



The Influence of the PnP and NHT Cooperative Learning Models on Natural and Social Sciences (IPAS) Student Learning Outcomes in Elementary Schools

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Abstract

The students' low learning outcomes suggest they struggle to grasp the material, likely due to boredom and passivity in class. To address this, teachers need innovative learning models that engage students actively. This study aimed to assess the impact of Picture and Picture (PnP) and Numbered Head Together (NHT) Cooperative Learning Models on fourth-grade students' learning outcomes in Natural Sciences and Social Sciences. Using a quasi-experimental method in two classes, the researcher found that in the first class, the average difference between using PnP and NHT was 17.62 points, while in the second class, the average difference was 21.19 points. Both classes show that PnP values are higher than NHT. The results of the t-test analysis show that in the two schools, there is a significant difference between the average score of PnP and NHT group (sig. values 0.005 and 0.006), so it is assumed that PnP is more effective than NHT. The research indicates that employing picture-based learning can significantly enhance learning outcomes compared to methods lacking visual aids. In conclusion, there is a difference in students' learning outcomes in the Natural and Social Sciences (IPAS) subjects for fourth-graders of the State Elementary School of Kutowinangun 07 and State Elementary School of Kutowinangun 01 using PnP and NHT. The lack of direct media in the NHT class hindered understanding and effectiveness. In contrast, the PnP class's use of visually stimulating picture media enhanced engagement and learning outcomes. Students were more focused and participative, leading to significant improvements compared to other similar learning models.

Keywords:

Cooperative Learning, PnP, NHT, Natural and Social Sciences (IPAS)

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Abstrak

Rendahnya hasil belajar siswa menunjukkan bahwa mereka kesulitan memahami materi, kemungkinan karena kebosanan dan kepasifan di kelas. Untuk mengatasi hal tersebut, guru memerlukan model pembelajaran inovatif yang melibatkan siswa secara aktif. Penelitian ini bertujuan untuk mengkaji pengaruh Model Pembelajaran Kooperatif Picture and Picture (PnP) dan Numbered Head Together (NHT) terhadap hasil belajar siswa kelas IV pada mata pelajaran IPAS. Dengan menggunakan metode kuasi eksperimen pada dua kelas, peneliti menemukan bahwa pada kelas I, selisih rata-rata penggunaan PnP dan NHT sebesar 17,62 poin, sedangkan pada kelas II selisih rata-ratanya sebesar 21,19 poin. Kedua kelas tersebut menunjukkan nilai PnP lebih tinggi dibandingkan NHT. Hasil analisis uji t menunjukkan bahwa pada kedua sekolah terdapat perbedaan yang signifikan antara rata-rata nilai kelompok PnP dan NHT (nilai sig. 0.005 dan 0.006), sehingga diasumsikan PnP lebih efektif dibandingkan NHT. Penelitian menunjukkan bahwa penerapan pembelajaran berbasis gambar dapat meningkatkan hasil belajar secara signifikan dibandingkan dengan metode yang tidak menggunakan alat bantu visual. Kesimpulannya, terdapat perbedaan hasil belajar siswa pada mata pelajaran Ilmu Pengetahuan Alam dan Ilmu Pengetahuan Sosial (IPAS) siswa kelas IV SD Negeri Kutowinangun 07 dan SD Negeri Kutowinangun 01 dengan menggunakan metode PnP dan NHT. Kurangnya media langsung di kelas NHT menghambat pemahaman dan efektivitas. Sebaliknya, penggunaan media gambar yang merangsang secara visual di kelas PnP meningkatkan keterlibatan dan hasil pembelajaran. Siswa lebih fokus dan partisipatif sehingga menghasilkan peningkatan yang signifikan dibandingkan model pembelajaran sejenis lainnya.

