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Cooperative Ability as a Moderator of Modeling Effects on Preschooler's Pattern Recognition Skills

Nabila Rachman*[1], Muhammad Adi Nugroho Sujatmiko[1], Muhammad Jamaluddin[1], Dulce Elda Ximenes dos Reis[2]

[1]*Faculty of Psychology, Maulana Malik Ibrahim State Islamic University, Indonesia;* [2]*Faculdade de Ciências da Saúde, Universidade Dili, Mascarenhas Dili, Timor Leste*

Corresponding author:

*Nabila Rachman
220401110221@student.uin-malang.ac.id

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Abstract

Background: This *research* explores how modeling as a learning strategy can support preschool children in recognizing patterns, and whether their cooperative skills influence this effect. **Objective:** This study aimed to examine the effect of modeling as a learning strategy on pattern recognition skills in preschoolers and to determine whether cooperative ability acts as a moderator. **Method:** Using a quasi-experimental design with pretest and posttest, the study involved 31 preschool children aged 4–5 years, 17 boys and 14 girls from a private kindergarten in East Java. The participants were divided equally into an experimental group and a control group. Measurements were conducted using validated pattern recognition skills and cooperative ability, and the data were analyzed using independent t-tests and ANOVA. **Results:** revealed that preschool children in the experimental group showed a significantly higher improvement in pattern recognition ($p < 0.001$). **Conclusion:** Furthermore, cooperation was found to strengthen the relationship between modeling and pattern recognition. These findings highlight the importance of combining cognitive learning strategies with social skill development in early preschool education.

Keywords: Behavior modification; cooperative; modelling; pattern recognition ability; preschool students

Abstrak

Latar Belakang: Penelitian ini mengeksplorasi bagaimana pemodelan sebagai strategi pembelajaran dapat mendukung anak-anak prasekolah dalam mengenali pola, dan apakah keterampilan kooperatif mereka memengaruhi efek ini. **Tujuan:** Penelitian ini bertujuan untuk menguji pengaruh pemodelan sebagai strategi pembelajaran terhadap keterampilan pengenalan pola pada anak-anak prasekolah dan untuk menentukan apakah kemampuan kooperatif bertindak sebagai moderator. **Metode:** Menggunakan desain kuasi-eksperimental dengan pretes dan posttes, penelitian ini melibatkan 31 anak prasekolah berusia 4–5 tahun, 17 laki-laki dan 14 perempuan dari taman kanak-kanak swasta di Jawa Timur. Peserta dibagi secara merata menjadi kelompok eksperimen dan kelompok kontrol. Pengukuran dilakukan dengan menggunakan keterampilan pengenalan pola dan kemampuan kooperatif yang tervalidasi, dan data dianalisis menggunakan uji-t independen dan ANOVA. **Hasil:** mengungkapkan bahwa anak-anak prasekolah dalam kelompok eksperimen menunjukkan peningkatan yang signifikan lebih tinggi dalam pengenalan pola ($p < 0,001$). **Kesimpulan:** Lebih jauh, kerja sama ditemukan untuk memperkuat hubungan antara pemodelan dan pengenalan pola. Temuan ini menyoroti pentingnya menggabungkan strategi pembelajaran kognitif dengan pengembangan keterampilan sosial dalam pendidikan prasekolah awal.

Kata Kunci: Kerjasama; kemampuan mengenal pola; modelling; modifikasi perilaku; siswa prasekolah

Introduction

Preschool children in the preschool stage typically grow across various domains, including physical, emotional, social, and cognitive abilities. Therefore, a good learning method is needed to develop aspects of preschool-age preschool children's development. To maximize the achievement of preschool children's development, the Ministry of Education and Culture designed learning outcomes as a foundation that must be achieved by preschool preschool children, one of which is the introduction of basic mathematics (Arvy, 2023). The initial concept of a basic introduction to mathematics that must be mastered first is to know patterns (Montague-Smith et al., 2018). Pattern recognition skills involve mental processes such as classification, grouping, sequencing, and prediction based on the observation of elements that are repetitive or have regularity (Qin et al., 2024).

