.001. Since the significance value (one-tailed) of 0.001 is less than 0.05, H0 is rejected and H1 is accepted. This means that the numeracy literacy skills of students using the collaborative learning model are better than those using the direct instruction model. Thus, the collaborative learning model is more effective in improving numeracy literacy skills than the direct instruction model.

Keywords: *Collaborative learning model; numeracy literacy; mathematics learning.*

Abstrak

Penelitian dilakukan untuk membandingkan penerapan model *collaborative learning* dan direct instruction dalam meningkatkan kemampuan literasi numerasi pada siswa kelas V sekolah dasar. Pendekatan yang digunakan dalam penelitian adalah kuantitatif dengan metode kuasi eksperimen dan desain *pretest–posttest control group design*. Subjek penelitian adalah 40 siswa kelas V SDN 274 Cempaka Arum Kota Bandung, yaitu 20 siswa kelas eksperimen dan 20 siswa kelas kontrol. Perolehan hasil dari analisis menunjukkan bahwa rata-rata *pre-test* masing-masing kelas dari uji Mann-Whitney menunjukkan tidak adanya perbedaan yang signifikan dilihat dari nilai Asymp. Sig. = 0,383 > 0,05. Sedangkan hasil N-Gain, terdapat perbedaan signifikan antar kelas. Hasil dari perhitungan nilai N-Gain kelas eksperimen memperoleh rata-rata sebesar 0,71 termasuk dalam kategori tinggi. Sementara rata-rata kelas eksperimen diperoleh sebesar 0,39 termasuk kategori sedang. Kemudian dilakukan perhitungan statistika inferensial dimulai dengan menguji normalitas, namun salah satu data tidak berdistribusi normal maka dilanjutkan uji alternatif Mann-Whitney dengan hasil dari perhitungan memperoleh nilai sig.(1-tailed) 0,001. Nilai sig.(1-tailed) 0,001 < 0,05 maka H_0 ditolak dan H_1 diterima, Artinya kemampuan literasi numerasi siswa yang menggunakan model *collaborative learning* lebih baik daripada yang menggunakan model *direct instruction.* Dengan demikian model *collaborative learning* lebih baik dalam meningkatkan kemampuan literasi numerasi daripada model *direct instruction.*

Kata Kunci: Model *Collaborative learning*; literasi numerasi; pembelajaran matematika.

Received	: 2026-02-28	Approved	: 2026-04-27
Reviesed	: 2026-04-25	Published	: 2026-04-30

Introduction

The education curriculum in Indonesia continues to evolve, particularly through the implementation of the Merdeka Curriculum, which calls for learning that focuses on strengthening

essential 21st-century skills. The focus of learning is not merely on mastering subject matter, but is directed towards developing critical thinking, problem-solving, collaboration and communication skills. One of the core competencies that is a key focus in the current curriculum is numeracy literacy, particularly at primary school level as the foundation for further learning (Aliftika & Utari, 2019).

The role of mathematics education in developing pupils' numeracy skills is highly strategic, as it is directly linked to reasoning, analysing information and making data-driven decisions. Literacy is a fundamental skill of vital importance in the learning process; essentially, it is the ability to read, comprehend messages and critically evaluate various forms of communication encountered. This encompasses oral communication, written communication, and communication using various mass media. Therefore, literacy can be viewed as a fundamental human ability namely reading, writing, understanding, and communicating which must be continually honed, practised, and developed (Nur et al., 2022). According to Alberta (2018), numeracy is defined as a person's ability, confidence, and willingness to interact with quantitative information (numbers) or spatial information (shapes) in order to apply information in various aspects of life. Numeracy competence is not merely about counting, but rather the ability to reason using mathematical concepts to analyse, process data, and make decisions in real-life contexts (Mahmud & Pratiwi, 2019). From the above, it can be concluded that numeracy is an individual's ability to use numbers and basic mathematical symbols to solve contextual problems. Numeracy skills encompass the ability to understand and analyse information presented in various forms, such as tables, graphs and diagrams, and then interpret the results of that analysis to make estimates and reach appropriate decisions.