Kata Kunci:

Pembelajaran Kooperatif, PnP, NHT, Ilmu Pengetahuan Alam & Sosial (IPAS)

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INTRODUCTION

The Merdeka Curriculum is a curriculum with diverse intra-curricular learning where the content will be more optimal so that students have enough time to delve into concepts and strengthen competencies. In the Merdeka Curriculum, there is a renewal of the previous curriculum; one of the innovations is to form two subjects, namely Science and Social Studies, into IPAS (Natural and Social Sciences) (Sugih et al., 2023). According to Elmi (2023), IPAS education in elementary schools focuses on building basic science literacy. IPAS is the foundation students use to prepare themselves to study more complex natural and social sciences in junior high school (Alfatonah et al., 2023).

Natural and Social Sciences (IPAS) is a discipline that focuses on understanding living beings and inanimate objects in this universe and interactions among them. It involves the study of individual human life as social beings by integrating various other knowledge logically and systematically, including analysis of cause and effect (Komariah et al., 2023). When studying their surroundings, elementary school students can observe and experience natural and social events as a whole. Students are trained to observe and explore, which is an important foundation before they learn about deeper concepts and topics in Science and Social Sciences subjects they will study in junior high school (Rahmayati & Pastowo, 2023).

Additionally, the IPAS framework integrates the study of natural sciences with social sciences to provide understanding to students. Thus, it can be understood that IPAS studies discuss the surrounding environment, including phenomena occurring around humans, the universe, and its relation to social life (Lestari et al., 2022).

Based on observations conducted in the fourth grade of the State Elementary School of the State Elementary School of Kutowinangun 07 and the State Elementary School of Kutowinangun 01, Salatiga City, Central Java, in the second semester of the academic year 2023/2024, it was found that the learning process applied was predominantly conventional, centered on the teacher, and

students became passive. The learning condition was less enjoyable due to the lack of innovative learning models and students' lack of motivation to learn. This condition resulted in students lacking confidence, less focus, being busy chatting with other classmates, and some students often feeling sleepy in class. This certainly affects students' learning outcomes, as evidenced by the school's failure to achieve the Minimum Completeness Criteria (KKM) set, especially in IPAS learning.

Then, based on observations of students, it was uncovered that some students had difficulty understanding the material explained by the teacher, felt bored, and tended to be passive because the learning was teacher-centered. Therefore, it impacted students' learning outcomes. With this situation, students found it difficult and boring to receive IPAS material. Students were not accustomed to developing their potential, so they could not think creatively and independently, making them lazy and bored during lessons. IPAS, or Natural and Social Sciences, is a subject that includes studies on science and social aspects, including studies on nature, technology, environment, geography, history, and culture.

Departing from the problem described above, one effort that can be made to overcome it is to choose a suitable learning model. Learning models play an essential role in the learning process, expanding and deepening the material and facilitating teachers in delivering the material (Mansur et al., 2021). Enjoyable learning processes are inseparable from the selection of the right learning models. If the learning model chosen is unsuitable for the class or environment, students will feel bored and lazy and pay less attention to the teacher. Learning models that can be used to improve student learning outcomes are cooperative learning models, such as Picture and Picture and Numbered Head Together.

The Picture and Picture (PnP) cooperative learning model is one group learning model that uses interesting pictures. The PnP cooperative learning model is a learning model that uses pictures to explain the material and facilitate students to actively learn because it has active, creative, innovative, and enjoyable characteristics (Daswati, 2020). The PnP cooperative learning

model presents the material with the help of visual media so that the material received by students is not only abstract material but also is proven with pictures and can stimulate students' motivation to learn and express opinions concretely (Merici et al., 2019). The PnP cooperative learning model can make a subject matter more interesting and useful because students can build their knowledge through various activities, such as arranging and sorting pictures into logical sequences.

Another cooperative learning model that can be applied is the Numbered Head Together (NHT) type. The NHT cooperative learning model is a learning model that involves many students studying the material of a subject and checking students' understanding of the subject matter; this learning model will enhance cooperation among students (Sulaksana et al., 2021). The NHT learning model allows students to share ideas and consider the most appropriate answers. Implementing the NHT learning model will allow students to learn through playing, competing, and collaborating in teams (Sulastri, 2020).