Pattern recognition introduced early can predict preschool children's math achievement in elementary school and support the discovery and use of arithmetic strategies (Ulni, 2021). Pattern recognition skills are the basic ability of preschool children to recognize the shape of an object and assemble objects according to certain conditions (Suarti & Yunitasari, 2023). Systematically, this ability can improve preschool children's logical thinking skills at an early age.

For preschool children to be able to understand patterns effectively, they need a fun, meaningful, and contextual learning strategy. One of the approaches that is considered appropriate is to use *modeling*, which is the process of learning through direct emulation (Bartels, 2023; Kolb, 2015). This method allows preschool children to form the meaning of the activities they perform in real life and to interact directly with the surrounding environment (Phakamach et al., 2022). According to Bandura's theory of learning, modeling is the basis for learning new behaviors (Bandura, 2021). Modeling techniques aim to change, add, or decrease behavior by learning through direct observation (Asri et al., 2024). This new attitude can be formed through the involvement of the school, family, and community (Adekunle et al., 2023).

Modelling-based learning not only has a cognitive impact but also strengthens the social-emotional aspects of preschool children. Preschool children learn through social interactions and engagement, which supports the growth of empathy and the ability to work together (Blewitt et al., 2018; Cantor et al., 2019). The ability to cooperate is a component of the social-emotional field (Trismahwati & Sari, 2020). In this context, the ability to work together is an important variable that can strengthen the effectiveness of the modeling process. In the world of education, cooperative skills are an important ability to accelerate the learning process (Nur, 2019). Research shows that preschool children who have high cooperative abilities show better learning outcomes when engaged in modelling-based learning compared to preschool children who tend to be individualistic (Ho et al., 2025). This finding strengthens the view that preschool children's social character plays an important role in the success of observation-based learning. In early preschool education, cognitive and social development must go hand-in-hand (Ghosh, 2024). An integrated learning approach can help with both simultaneously. Designing educational activities that promote social interaction, such as teamwork, in addition to a logical attitude is crucial.

Open-nature-based activities designed with a modelling approach are able to improve understanding of preschool children's patterns and collaborative skills (Asri et al., 2024). These results are in line with the view that social-cognitive learning can occur more effectively through structured and meaningful interactions (Forestal & Finch, 2021). What makes this study different from previous research is its focus on how cooperative ability acts as a moderating factor in the relationship between modeling and pattern recognition. This perspective has rarely been explored, especially in the context of preschool education in Indonesia.

Method

This study used a quasi-experimental research method with a pretest-posttest control group design. This method is used to find the cause and effect between independent variables and bound variables (Jannah, 2018). The design used in this study is a nonrandomized pretest-posttest control group design, which is divided into two groups, namely the control group that did not receive intervention and the experimental group that received intervention.

Data collection was carried out by means of observation before and after the intervention through observation sheet instruments and observation sheets of cooperative ability that have been tested for validity and reliability through expert judgement tests and reliability tests between risks and documentation. The training design is described as follows:

Table 1. Research design

Subject	Pre-tests	Intervention	Post-tests
Experimental Group	R1	E	R3
Group Control	R2		R4

Information:
R1 = Pre-treatment measurements in the experimental group
R2 = Pre-treatment measurements in the control group
E = Treatment of experimental groups with modeling techniques
R3 = Post-treatment measurements in the trial group
R4 = Post-treatment measurements in the control group

Based on the ability to cooperate, the scale score range was categorized into three parts: low, medium, and high. The categories are shown in Table 2.

Table 2. Categories of ability to cooperative

Categories	Value Range
Low	5-10
Medium	11-15
High	16-20

Participant

The participants in this study were preschool children aged between 4 and 5 years. The selection of participants was carried out using non-randomized cluster sampling by bifurcating the data into groups (Adeoye, 2023) based on preliminary teacher assessments and observations. All preschool children included in the study had previously been introduced to basic pattern recognition activities but had not yet mastered them, often requiring prompts or assistance to complete simple pattern tasks.