Various reports indicate that students' numeracy skills in Indonesia remain relatively low. Data from the Programme for International Student Assessment (PISA) show that Indonesian students' mathematics literacy scores are below the average for OECD member countries. This situation highlights an urgent need for improvements and innovation in the mathematics learning process (Delima et al., 2022). These low numeracy skills are also reflected in the report by the Ministry of Education, Culture, Research and Technology regarding the results of the Minimum Competency Assessment (AKM) at primary school level. The data shows that around 47.04% of Year 5 primary school pupils have not yet reached the stipulated minimum level of numeracy competence. This situation is influenced by various factors, one of which is the continued use of teacher-centred teaching models, resulting in suboptimal student engagement in the learning process. Mathematics teaching dominated by direct instruction tends to position pupils as passive recipients of information. This situation leads to low levels of participation in discussions and limits the development of critical thinking and context-based problem-solving skills (Bahja et al., 2025).

Twenty-first century learning requires the use of learning models that encourage active student engagement and facilitate social interaction in the learning process (Sagena et al., 2023). These requirements include the development of 4C competencies, namely Critical thinking, Creativity, Collaboration, and Communication. These skills support individuals to be able to think independently, work in teams, innovate, and communicate effectively amid rapid changes (Aliftika & Utari, 2019). A learning model is a conceptual framework used as a guideline in designing and implementing the learning process in the classroom (Helmiati, 2012). The collaborative learning model is an approach to learning that emphasises interaction and collaboration among students in small groups to build shared understanding through discussion, idea sharing, and collective problem solving (Ntobuo, 2018). This view is in line with Jean Piaget's constructivist theory, which states that the learning process is an active activity in building cognitive structures through

experience and interaction with the environment, so that knowledge is not obtained directly, but is constructed by the individual themselves (Insani et al., 2024).

The collaborative learning model in this study was implemented through six structured learning stages to help pupils gain a deeper understanding of the concepts of the volume of cubes and cuboids. The first stage involved orienting the pupils, whereby the teacher outlined the learning objectives, provided an overview of the material on the volume of cubes and cuboids, and motivated the pupils. The teacher also linked the material to everyday life, such as calculating the volume of boxes or containers, so that pupils could more easily grasp the concepts being studied. The second stage involves forming groups, where students are divided into small, heterogeneous groups of 4–5 members. The aim of this grouping is to optimise students' individual abilities through interaction and cooperation in understanding the concept of volume. The third stage involves setting learning tasks, whereby the teacher provides tasks in the form of contextual problems related to the volume of cubes and cuboids. The tasks are designed so that students are able to identify the length, width and height, and determine the volume using the correct concepts. The fourth stage is facilitating student collaboration, where students work together in groups to complete the tasks. Students discuss, exchange ideas and check each other's answers. The teacher acts as a facilitator, guiding the discussion and ensuring every student is actively involved. The fifth stage is assessment and evaluation, where the teacher assesses students' work and evaluates their understanding of the concepts of the volume of cubes and cuboids. The sixth stage is awarding recognition, both individually and to groups. The aim of this recognition is to boost pupils' motivation to learn and encourage active participation in the learning process. Through these stages, learning focuses not only on the results of volume calculations but also on the process of conceptual understanding and cooperation among pupils (Ntobuo, 2018). Collaborative learning provides space for pupils to participate actively, develop social skills, and deepen their understanding of mathematical concepts in a meaningful way (Fernando Siagian & Maulana, 2023).

A number of previous studies have shown that the implementation of collaborative learning models has a positive effect on primary school pupils' mathematics learning outcomes and numeracy skills. One such study, conducted by Kadek Beny Agus Permana et al. (2020), showed that the average improvement in learning outcomes in the experimental class implementing collaborative learning was higher than in the control class using conventional teaching methods. The average score for the experimental group was 17.40, whilst that of the control group was 15.06. The results of the statistical test showed a calculated t-value (7.09 > 1.983), indicating a significant difference between the two groups. Collaborative learning has proven effective in optimising conceptual understanding, motivation to learn, and students' ability to analyse and solve mathematical problems (Beny et al., 2020). Nevertheless, research specifically examining the effectiveness of collaborative learning models in optimising the numeracy skills of Year 5 primary school pupils using a quasi-experimental design remains limited, particularly in the context of state primary schools in the city of Bandung.