The PnP and NHT cooperative learning models are cooperative learning strategies designed to activate the active participation of students and promote deeper understanding through cooperation among students. The PnP cooperative model aims to facilitate cooperation between pairs of students and promote better understanding through discussion and joint information processing. At the same time, the main goal of NHT is to encourage active participation of each group member and ensure uniform understanding among them (Erita, 2017). Both aim to activate student participation, but the approach, work structure, material acceptance, interaction style, and main goals to be achieved are different (Febriani et al., 2023; Hayati & Prima, 2023).

This research is supported by several previous studies such as research by Hanggara et al. (2019) that stated that the NHT cooperative learning model influences student learning outcomes. Specifically, NHT is considered effective when compared to conventional models. This research implies that NHT is effective in increasing learning motivation and critical thinking skills during

learning as well as improving student learning outcomes.

Another research group found that this type of PnP was also effective across multiple timelines. For example, a study carried out by Daryanti & Taufina (2020) and Dahlia et al. (2021) uncovered that the PnP cooperative learning model can improve learning outcomes. Those are in line with research conducted by Fadjarajani et al. (2020), Habibi & Adnan (2021), and Lokat et al. (2022) that exposed the significant influence of using the PnP cooperative learning model on student learning outcomes. In addition, Wahyudi et al. (2023) exhibited an influence of the PnP cooperative learning model on student learning outcomes in the State Elementary School of Menteng 5. In general, PnP is considered effective when compared to conventional models.

Furthermore, other research shows that the PnP model tends to be appropriate for use in science subjects. According to Khotimah & Jaelani (2019), the PnP cooperative learning model in science learning has a significant influence. Research conducted by Handayani et al. (2017) also showed that applying the PnP cooperative learning model can improve science learning outcomes explicitly in fifth-grade students. Furthermore, research by Saputri (2018) revealed that the PnP cooperative learning model can improve the learning outcomes of sixth-grade students in natural science subjects.

Both two cooperative models are also used to enhance certain characteristics and are effective when combined with certain media. For example, research by Sudewiputri & Dharma (2021) concludes that the NHT learning model effectively improves student motivation and learning outcomes. Rozi et al. (2021) also demonstrated that the PnP learning model could improve children's learning through media of picture and Hidayatullah et al. (2024) employ puzzle. Picture and other visual media have their advantage and make students more enjoy when learning.

However, lack of studies comparing the two cooperative learning models. Among these few is a study conducted by Sulaksana et al. (2021) concluded that the implementation of the NHT cooperative learning model is more effective in elementary school social

studies learning. Meanwhile, Utami et al. (2024) concluded that the NHT cooperative learning model is more suitable for improving learning outcomes in IPAS subjects in elementary school students compared to other models.

Based on the previous research above, while several studies state that the PnP cooperative learning model is superior, several other studies assert that the NHT cooperative learning model is superior. To prove which cooperative learning model is superior among the PnP and NHT, this study aims to determine the effect of applying the PnP and NHT cooperative learning models on the learning outcomes of IPAS subjects in fourth-grade elementary school. With this learning model, it is expected that students can improve their learning outcomes because in a game atmosphere, students can learn without feeling burdened, and teachers can also deliver material according to the goals to be achieved.

METHODS

This type of research is quantitative, using a quasi-experimental design with a Nonequivalent Control Group Design. The independent variables in this study were the PnP and NHT cooperative learning models. In contrast, the dependent variable in this study was the IPAS learning outcomes of fourth-grade elementary school students. The research instrument consisted of observations with cognitive indicators (knowledge, understanding, application, analysis, creation, and evaluation), effective indicators (reception, response, and determination of value), and psychomotor indicators (fundamental movement, generic movement, ordinative movement, and creative movement), written tests in the form of pre-test and post-test questions comprising ten multiple-choice questions and ten essay questions on the IPAS subject, specifically the topic of plant growth-material—plant sources of life, as well as documentation.