Non-randomized cluster sampling was used. This is a method of simplifying the process of data collection whereby a population is divided into clusters (Ahmed, 2024). The study population was enrolled in a private kindergarten located in East Java, Indonesia. They were evenly divided into two groups: 15 preschool children in the experimental group and 16 in the control group. The experimental and control groups were determined based on kindergarten classes. This group was considered appropriate for the study because it represented a transitional stage in cognitive development, where interventions such as modeling could be effectively tested.

Procedure

In this study, the researcher used an experimental approach with a pretest and posttest control group design. There were two groups: an experimental group and a control group. Before administering a treatment, pretest data collection was carried out for each group (Jannah et al., 2023) to ensure any differences after the treatment rather than pre-existing differences between groups (Miller et al., 2021). The data taken in the pretest are pattern recognition ability and data on cooperative ability as a moderator variable. The given treatment was modeled. The type of modelling used is a multiple model by demonstrating directly by a researcher using a card or picture as a media (Ropiah et al., 2021). The researcher prepared the pattern that had been neatly cut and a piece of paper as a medium for attaching patterns. During the learning period, the researcher provided an example of how to arrange a pattern according to the instructions on the prepared piece of paper. Then, the researcher let the preschool children arrange a pattern according to the researcher's example. The last step is to give post-test pattern recognition ability to measure differences after the treatment.

Data Measurement

The data collection technique used was the Likert scale. The pattern recognition measurement tool used amounted to 18 items, of which 7 items measured the ability to recognize 2 different types of patterns, while the other 11 items measured the ability to recognize 3 types of patterns (Ummah et al., 2025). The ability to cooperate using scales from Ummah et al. (2025).

Data Analysis

The data analysis method used for the first purpose was an independent t-test to evaluate the differences between the two groups. The experimental and control groups' gain scores were the ones that were

used. For the second purpose, ANOVA was used. This calculation used a computer application called Jeffrey's Amazing Statistics Program (JASP) version 0.17.3.0.

Result

A comprehensive overview of the research participants involved in this study is systematically presented in Table 3. The purpose of this detailed tabulation is to provide a clear understanding of the diversity and characteristics of the individuals who contributed the data to this research.

Table 3. Subject description

Gender	Experiment Group	Control Group	Entire	Percentage
Boy	8	9	17	55%
Girl	8	6	14	45%
Entire	16	15	31	100%

Based on Table 3, the majority of subjects in this study were male, with a total of 17 people or equivalent to 55% of all research participants. Meanwhile, there were 14 female participants, accounting for 45% of the total subjects involved. This indicates a fairly balanced proportion between male and female participants, although males slightly dominated the composition of the research participants. This gender distribution provides a clearer picture of the sample characteristics, which is important for the further analysis of the variables tested in this experiment. In addition, the relatively proportional distribution between males and females can also help offer more diverse and representative insights into the study's findings by considering gender differences as a factor that may influence the results.

Table 4. Description of the experimental and control group data

Subject	Experimental Group			Subject	Control Group		
	Pre test	Post test	Gain Score		Pre test	Post test	Gain Score
A1	54	60	6	B1	55	58	3
A2	45	60	15	B2	59	60	1
A3	35	49	14	B3	21	21	0
A4	24	41	17	B4	42	40	-2
A5	33	52	19	B5	30	32	2
A6	36	53	17	B6	27	30	3
A7	45	60	15	B7	44	43	-1
A8	36	58	22	B8	58	60	2
A9	42	60	18	B9	48	51	3
A10	36	50	14	B10	46	48	2
A11	49	60	11	B11	42	43	1
A12	39	57	18	B12	37	37	0
A13	37	51	14	B13	39	42	3
A14	38	53	15	B14	33	35	2
A15	54	56	2	B15	25	26	1
				B16	49	47	-2
Average	40,20	54,67	14,47	Average	40,95	42,05	1,12

Based on data from Table 4, before treatment, the experimental group had an average score of 40,20 and after treatment, an average score of 54,67 with a gain score average of 14,47 which indicated that there was an increase in the pattern recognition ability. While the control group before treatment had an average score of 40,95 and after treatment, the average score 42,05 with a gain score average of 1,12 which indicated there was an increase in the pattern recognition ability, but not that significant, compared to the experimental group.