Referring to the results of a preliminary study conducted by administering a numeracy literacy test at SDN 274 Cempaka Arum, it was found that the numeracy literacy skills of the pupils in the class remain relatively low. Furthermore, according to interviews with teachers, around 80% of pupils struggle to solve context-based maths problems, even though the relevant material has been taught previously. In fact, the teacher stated that the majority of pupils were still unable to perform calculations using basic arithmetic operations such as multiplication and division. Mathematics lessons in that class tended to be monotonous, with limited variation in teaching methods, resulting in low levels of active pupil participation and a negative perception of

the subject (Khairinnisa et al., 2024). This matter becomes a consideration for the researcher in conducting the study by introducing alternative learning models to address the problems present in class 5 of SDN 274 Cempaka Arum.

This study focuses on testing the application of a collaborative learning model to improve the numeracy skills of Year 5 pupils and comparing it with the teaching methods typically used at SDN 274 Cempaka Arum. Based on a review of the theory and previous research findings, this study formulates the following hypotheses: H0: There is no difference in the improvement of numeracy literacy skills between students learning using the collaborative learning model and those learning using the direct instruction model, H1: The improvement in numeracy literacy skills among students learning using the collaborative learning model is better than that of students learning using the direct instruction model. It is hoped that the results of this study will not only enrich empirical research in the field of mathematics education but also provide practical implications for teachers in designing more participatory and numeracy oriented learning activities.

Research Methods

This study employs a quantitative approach. The quantitative approach is based on the positivist paradigm and is used to investigate a specific population or sample through data collection using research instruments and statistical analysis to test established hypotheses (Irvan, 2023). This study used a quasi-experimental design involving a control class that received This study employs a quasi-experimental design involving a control class receiving direct instruction and an experimental class receiving treatment in the form of a collaborative learning model. The choice of this design is based on the researcher's limitations in controlling all external variables that influence the learning process (Anantasia & Rindrayani, 2025; Sugiyono, 2018).

This study employed a pretest-posttest group design with two groups of participants: an experimental group and a control group. The experimental group was taught using the collaborative learning model, whilst the control group used the direct instruction model as a comparison. The study began with both the experimental and control classes being given a pre-test to assess the students' initial abilities, after which the intervention was administered to each class. Once the intervention was completed, a post-test was conducted to measure the students' final abilities and to assess the effectiveness of the collaborative learning model in improving students' numeracy skills. An illustration of this research design is as follows, modified from (Sugiyono, 2018):

Table 1. Research Design

Group	Pre-Test	Treatment	Post-Test
Experimental	O_1	X	O_2
Control	O_3		O_4

Description :
X : Treatment given to the experimental class using the collaborative learning model and the control class using direct instruction.
O_1 : Pre-test given to the experimental class.
O_2 : Post-test given to the experimental class.
O_3 : Pre-test given to the control class.
O_4 : Post-test given to the control class.

The research was conducted at SDN 274 Cempaka Arum, Bandung City. The research was carried out in the even semester of the 2025/2026 academic year, covering the preparation stage, data collection, and data analysis.

The research sample consisted of Year 5 pupils at SDN 274 Cempaka Arum. The researcher employed purposive sampling to select the sample based on specific criteria and to achieve the research objectives (Sugiyono, 2018). The purposive sampling technique was used whilst taking into account the equivalence of the pupils' academic characteristics, such as prior ability, class size, and the curriculum used, so that the two groups could be compared objectively (Inggriyani & Putri, 2026). The subjects comprised two classes: the experimental class, where the Collaborative Learning model was implemented, and the control class, where the direct instruction model was applied.

The research stages were as follows: 1) Preparation stage: Developing numeracy literacy test instruments, observation sheets, teaching modules and worksheets. 2) Implementation stage: a. Administering a pre-test to each class to assess pupils' abilities prior to implementing the model. b. Applying the treatment: the experimental class received the Collaborative Learning model, whilst the control class received the direct instruction model. c. Administering a post-test to both classes after the model had been implemented. 3) Analysis Stage: The analysis involved two methods of testing, namely descriptive statistical analysis and inferential statistical analysis.