In addition, the subjects in this study were 21 fourth-grade students of the State Elementary School of the State Elementary School of Kutowinangun 01 and 17 fourth-grade students of the State Elementary School of Kutowinangun 07. In each school, two learning models were applied: PnP and NHT

cooperative learning models. The sampling technique employed was simple random sampling. The research data were analyzed using prerequisite tests, namely, normality test, homogeneity test, mean difference test, and t-test (Independent Sample test) utilizing SPSS 20. This study hypothesizes that the PnP cooperative learning model has a significantly greater effect than the NHT cooperative learning model in fourth-grade IPAS learning (H_a). Meanwhile, H_0 states that the PnP cooperative learning model does not have a significantly greater effect than the NHT cooperative learning model in fourth-grade IPAS learning.

RESULTS AND DISCUSSION

Result of the Experimental Process

In the implementation class of the two models, the PnP model predominantly uses images or pictures while the NHT model uses more discussion. Both seem to increase student engagement. As seen in Figure 1 and Figure 2.



Figure 1. Control Class Learning Activities



Figure 2. Experimental Class Learning Activities

The analysis of learning outcomes data for the State Elementary School of Kutowinangun 01 and the State Elementary School of Kutowinangun 07 utilizing SPSS version 20 is as follows.

Table 1. Descriptive Statistical Analysis of the State Elementary School of Kutowinangun 07 Result

	N	Min	Max	Mean	Std. Dev.
Pre-test PnP	17	40	70	61.76	10.744
Post-test PnP	17	70	100	81.76	8.650
Pre-test NHT	17	30	70	50.59	12.485
Post-test NHT	17	40	100	64.12	14.168
Valid N (listwise)	17				

Based on Table 1, the first test scores at the State Elementary School of Kutowinangun 07 before the application of PnP and NHT cooperative learning models with the pre-test showed that the average scores of both classes were still in the low category below the Minimum Criteria Mastery (KKM), which is below the score of 75. Then, in the second test, after applying the PnP cooperative learning model, the post-test results exhibited improved learning outcomes with scores exceeding the KKM, with an average score of 81.76. Meanwhile, in the classes with the application of the NHT learning model, there was no significant improvement in student learning outcomes, as the scores remained below the KKM, with an average score of 64.12.

Table 2. Descriptive Statistical Analysis of the State Elementary School of Kutowinangun 01 Result

	N	Min	Max	Mean	Std. Dev.
Pre-test PnP	21	50	80	62.14	9.562
Post-test PnP	21	75	95	85.24	5.804
Pre-test NHT	21	20	70	46.67	14.606
Post-test NHT	21	40	85	64.05	13.930
Valid N (listwise)	21				

Table 2 displays that the first test scores at the State Elementary School of Kutowinangun 01 before the application of PnP and NHT cooperative learning models

with the pre-test revealed that the average scores of both classes were still in the low category below the Minimum Criteria Mastery (KKM), which is below the score of 75. Then, in the second test, after applying the PnP cooperative learning model, the post-test results showed improved learning outcomes with scores exceeding the KKM, with an average score of 85.24. In comparison, in the classes with the application of the NHT learning model, there was no significant improvement in student learning outcomes, as the scores remained below the KKM, with an average score of 64.05.

Table 3. Normality Test

Statistic	Kutowinangun 07	Kutowinangun 01
	<i>Sig (2-tailed)</i>	0.135
Sig. Level	0.05	
Conclusion	Normal	Normal

The prerequisite for data to be normally distributed is if $\text{sig} > 0.05$. Conversely, data are not normally distributed if $\text{sig} < 0.05$. The sig (2-tailed) values for both the State Elementary School Kutowinangun 07 and Kutowinangun 01 were greater than 0.05 ($0.135 > 0.05$ and $0.144 > 0.05$), indicating that both datasets were normally distributed.