Table 5. Cooperative Ability Scores

Subject	Experimental Group	Categories	Subject	Control Group	Categories
A1	15	Medium	B1	11	Medium
A2	19	High	B2	16	High
A3	16	High	B3	14	Medium
A4	10	Low	B4	14	Medium
A5	12	Medium	B5	10	Low
A6	13	Medium	B6	17	High
A7	14	Medium	B7	13	Medium
A8	18	High	B8	11	Medium
A9	14	Medium	B9	16	High
A10	10	Low	B10	15	Medium
A11	17	High	B11	15	Medium
A12	16	High	B12	14	Medium
A13	15	Medium	B13	13	Medium
A14	13	Medium	B14	12	Medium
A15	17	High	B15	10	Low
			B16	13	Medium
Average	14,6			13,37	

Table 5 shows that in the experimental group, there were six data in the high category, seven data in the medium category, and two data in the low category. In the control group, there were 3 data in the high category, 11 data in the medium category, and 2 data in the low category.

Statistical tests were performed to determine if there was a difference in gain scores between the experimental and control groups. The results of the data analysis are shown in the table below:

Table 6. Independent sample t-test results

	T	df	p
Gain Score on Pattern Recognition Ability	10.002	29	< .001

Based on Table 6, the gain score pattern recognition ability is 10.002 with a p value of less than 0.001. This signifies that there is a difference between the gain score of the experimental group and the control group. The modeling intervention provides assumptions caused by these variations in profit scores. This calculation implies that modeling has a significant effect on early preschool recognition abilities.

Table 7. Descriptives cooperative ability the experimental group

	High	Medium	Low
Valid	6	7	2
Mean	17.167	13.714	10.000
Std. Deviation	1.169	1.113	0.000
Minimum	16.000	12.000	10.000
Maximum	19.000	15.000	10.000

Table 7 shows the distribution of cooperative abilities in the experimental group divided into three categories: high, medium, and low. In the high category, there were six subjects with an average score of 17.167 and a standard deviation of 1.169. The minimum score for this category is 16, and the maximum is 19. In the medium category, there were seven subjects with an average score of 13.714 and a standard deviation of 1.113. The minimum score in this category is 12, and the maximum is 15. Meanwhile, in the low category,

there were only two subjects with an average score of 10.000 and a standard deviation of 0.000, indicating that both subjects had the same score, namely 10, for both the minimum and maximum values. This data presentation provides a clearer picture of the distribution of cooperative abilities within the experimental group as well as the variation among subjects in each cooperative ability category.

Table 8. Anova results experimental group

				Preschool student's collaboration	
	Sum of Squares	df	Mean Square	F	p
Between Groups	318.233	2	159,117	50,917	<0,001
Residuals	37.500	12	3,125		

The results of the ANOVA test on the gain score pattern recognition skills based on the cooperative ability category showed an average value in the low category of 10.00, in the medium category of 13.714, and in the high category of 17.167 with an f value of 50.917 and a p value of <0,001. Because the p value is less than 0.05 (p<0.05), it can be concluded that there are differences in the average gain score pattern recognition skills based on the cooperative ability category in the experimental group.

Table 9. Post hoc tests

			95% Cl for Mean Difference				
Category	Category	Mean Difference	Lower	Upper	Std. Error	t	Sig.
High	Medium	4,500	1,876	7,124	0,983	4,576	0,002
	Low	14,500	10,649	18,351	1,443	10,046	<0,001
Medium	Low	10,00	6,219	13,781	1,417	7,055	<0,001

The results of the post hoc test on the experimental group using the Tukey test, which determines the differences in certain groups after significant results in the ANOVA are detected (Agbangba et al., 2024), show that the high category with the medium and low categories and the medium category with the low category have a sig. value of less than 0.05 (p <0.05). It s means that there were differences in the cooperative ability category in the average gain score pattern recognition skills in the experimental group.