Teaching in the experimental and control classes was carried out by the same teacher to ensure consistency in the treatment. The main difference lay in the teaching model used, with the experimental class employing collaborative learning based on group discussions, whilst the control class used direct instruction. The data used in this study is quantitative data derived from students' learning achievement scores (Novita Fitriani, 2025). Han (2017) states that numeracy has the following indicators: (1) the ability to apply numbers and mathematical symbols in everyday life, (2) the ability to analyse information provided in the form of word problems and tables, and (3) the ability to interpret the results of the analysis to make predictions and decisions for problem-solving (Han, 2017; Darmastuti, 2024). Tests were administered at the beginning (pre-test) and end of the learning process (post-test).

The research instruments consisted of pre-test and post-test questions, the validity and reliability of which had been tested. The results of the validity test using Pearson's correlation coefficient showed that all items had a calculated r value greater than the table r value, and were therefore deemed valid. The reliability test using Cronbach's Alpha yielded a value of 0.942, which is greater than 0.6, meaning that the research instruments were reliable (Tahitu & Wattimena, 2023). Data were collected using both test and non-test techniques. Test techniques were used to obtain quantitative data on the numeracy literacy skills of the research subjects. Non-test techniques, comprising observation and limited interviews with class teachers, were employed to gather supporting data regarding the conduct of the research and the students' circumstances throughout the study (Sugiyono, 2018).

After obtaining the data, inferential statistical analysis was performed, beginning with a normality test using the Shapiro-Wilk test. The test was performed using the following formula:

$$T_3 = \frac{1}{\sum_{i=n}^{n}(X_{i-} - \bar{X})^2}\left[\sum_{i=1}^{n} a_i(x_{n-1+i} - X_i)\right]^2$$

Explanation:

T_3= Shapiro Wilk test

a_i= Shapiro Wilk test coefficient

x_{n-1+i} = Data at n-i+1
X_i = Data at i
$\bar{X}$ = Data average

If the data is normally distributed, proceed with the homogeneity test using the following test formula:

$$Fhitung = \frac{\text{Largest Variance}}{\text{Smallest Variance}} = \frac{S_1^2}{S_2^2}$$

Degrees of freedom (dk/df):

$$df_{Numerator=} n_{large} - 1$$
$$df_{Denominator =} n_{small} - 1$$

Criteria:
Homogeneous: $F_{Numerator} \leq F_{tabel}$
Non-homogeneous: $F_{numerator} \leq F_{table}$
Note: Variance (S^2) is calculated with $\frac{\Sigma(xi-x)^{-2}}{n-1}$

However, if one or both data sets are not normally distributed, perform the Mann-Whitney alternative test (Mahmud & Pratiwi, 2019). Use the following test formula:

$$U_1 = n_1 n_2 + \frac{n_1(n_1-1)}{2} - R_1$$
$$U_2 = n_1 n_2 + \frac{n_2(n_2-1)}{2} - R_2$$

Explanation:
U: Mann-Whitney test statistics (smallest value between U_1 and U_2)
n_1= Number of samples in group 1
n_2= Number of samples in group 2
R_1= Number of ranks in sample 1
R_2= Number of ranks in sample 2

All inferential statistical tests were conducted using IBM SPSS Statistics V.27 software to ensure the accuracy and significance of the research results (Anantasia & Rindrayani, 2025).

Results and Discussion

Based on research conducted at SDN 274 Cempaka Arum, the study involved the implementation of the model across a total of six sessions in each class. This comprised an initial session for the pre-test, followed by four sessions for the treatment phase (the experimental class utilised the collaborative learning model, whilst the control class employed the conventional direct instruction model), and concluded with a single session for the post-test.

Before testing the hypotheses, the data obtained were analysed using descriptive statistics to provide an overview of the distribution of students' numeracy literacy scores. The descriptive analysis included the mean, standard deviation, lowest score, and highest score for each class.