Table 4. Homogeneity Test

Statistic	Kutowinangun 07	Kutowinangun 01
	<i>Sig (2-tailed)</i>	0.649
Sig. Level	0.05	
Conclusion	Homogeneous	Homogeneous

The criteria for adequacy are if $\text{sig} > 0.05$, the variance of the data groups is homogeneous, whereas if $\text{sig} < 0.05$, the variance of the data groups is different (non-homogeneous). Based on Table 3, the sig (2-tailed) values for both the State Elementary School Kutowinangun 07 and Kutowinangun 01 were greater than 0.05 ($0.649 > 0.05$ and $0.117 > 0.05$). This means the data obtained came from the same group variance (homogeneous).

Table 5. Mean Difference Test of Learning Models

Class	Learning Model		
	PNP	NHT	Differences
Kutowinangun 07	81.76	64.12	17.62
Kutowinangun 01	85.24	64.05	21.19

The mean test aimed to determine which learning model significantly affected student learning outcomes based on their average scores. In Table 4, for the State Elementary School of Kutowinangun 07, with the application of the PnP cooperative learning model, the average student score was 81.76. With the application of the NHT learning model, the average student score was 64.12. In comparison, for the State Elementary School of Kutowinangun 01, with the application of the PnP cooperative learning model, the average student score was 85.24. With the application of the NHT learning model, the average student score was 64.05. Based on the average score obtained from the application of both learning models, in the application of the PnP cooperative learning model, the average student score is superior to the application of the NHT learning model. Thus, applying the PnP cooperative learning model has a significantly greater effect than the NHT learning model in fourth-grade IPAS learning at the State Elementary School of Kutowinangun 07 and Kutowinangun 01.

Table 6. Hypothesis Test

Statistic	Kutowinangun 07	Kutowinangun 01
<i>Sig (2-tailed)</i>	0.005	0.006
Sig. Level	0.05	
Conclusion	Sig (2-tailed) < 0.05= H_0 rejected; otherwise= H_a accepted.	

The decision-making for the hypothesis is if the sig (2-tailed) value is < 0.05, H_0 is rejected, and H_a is accepted, whereas if the sig (2-tailed) value is > 0.05, H_0 is accepted, and H_a is rejected. Based on the hypothesis test results, the sig (2-tailed) values obtained for the State Elementary School Kutowinangun 07 and Kutowinangun 01 were 0.005 and 0.006. The sig (2-tailed) values are < 0.05, where $0.005 < 0.05$ and $0.006 < 0.05$. Therefore, H_a

was accepted (the PnP cooperative learning model had a significantly greater effect compared to the NHT learning model in fourth-grade IPAS learning. Meanwhile, H_0 was rejected (the PnP cooperative learning model did not have a significantly greater effect compared to the NHT learning model in fourth-grade IPAS learning.

Discussion

This study aims to determine the effect of implementing the PnP and NHT cooperative learning models on the learning outcomes of fourth-grade elementary school students in the IPAS subject. The cooperative model is a learning strategy emphasizing student cooperation in achieving learning goals.

The results of this study indicate that both PnP and NHT cooperative learning models improved student learning outcomes compared to conventional learning. Specifically, applying the PnP cooperative learning model significantly improves student learning outcomes more than the NHT cooperative learning model.

The result is relevant to Habibi & Adnan (2021), Lokat et al. (2022), and Wahyudi et al. (2023) that revealed a significant influence of the PnP cooperative learning model on student learning outcomes. The impact was as significant as the findings of Fadjarajani et al. (2020) and Rozi et al. (2021) that the PnP learning model can enhance children's learning outcomes with the assistance of visual media. Image or picture media has its attractiveness, making students more interested in learning.

In the context of IPAS, a subject which still contains a lot of combined concepts of science and social science material, needs to be assisted with visualization images, the PnP model is still relevant. It is in line with Saputri (2018) and Khotimah & Jaelani (2019) which revealed that the PnP cooperative learning model can improve science learning outcomes. This research contributes a new finding since the PnP model is still effective not only in the science context but also expanded with IPAS.