Table 10. Descriptive Cooperative Ability the Control Group

	High	Medium	Low
Valid	3	11	2
Mean	16.333	14.583	10.000
Std. Deviation	0.577	5.035	0.000
Minimum	16.000	11.000	10.000
Maximum	17.000	30.000	10.000

Table 10 illustrates the distribution of cooperative abilities in the control group, which was divided into three categories: high, medium, and low. In the high category, there were three subjects with an average score of 16.333 and a standard deviation of 0.577. The minimum score for this category is 16, and the maximum is 17. In the medium category, there were 11 subjects with an average score of 14.583 and a relatively large standard deviation of 5.035. The minimum score in this category is 11, and the highest recorded score is 30, indicating a very wide range of values. Meanwhile, in the low category, there are only two subjects with an average score of 10.000 and a standard deviation of 0.000, which means both subjects have the same score of 10 for both the minimum and maximum values. This data presentation provides information about the variability of cooperative abilities within the control group, highlighting marked differences between the categories of cooperative abilities, especially in the medium category, which had a high standard deviation, indicating significant variations in the participants' scores within that category.

Table 11. Anova results control group

				Preschool student's collaboration	
	Sum of Squares	df	Mean Square	F	p
Between Groups	30,114	2	15,057	14,354	<0,001
Residuals	13,636	13	1,049		

The results of the anova test on the gain score pattern recognition skills based on the cooperative ability category showed an average value in the low category of 10.00, in the medium category of 14.583, and in the high category of 16,333 with an f value of 14.354 and a p value of <0,001. Because the p value is less than 0.05 (p<0.05), it can be concluded that there are differences in the average gain score pattern recognition skills based on the cooperative ability category in the control group.

Table 12. Post hoc tests

			95% Cl for Mean Difference				
Category	Category	Mean Difference	Lower	Upper	Std. Error	t	Sig.
High	Medium	1,818	0,057	3,580	0,667	2,726	0,043
	Low	5,000	2,531	7,469	0,935	5,348	<0,001
Medium	Low	3,182	1,103	5,261	0,787	4,041	0,004

The results of the post-hoc test on the control group using the Tukey test show that the high category with the medium and low categories and the medium category with the low category have a sig. value of less than 0.05 (p <0.05). s indicates that there were differences in the cooperative ability category in the average gain score pattern recognition skills in the control group.

Table 13. Independent samples t-test

	t	df	p
High Score Cooperative Ability	1.139	7	0.292

Table 13 shows that the t value is 1.139 with a p value of 0.292. Because the p value is greater than 0.05 (p>0.05), it indicates that there is no difference in the average value of pattern recognition skills with high cooperative ability values based on the group.

Table 14. Independent samples t-test

	t	df	P
Medium Score Cooperative Ability	0,847	16	0.410

Table 14 shows that the t value is 0,847 with a p value of 0.410. Because the p value is greater than 0.05 (p>0.05), it indicates that there is no difference in the average value of pattern recognition skills with medium cooperative ability values based on the group.

Discussion

The comparison of pre-test and post-test results between the two groups was analyzed using a statistical test on *the gain score*. The results of the analysis showed that there was a significant difference between the experimental and control groups, with a significance value (p) of < 0.001. This value is well below the significance limit of 0.05, indicating that the difference is statistically significant.

Based on these results, it can be concluded that modelling learning strategies have a real influence on improving pattern recognition skills in preschool preschool children. Preschool children in the experimental group showed a higher increase in scores than preschool preschool children in the control group. This strengthens the hypothesis that modelling is an effective method in supporting the development of preschool preschool children's cognitive abilities, especially in terms of recognizing patterns. In this context, the use of

visual media like patterns card or picture while giving a modelling can concrete stimuli, so the learning process with modelling can become more contextual and memorable for preschool children (Aliyah & Faridah, 2025).

Based on the above results, good preschool children's cooperative skills also have an effect on their pattern recognition skills in preschool children. Preschool children with high levels of cooperation showed higher gain scores, as supported by the post hoc ptukey test (Moore et al., 2024). Cooperative ability can act as a moderator to strengthen treatment (modelling) and pattern recognition skills. These activities involve mutual help, sharing of materials, and discussions, which foster a deeper understanding of patterns (Tarım, 2016). From a child development perspective, cooperative ability is an important part of early childhood social-emotional development (Blewitt et al., 2018). By working together, children are exposed to multiple perspectives in problem solving, which can improve their ability to identify and understand patterns well (Stephen et al., 2017).