Table 2. Pre-test descriptive statistics

	N	Mean	Std.Dev	Min	Max
Experimental	20	24,3	2,5	18,3	27
Control	20	23,5	2,3	18,7	25

Descriptive statistical analysis indicates that the initial abilities of the two classes were relatively equivalent, as evidenced by the pre-test mean scores, which showed no significant difference between the two classes. The pre-test mean scores for both classes indicated equivalent initial abilities, with the experimental class achieving a mean score of 24.3 and the control class achieving a mean score of 23.5. Subsequently, inferential statistical analysis was carried out using IBM SPSS V.27 software, beginning with a normality test; however, the results of the test on one of the datasets indicated a non-normal distribution. The analysis therefore proceeded with the Mann-Whitney U test, yielding the following results:

Table3. Mann Whitney Pre-test Score

Mann-Withney U	167.000
Wilcoxon W	377.000
Z	-0.903
Asymp. Sig. (2-Tailed)	0.366
Exact Sig. [2*(1-tailed sig)].	0.383

Based on the results of inferential statistical tests conducted using IBM SPSS Statistics software, a significance value of 0.383 was obtained. As 0.383 > 0.05, there was no difference in ability between the two classes prior to the implementation of the collaborative learning model. After conducting lessons using the collaborative learning model in the experimental class and direct instruction in the control class, a post-test was administered to each class. Following the teaching interventions, a descriptive statistical analysis was carried out, and post-test data were obtained for the experimental and control classes. The results of the analysis showed that the mean post-test score in the experimental class was higher than that in the control class. In the experimental class, the mean post-test score was 77.35, whilst in the control class it was 52.83. This indicates that students who participated in learning using the collaborative learning model achieved better learning outcomes than those who participated in learning using the direct instruction model. Furthermore, the maximum score in the experimental class was 90, whilst in the control class it was 67. The minimum score in the experimental class was 59, whilst in the control class it was 40. The range of scores in the experimental class indicates that the majority of students were able to achieve high learning outcomes after participating in collaborative learning. In terms of data distribution, the standard deviation in the experimental class was 6.6, whilst in the control class it was 7.8. This indicates that the variation in scores in the experimental class was smaller than in the control class, meaning that student learning outcomes in the experimental class were more evenly distributed.

The results of the pre-test and post-test were then calculated using N-Gain with the following formula:

$$N - Gain = \frac{Posttest\ score - Pretest\ score}{Ideal\ score - Pretest\ score}$$

The criteria for interpreting N-Gain are as follows

Table 4. Interpretation Criteria

Nilai (g)	Interpretasi
g < 0,30	Low
0,30 ≤ g < 0,70	Medium
g ≥ 0,70	High

(Hake's, 1999; Sukarelawa et al., 2024)

Based on the results of calculations using the N-Gain formula, the average for the experimental class was 0.71 and for the control class 0.39. Consequently, the experimental class

falls into the high category and the control class into the moderate category. The N-Gain scores per pupil, broken down by pupil numbers, are as follows:

Table 5. Number of categories of student N-gain improvement

Class	Categori		
	Low	Medium	High
Experimental	0	6	14
Control	5	15	0

Based on the data from the experimental class, it was found that out of 20 students, 14 fell into the high category and 6 into the medium category. Meanwhile, in the control class, out of 20 students, 5 fell into the low category and 15 into the medium category. When examining the distribution of categories, there were no students in the low category in the experimental class, and many students achieved the high category. Conversely, in the control class, there were still students in the low category and none in the high category.

Calculations were performed using IBM SPSS software to determine the level of significance, starting with a normality test; however, as one dataset was not normally distributed, the Mann–Whitney test was subsequently applied. Prior to conducting the hypothesis test using the Mann–Whitney test, the research hypotheses were formulated as follows: H0: There is no difference in the improvement in numeracy literacy skills between students learning using the collaborative learning model and those learning using the direct instruction model; H1: The improvement in numeracy literacy skills among students learning using the collaborative learning model is better than that of students learning using the direct instruction model. The results of the Mann–Whitney test are as follows:

Table 6. Mann Whitney N-Gain score test Skor

Mann-Withney U	4.000
Wilcoxon W	214.000
Z	-5.303
Asymp. Sig. (2-Tailed)	0.001
Exact Sig. [2*(1-tailed sig)].	0.001

Based on the results of inferential statistical tests conducted using IBM SPSS Statistics software, a significance value (one-tailed) of 0.001 was obtained. As the significance value (one-tailed) of 0.001 (the result of dividing the two-tailed value by 2) is less than 0.05, H0 is rejected and H1 is accepted; this means that the collaborative learning model is superior to the direct instruction model. It can therefore be concluded that the numeracy skills of students using the collaborative learning model are superior to those of students using the direct instruction model.