In fact, this research also found that NHT can improve students' achievements supporting Hanggara et al. (2019) and Sudewiputri & Dharma (2021). However, it is not effective enough to exceed the stated

criteria of completeness. The results of this research are also a challenge as a comparison to Sulaksana et al., (2021) where the counter results show that PnP is more effective than NHT. It can be influenced by several other factors and the lesson material is thought to be one of them.

Compared to previous research, the novelty of this study is that it combined two cooperative models with different advantages to maximize learning benefits. Previous studies generally focused only on one learning model, PnP or NHT. Additionally, this study conducted a more in-depth analysis of the effects of PnP and NHT cooperative learning models on various aspects of learning outcomes, such as conceptual understanding, problem-solving skills, and learning motivation. Previous studies mostly focused on specific aspects of learning outcomes, such as conceptual understanding. This study integrates creative and dancing activities, such as drawing and discussions, into the PnP and NHT learning models, thereby increasing student engagement in IPAS learning.

As such, this study provides practical recommendations for elementary school teachers to implement PnP and NHT cooperative learning models to improve IPAS learning outcomes. Also, this study contributes theoretically to understanding the effectiveness of cooperative learning models in elementary school IPAS learning. This study has several innovative points compared to previous research (Komariah et al.,2023); thus, it is expected to contribute significantly to the literature on cooperative learning models and improve learning practices, particularly enhancing student learning outcomes in elementary school IPAS learning.

For future research, the development of research on the effects of the PnP and NHT cooperative learning models on student learning outcomes can be expanded by applying them to other subjects and levels to test their effectiveness more broadly. Researching the effectiveness of PnP and NHT models on more complex topics can be done.

Other cognitive aspects, such as critical and creative thinking skills as well as non-cognitive aspects, such as attitudes toward science and social skills also could be an alternative in-depth exploration to those

models as well as following the trend of integrating PnP and NHT models with learning technologies such as online learning platforms and educational apps can enhance student engagement and interaction.

The development of this research is expected to provide a more comprehensive understanding of the effectiveness of PnP and NHT models in various contexts. More specific practical recommendations exist for teachers in implementing PnP and NHT models. A significant theoretical contribution is provided to the literature on cooperative learning models.

CONCLUSION

Based on the results of the data analysis conducted, according to the hypothesis testing with the Independent Sample t-test, sig (2-tailed) values of 0.005 and 0.006 were obtained. The sig values (2-tailed) are < 0.05 , where $0.005 < 0.05$ and $0.006 < 0.05$, thus rejecting H_0 and accepting H_a . This means that the Picture and Picture cooperative learning model has a more significant effect than the NHT cooperative learning model in teaching IPAS to fourth-grade elementary school students.

The implications of this study include, for teachers, that the Picture and Picture (PnP) and Number Head Together (NHT) cooperative learning models can improve student learning outcomes and encourage group discussions and question-and-answer sessions. It can enhance learning motivation and engagement for students and improve conceptual understanding, communication skills, and cooperation. For schools, it provides alternative innovative and creative teaching models.

Several recommendations for future research related to the development of research on the influence of Picture and Picture and Numbered Head Together cooperative learning models on student learning outcomes are provided as follows. (1) Applying the PnP and NHT cooperative learning models to other subjects in elementary, junior high, and senior high schools to test their effectiveness more broadly; (2) Researching the effectiveness of the PnP and NHT cooperative learning models on more complex topics; (3) Analyzing the influence of the PnP and NHT cooperative

learning models on other cognitive aspects, such as critical and creative thinking skills; (4) Investigating the influence of the PnP and NHT cooperative learning models on non-cognitive aspects, such as attitudes toward science and social skills; (5) Integrating the PnP and NHT cooperative learning models with learning technologies such as online learning platforms and educational apps to enhance student engagement and interaction.

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