Based on these theories, by working together, preschool children are exposed to a variety of perspectives in problem-solving that can improve their ability to identify and understand patterns well. Based on the results of this study, the level of cooperative skills has an influence on pattern recognition abilities. This is in line with the conclusion of Ho et al. (2025), which states that cooperative skills show the final results of the pattern form and help in understanding the pattern recognition process. Furthermore, in the context of modeling-based learning, collaboration not only supports cognitive learning but also strengthens the affective aspect through emotional and social engagement. This is in line with the integrated learning approach proposed by Cantor et al. (2019), where social and cognitive skills are developed simultaneously through active and meaningful learning.

This proves that collaboration remains an important aspect of long-term development. Although the direct effect of collaboration on pattern recognition is not significant, it is important to support a more complex and comprehensive long-term learning process. To encourage the development of cooperative skills among preschoolers, teachers must first understand tactics that suit their needs (van der Storm et al. 2021; Adekunle et al. 2023). Therefore, the learning process focuses on developing preschoolers' social skills.

The findings from this study indicate that the implementation of model-based learning strategies has a significant impact on pattern recognition skills in early childhood. This intervention not only enhances children's cognitive abilities in recognizing patterns but also strengthens their social skills through collaboration that occurs during the learning process. This is in line with research by Blewitt et al. (2018), which states that socio-emotional learning integrated with the development of cognitive skills, such as pattern recognition, can facilitate the holistic development of young children. Furthermore, the use of visual media such as pattern cards or images during modeling sessions provides concrete stimuli that help children understand and recall the concept of patterns more effectively. Therefore, educators should consider applying this method more broadly in the context of early childhood education, both in formal learning in kindergartens and group-based activities.

Although the results of this study demonstrate significant effectiveness, there are several limitations that need to be noted. First, the relatively short duration of the intervention may not be sufficient to observe long-term changes in children’s pattern recognition skills; therefore, further research with longer durations and repeated measurements is needed to observe the sustained impact of this method. Second, this study included only children from one type of educational institution, namely kindergarten, which may limit the generalizability of these findings to a broader population. Therefore, it is recommended to conduct follow-up research involving various types of educational institutions and different age groups, as well as paying attention to other external factors, such as parental support and social environment, that can affect children’s development. Further research combining modeling-based learning models with other approaches, such as group counseling or the use of digital media, may offer new insights into maximizing the developmental potential of early childhood (Tarım, 2016).

Conclusion

Based on data analysis, there was a significant increase in preschool children's pattern recognition abilities, as seen from their pattern recognition scores before and after the intervention. In addition, cooperative skills also influence the improvement of children's pattern recognition skills. The results of this study indicate that modeling-based instructional strategies have a significant impact on pattern recognition abilities and that cooperative skills can strengthen this effect. Therefore, educators should consider implementing modeling-based strategies in early childhood education, especially when introducing mathematical concepts and patterns that can support children’s cognitive development. Furthermore, promoting collaborative activities during

modeling sessions can enhance learning outcomes by strengthening social interactions and collaborative problem-solving.

Although the results of this study show significant effectiveness, there are some limitations. First, the relatively short duration of the intervention may not have been sufficient to observe long-term changes in children's pattern recognition skills. Therefore, further research with a longer duration and repeated measurements is required to assess the sustained impact of this method. Second, this study included only children from a single type of educational institution, specifically kindergarten, which may limit the generalizability of the findings to a broader population. The study also did not consider other external factors, such as parental support and the social environment, which could influence the outcomes of the intervention.

For future research, it is recommended to broaden the participant base to include various institutional backgrounds and age groups. Research can also be conducted with an extended intervention duration to observe the long-term effects of modeling-based instructional strategies. In addition, studies integrating other approaches, such as group counseling or the use of digital media, could offer new insights into maximizing the developmental potential of early childhood. Research involving external factors, such as parental support, as well as more holistic intervention approaches, could open the door to developing more effective and comprehensive instructional methods.