This distribution pattern shows that the improvement in the experimental class was not limited to a small proportion of pupils, but was relatively even and even enabled almost half of the pupils to achieve a high level of improvement. These results comprehensively demonstrate a difference in pre-test and post-test scores between the experimental class, which used the collaborative learning model, and the control class, which used the direct instruction model. Pedagogically, an N-Gain score of 0.71 indicates that the model used by the experimental class is more effective in improving students' numeracy skills. Thus, the N-Gain results show that the improvement in skills in the class implementing the collaborative learning model is greater than in the class using the direct instruction model.

The improvement in the numeracy skills of pupils in the experimental class is closely linked to the implementation of a collaborative learning model, which fosters an active and meaningful

learning environment. Based on observations during lessons, pupils demonstrated high levels of enthusiasm, evident in their participation in group discussions, their confidence in expressing their opinions, and their ability to explain concepts to their peers. These findings indicate that collaborative learning impacts not only learning outcomes but also the learning process itself. Students no longer act as passive recipients of information but are actively engaged in building understanding through social interaction. The understanding gained through discussions with peers tends to be more meaningful as students experience a process of thinking together, correcting one another, and clarifying concepts.

This is consistent with research by Nuraini et al. (2025), which shows that collaborative learning significantly improves numeracy skills through group interaction and joint task completion. The findings of this study confirm that group work can strengthen conceptual understanding as students are directly involved in the process of knowledge construction (Nuraini et al., 2025).

The average N-Gain score for the control class was only 0.39. This low increase may be due to the characteristics of the direct instruction model, which tends to focus on the teacher as the main source of information. In this model, students receive more explanations and examples of problems without ample opportunity for discussion or exploration of problem solving independently or in groups. Limited interaction and a lack of reflective activities result in students being less cognitively involved in developing a deep understanding of the concepts being studied. This has an impact on the low N-gain scores in the control class using the direct instruction model. (Wildaningsih et al., 2019). Furthermore, the increase in students' enthusiasm and motivation for learning in this study is also supported by the research titled 'The Influence of Collaborative Learning Models in Increasing Elementary School Students' Creativity and Motivation', which states that collaborative learning models can enhance students' motivation, creativity, and engagement in learning (Sanasintani, 2024). This is evident in students becoming more active in asking questions, discussing, and daring to express their ideas during the learning process. The improvement in students' numeracy literacy in this study also indicates that collaborative learning is effective in developing the ability to understand problems, analyse information, and determine solutions. Students' ability to exchange opinions and explain concepts to peers demonstrates the development of mathematical communication skills. This is crucial in numeracy literacy, as students are not only required to be able to calculate but also to explain and interpret the results of their calculations. Research conducted by Ruba'iyyah et al. (2024) explains that collaborative learning can improve students' conceptual understanding, communication, and thinking skills in mathematics(Ruba'iyyah et al., 2024).

The improvement in numeracy literacy skills in the experimental class can be explained through Jean Piaget's perspective on his theory of constructivism, which emphasises that individuals acquire knowledge through direct engagement and active interaction with their surroundings. In the collaborative learning model, rather than sitting and listening, pupils play an active role in processing and understanding the material presented and are actively involved in discussions, negotiating meaning, and collaborative problem-solving. Such interaction facilitates a deeper elaboration of understanding, so that mathematical concepts are not merely understood procedurally, but also conceptually and contextually. Thus, collaborative learning provides space for the development of higher-order, analytical, and reflective thinking skills. These abilities are also an integral part of numeracy literacy.

The findings of this study are consistent with the results of a previous study conducted by Kadek Beny et al. (2020), which stated that teaching using the collaborative learning model has a positive impact on mathematics learning outcomes and on students' critical thinking skills.

Previous research has shown that collaborative learning increases students' active participation and strengthens conceptual understanding through group discussions. The consistency of these results reinforces the assumption that social interaction in learning contributes significantly to the development of more meaningful mathematical competence. The data suggest that this study provides additional empirical support for the effectiveness of collaborative learning in the context of numeracy literacy learning in primary schools.