References

Adekunle, M., Rosemary, R., & Matsie, N. (2023). Social Sciences & Humanities Open Modelling secondary school students ' attitudes toward TVET subjects using social cognitive and planned behavior theories. *Social Sciences & Humanities Open*, *8*(1), 100478. https://doi.org/10.1016/j.ssaho.2023.100478

Adeoye, M. A. (2023). Review of sampling techniques for education. *ASEAN Journal for Science Education*, *2*(2), 87–94. https://ejournal.bumipublikasinusantara.id/index.php/ajsed

Agbangba, C. E., Sacla Aide, E., Honfo, H., & Glèlè Kakai, R. (2024). On the use of post-hoc tests in environmental and biological sciences: A critical review. *Heliyon*, *10*(3), e25131. https://doi.org/10.1016/j.heliyon.2024.e25131

Ahmed, S. K. (2024). How to choose a sampling technique and determine sample size for research: A simplified guide for researchers. *Oral Oncology Reports*, *12*(September), 100662. https://doi.org/10.1016/j.oor.2024.100662

Aliyah, H., & Faridah, I. (2025). Increasing children's interest in reading and writing through picture card teaching aids at RAM NU 168 Al Istiqomah Gresik. *Indonesia Journal of Education and Social Humanities*, *2*(March). https://doi.org/10.62945/ijesh.v2i1.476

Arvy, B. R. (2023). Pengenalan pola pada anak usia dini : Rancangan tugas dan aktivitas pendukung. *Journal on Education*, 6(1), 10019-10029. https://doi.org/10.31004/joe.v6i1.4672

Asri, N., Siswono, H., & Sugiarto, M. A. (2024). Penerapan teknik modeling untuk meningkatkan kedisiplinan anak usia dini di taman kanak-kanak. *Jurnal Pendidikan Anak Usia Dini*, 4(4), 1017–1028. https://doi.org/10.14421/njpi.2024.v4i4-9

Bandura, A. (2021). Analysis of modeling processes. *In Psychological modeling (pp. 1-62)*. Routledge.

Bartels, K. P. R. (2023). *Experiential learning : A relational approach to sustaining community-led social innovation*. *1610*. https://doi.org/10.1080/13511610.2022.2121268

Blewitt, C., Hons, B.P. S., Fuller-Tyszkiewicz, M., Nolan, A., Bergmeier, H., Vicary, D., Huang, T., & Mccabe, P. (2018). Social and emotional learning associated with universal curriculum-based interventions in early childhood education and care centers: A systematic review and meta-analysis. *JAMA Netw Open*, *1*(8), 1–19. https://doi.org/10.1001/jamanetworkopen.2018.5727

Cantor, P., Osher, D., Berg, J., Steyer, L., Rose, T., Cantor, P., Osher, D., Berg, J., Steyer, L., Rose, T., Cantor, P., & Osher, D. (2019). Malleability, plasticity, and individuality : How children learn and develop in context. *Applied Developmental Science*, *0*(0), 1–31. https://doi.org/10.1080/10888691.2017.1398649

Forestal, J., & Finch, J. K. (2021). Teaching the town hall: Incorporating experiential learning in a large introductory lecture course. *Journal of Political Science Education*, *17*(sup1), 116-129. https://doi.org/10.1080/15512169.2020.1725528

Ghosh, D. (2024). The impact of early childhood education on cognitive and social development. *International Journal For Multidisciplinary Research*, *6*(6), 1–2. https://doi.org/10.36948/ijfmr.2024.v06i06.34143

Ho, W. W. Y., & Lau, Y. H. Y. (2025). Role of reflective practice and metacognitive awareness in the relationship between experiential learning and positive mirror effects : A serial mediation model. *Teaching and Teacher Education*, 157 (2025), 104947. https://doi.org/10.1016/j.tate.2025.104947

Jannah, M. (2018). *Metode penelitian kuantitatif untuk psikologi*. Unesa University Press.

Jannah, M., Widohardhono, R., & Kencana, N. T. (2023). Progressive muscle relaxation: Can it reduce competitive anxiety?. *Physical Education Theory and Methodology*, *23*(5), 662–667. https://doi.org/10.17309/tmfv.2023.5.02

Kolb, D. A. (2015). *Experiential learning: Experience as the source of learning and development* (2nd ed). . Pearson.