The average N-Gain score for the control class was only 0.39. This low increase may be attributed to the characteristics of the direct instruction model, which tends to be teacher-centred, with the teacher serving as the primary source of information. In this model, pupils primarily receive explanations and example problems without ample opportunity for discussion or for exploring problem-solving independently or in groups. Limited interaction and a lack of reflective activities result in students being less cognitively engaged in developing a deep understanding of the concepts being studied. This has an impact on the low N-Gain scores in the control class using the direct instruction model (Wildaningsih et al., 2019). The findings of this study indicate that the collaborative learning model has a positive impact not only on improving learning outcomes but also on the learning process, such as increased student engagement, confidence, communication skills, and cooperation. This suggests that collaborative learning is capable of creating a more meaningful learning experience compared to learning using the direct instruction model.

Despite the positive findings, this study has several methodological limitations that remain important considerations for future research. Firstly, the limited sample size within a single school may restrict the generalisability of the findings to a wider audience. Secondly, the relatively short duration of the intervention namely, four sessions may not fully represent the long-term impact of implementing collaborative learning. Thirdly, external factors such as student attendance and classroom conditions during the study may also have influenced the results. Therefore, further research involving a larger sample population and a longer intervention period is recommended to strengthen the validity of the findings.

Conclusion

Based on the results of the analysis of improvements in numeracy literacy skills using the N-Gain calculation, the average N-Gain for the experimental class was 0.71, which falls into the high category, whilst the average N-Gain for the control class was 0.39, which falls into the moderate category. Descriptively, these findings indicate that the improvement in students' numeracy literacy skills in the class implementing the collaborative learning model was greater than in the class using the direct instruction model. Furthermore, the results of inferential statistical testing using the Mann-Whitney test showed a significance value (1-tailed) of 0.001 < 0.05, which means that numeracy skills using the collaborative learning model were better than those using the direct instruction model. Thus, it can be concluded that the collaborative learning model is significantly better at improving students' numeracy skills compared to the direct instruction model.

References

Aliftika, O., & Utari, S. (2019). *Wahana Pendidikan Fisika). 4*(2), 141–147.

Anantasia, G., & Rindrayani, S. R. (2025). Metodologi Penelitian Quasi Eksperimen. *Adiba: Journal Of Education*, *5*(2), 183–192.

Bahja, A. W. T., Hakim, L., & Af'idah R, A. (2025). Literature Review: Analisis Model Pembelajaran Efektif dalam Implementasi Kurikulum Merdeka di Sekolah. *Konstruktivisme : Jurnal Pendidikan Dan Pembelajaran*, *17*(1), 11–27. https://doi.org/10.35457/konstruk.v17i1.3651

Beny, K., Permana, A., Renda, N. T., & Gede Margunayasa, I. (2020). Model Pembelajaran Kolaboratif Meningkatkan Hasil Belajar Matematika Siswa. *JP2*, *3*(2), 223–232.

Darmastuti, L. M. R. Wardani. (2024). Kemampuan Literasi Numerasi: Materi, Kondisi Siswa,dan Pendekatan Pembelajarannya. *JRPMS (Jurnal Riset Pembelajaran Matematika Sekolah)*, *8*, 17–26.

Delima, N., Kurniasih, I., Tohari, Hutneriana, R., Amalia, F. N., & Arumanegara, E. (2022). *PISA DAN AKM Literasi Matematika dan Kompetensi Numerasi* (N. Delima, Ed.). Unsub Press.

Fernando Siagian, A., & Maulana, D. (2023). Efek Model Pembelajaran Kolaboratif Berbasis Masalah Berbantuan Media Livewire Terhadap Kemampuan Literasi Numerasi Siswa. In *Jurnal Sinestesia* (Vol. 13, Number 2). https://sinestesia.pustaka.my.id/journal/article/view/426

Helmiati. (2012). *Model Pembelajaran* (L. Susanti, Ed.). Aswaja Pressindo.

Inggriyani, F., & Putri, S. A. (2026). Peningkatan Model Priject Based Learning Berbasis Pendekatan Clturally Responsive Teaching dan Media Flipbook Cerita Tokoh Pahlawan Terhadap Kemampuan Menulis Teks Pidato Peserta Didik di Sekolah Dasar. In *Sastra Indonesia dan Daerah* (Vol. 16, Number 1).