Miller, C. J., Smith, S. N., & Pugatch, M. (2021). Experimental and quasi-experimental designs in implementation research. *Psychiatry Research*, *8*(1), 1–20. https://doi.org/10.1016/j.psychres.2019.06.027

Montague-Smith, A., Cotton, T., Hansen, A., & Price, A. J. (2018). *Mathematics in early years education (4th ed.)*. Routledge. https://doi.org/https://doi.org/10.4324/9781315189109

Moore, A. M., Fairhurst, P., Bennett, J. M., Harrison, C., Correia, C. F., & Durk, J. (2024). Assessment and practical science: identifying generalizable characteristics of written assessments that reward and incentivise effective practices in practical science lessons. *International Journal of Science Education*, *46*(7), 643–669. https://doi.org/10.1080/09500693.2023.2253366

Nur, K. R. (2019). Peningkatan kemampuan kerjasama melalui model. *Jurnal Pendidikan Guru Sekolah Dasar*, *7*, 695–705. https://journal.student.uny.ac.id/ojs/index.php/pgsd/article/download/15014/14557

Phakamach, P., Senarith, P., & Wachirawongpaisarn, S. (2022). The Metaverse in Education: The Future of Immersive Teaching & Learning. *RICE Journal of Creative Entrepreneurship and Management*, *3*(2), 75–88. https://www.ricejournal.net/index.php/rice/article/view/54

Qin, Y., Yue, A., Zhang, Y., & Zhang, X. (2024). Dietary diversity and development among early childhood children in rural China. *Frontiers in Public Health*, 12, 1485548. https://doi.org/10.3389/fpubh.2024.1485548

Ropiah, S., Kenedi, A., & Hakim, N. M. L. (2021). Implementasi teknik modeling untuk meningkatkan kemampuan sosial anak usia dini. *Jurnal Keguruan Dan Ilmu Pendidikan*, *1*(2), 574–580.

Stephen, M. F., Graesser, A., Greiff, S., Griffin, P., Gong, B., Kyllonen, P., Massey, C., O'Neil, H., Pellegrino, J., Rothman, R., & Davier, H. S. A. von. (2017). *Collaborative problem solving: Considerations for the national assessment of educational progress.* Alexandria VA, Unknown/Unspecified: National Center for Education Statistics.

Suarti, S. & Yunitasari, S. E.. (2023). Gambaran Kemampuan Mengenal Pola pada Anak Usia Dini melalui Pemanfaatan Pembelajaran Berbasis Alam. *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, *6*(12), 10406-10411. https://doi.org/10.54371/jiip.v6i12.3367

Tarım, K. (2016). Effects of Cooperative Group Work Activities on Pre-school Children's Pattern Recognition Skills. *Educational Sciences: Theory & Practice*, *15*(6), 1597–1604. https://doi.org/10.12738/estp.2016.1.0086

Trismahwati, D. & Sari, N. I. (2020). Identifikasi kemampuan kerjasama anak usia dini melalui permainan tradisional. *Azzahra: Jurnal Pendidikan Anak Usia Dini*, 1(2), 1-20. https://staidarussalamlampung.ac.id/ejournal/index.php/azzahra/article/view/204

Ulni, E. K. (2021). Pengembangan model pembelajaran sorting predict-think discovery untuk meningkatkan kemampuan mengenal pola abstrak. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *5*(1), 303–314. https://doi.org/10.31004/obsesi.v5i1.576

Ummah, I., Fitri, R., & Jannah, M. (2025). The effect of experiential learning on the ability to recognize patterns and cooperation in children aged 4-5 years. *Studies in Philosophy of Science and Education*, 6(1), 47-54. https://doi.org/10.46627/sipose.v6i1.582

van der Storm, L., van Lissa, C. J., Lucassen, N., Helmerhorst, K. O. W., & Keizer, R. (2021). Maternal and paternal parenting and child prosocial behavior: A meta-analysis using a structural equation modeling design. *Marriage & Family Review*, *58*(1), 1–37. https://doi.org/10.1080/01494929.2021.1927931