Insani, A. A., Sugeng Sholehuddin, M., & Khobir, A. (2024). Pemikiran Konstruktivisme Jean Piaget Dalam Pendidikan Islam. *Gudang Jurnal Multidisiplin Ilmu*, *2*, 83–86. https://doi.org/10.59435/gjmi.v2i1.191

Irvan, I. A. A. M. W. I. (2023). Filosofi Penelitian Kuantitatif dalam Manajemen Pendidikan Islam. *Jurnal Review Pendidikan Dan Pengajaran*, *6*(Filosofi Penelitian Kuantitatif Dalam Manajemen Pendidikan Islam), 1407–1417.

Khairinnisa, W., Nurhasanah, N., & Maksum, A. (2024). Hubungan Gaya Mengajar Guru dengan Keaktifan Belajar Siswa pada Pembelajaran Matematika di Kelas V Sekolah Dasar. *Jurnal Basicedu*, *8*(3), 2283–2291. https://doi.org/10.31004/basicedu.v8i3.7711

Mahmud, M. R., & Pratiwi, I. M. (2019). Literasi Numerasi Siswa dalam Pemecahan Masalah Tidak Terstruktur. *Jurnal Pendidikan Matematika*, *4*(1), 69–88.

Novita Fitriani, S. S. I. A. S. (2025). Peningkatan Hasil Belajar Matematika Materi Bangun Datar dengan Bantuan Media Konkret Berbasis Game Edukasi (Media Papeda) di Kelas III SDN Sunyaragi 1 Tahun Pelajaran 2024/2025. *Jurnal Jendela Pendidikan*, *5*, 368–376.

Ntobuo, N. E. (2018). *Model Pembelajaran Kolaboratif JIRE Teori dan Aplikasi* (N. E. Ntobuo, Ed.; 1st ed.). Universitas Gorontalo.

Nur, A. A., Inayah, ini, Paundria Nagari, G., Setiawan, K., Anisah, N., & Indraprasta PGRI, U. (2022). *Kemampuan Literasi Numerasi untuk Mengembangkan Pemahaman Konsep dalam Pembelajaran Matematika*.

Nuraini, N. L. S., Cholifah, P. S., Rini, T. A., Aurelia, D., & Nabila, S. (2025). How project-based collaborative learning affect on numeracy ability of elementary school teacher education students. *Psychology, Evaluation, and Technology in Educational Research*, *7*(2). https://doi.org/10.33292/petier.v7i2.256

Ruba'iyyah, S., Zahro, I., & Adhim, F. (2024). Upaya Meningkatkan Kemampuan Numerasi Anak Usia Dini dengan Metode Pembelajaran Kolaboratif Usia 5-6 Tahun di TK Darut Tauhid Balung. *Efektor*, *11*(2), 73–84. https://doi.org/10.29407/e.v11i2.23449

Sagena, U., Imbar, M., Mesra, R., Afifah, V., Kobi, W., Djerubu, D., Valentine Aydalina, R., T Salem, V. E., Fajryani Usman, N., & Nisa, K. (2023). *Model Pembelajaran Abad 21* (Sarwandi, Ed.). PT. Mifandi Mandiri Digital.

Sanasintani, S. (2024). The Influence of Collaborative Learning Models in Increasing Elementary School Students' Creativity and Motivation. *Journal of Social Science Utilizing Technology*, *2*(1), 261–274. https://doi.org/10.70177/jssut.v2i1.703

Sugiyono. (2018a). *Metode Penelitian Kuantitatif*.

Sugiyono. (2018b). *Metode Penelitian Kuantitatif Kualitatif dan R&d* (2nd ed.). Alfabeta.

Sukarelawa, M. I., Kus Indratno, T., & Ayu, S. M. (2024). *N-Gain vs Stacking* (1st ed.). Suryacahya.

Tahitu, A., & Wattimena, D. (2023). *Pengaruh Media Online Tribun Ambon Terhadap Informasi Cepat Kepada Publik* (Vol. 5, Number 2).

Wildaningsih, S., Mutaqin, J., & Muslihah, N. N. (2019). *Perbandingan Model Pembelajaran Direct Intruction (DI) dengan Model Pembelajaran Kooperatif Tipe Numbered Head Together (NHT) Kemampuan Komunikasi Matematis Siswa*. *2*(2), 184–192. https://jurnal.uns.ac.id/shes