The Effectiveness of the Problem-Based Learning Model Assisted by Mind Mapping in Natural and Social Sciences Subjects (IPAS)

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Abstract: Natural and Social Sciences (IPAS) education in Indonesia has emerged and evolved through various changes in accordance with the conditions and needs of the Indonesian nation. The aim of this research is to examine the effectiveness of the Problem-Based Learning (PBL) model assisted by Mind Mapping in Grade IV at SDN Kalibanteng Kidul 01, Semarang City, for the Social Studies subject focusing on Indonesia's rich culture. The research employs a quasi-experimental design. The study population consists of all Grade IV students from SDN Kalibanteng Kidul 01, Semarang City, for the 2023/2024 academic year, with a total of 81 students. This population is divided into an experimental class (Grade IV A) and a control class (Grade IV B). The average posttest score of the experimental class was higher than that of the control class, with the experimental class scoring 81.60 and the control class scoring 60.17. The t_{table} value was found to be 1.701. With this, it can be concluded that H_0 is rejected. H_a is accepted because the t-test < 0.05, namely $0.000 < 0.05$ and $t_{count} > t_{table}$, namely $6.362 > 1.701$. Although the results of the analysis of the difference in pretest and posttest scores obtained a t-count of 5.682 with a significance level of 0.000. Even though ttable is 1.701 with a significance level of 0.000. With this, it was concluded that H_0 was rejected and H_a was accepted because the t-test < 0.05, namely $0.000 < 0.05$ and $t_{count} > t_{table}$, namely $5.682 > 1.701$. Thus, it is concluded that the Problem-Based Learning model assisted by Mind Mapping in Grade IV at SDN Kalibanteng Kidul 01, Semarang City, has a significant impact on improving students' learning outcomes in Social Studies compared to the control class.

Keywords: Learning Outcomes; Mind Mapping; PBL Model

Introduction

Education, in its broadest sense, refers to schools. This mechanism plays a role for those in the position of students, including school students or university students (formal educational institutions). Educator Ki Hajar Dewantara's famous principles include "Ing Ngarso Sung Tulodo" (leading by example), "Ing Madyo Mangun Karso" (inspiring and building motivation from the middle), and "Tut Wuri Handayani" (supporting and encouraging from behind) (Putri Febrianti, 2023). Education is a crucial aspect in nurturing and shaping the younger generation. The

quality of education must be improved so that every individual can thrive in this era, and thus everyone should possess 21st-century skills (Mutia & Alberida, 2022). As an educational body focused on enhancing teaching quality, it is essential to develop 4C skills. The 4C skills include creative thinking, critical thinking and problem-solving, communication, and collaboration (Septikasari & Frasandy, 2018). Education plays a significant role in an individual's life. It is a means to advance all aspects of human life, including economic, social, technological, security, skills, moral values, welfare, culture, and others (Nurhidayat & Nana, 2020). Education can produce a more prepared and skilled generation to compete in the globalization era. It can also

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serve as a benchmark for improving a country's quality through human resource utilization. Education is an essential component for improving the living standards of the Indonesian people (Ladaria et al., 2020). Education is critical for national or state development; without education, there is a risk that the nation will lag behind others (Herdiansyah & Kurniati, 2020).

(Tamarli, 2017) The more students are taught to think critically during classroom instruction, the more their knowledge and experience in solving problems both inside and outside the classroom will improve. Consequently, it is the educator's responsibility to foster critical thinking in their teaching process. Teaching is the leadership of the educational process for a group. Teaching involves the transfer of knowledge, skills, attitudes, and learning criteria (Dadri et al., 2019). Teachers play a crucial role in learning as they must not only provide information to students but also create a pleasant and energetic learning environment. Educators need new methods, including creating proper plans, designs, and examples to stimulate learning. Implementing a scientific approach to learning is recommended (Pahlevi et al., 2018).

Based on preliminary survey results conducted by the researcher at SDN Kalibanteng Kidul 01, Semarang City, with the Grade IV teacher, it was indicated that the learning outcomes of Grade IV students were below the Minimum Competency Criteria (KKM). The KKM value at SDN Kalibanteng Kidul 01, Semarang City, is low. Educators lack imaginative and creative learning visions. The teaching design for Social Studies includes lectures, discussions, and Q&A sessions. However, teachers predominantly use the lecture method, with less emphasis on discussion and Q&A, leading to a lack of engagement from students and a teacher-centered approach. It may appear that in the educational process, students pay minimal attention to the material presented by the teacher, engaging in off-task behaviors like talking with classmates or handling stationery, which makes it difficult for students to concentrate on learning.

From this phenomenon, it can be observed that different teaching models can affect students' learning techniques. Therefore, the choice of teaching methods should be versatile and appropriate based on their effectiveness. One such teaching model that can be applied is Problem-Based Learning (PBL). In the teaching process, methods and teaching models are closely related and both play crucial roles.

One of the teaching models is Problem-Based Learning (PBL). PBL is a learning module where students are required to address real-world problems they encounter during a given period (Widiasworo, 2018). It is believed that students are more motivated to learn when their learning is based on actual problems. Providing problems to students before the learning

process begins allows them to examine, interpret, and find solutions.

Problem-Based Learning (PBL) is a problem-based teaching method designed to train students to learn and work in groups to find solutions, think critically and analytically, and seek out and use appropriate learning resources. The PBL method or problem-solving approach involves presenting students with a problem or an open-ended issue that can be conceptually resolved (Hotimah, 2020). The advantages of implementing PBL include more active learning in the classroom, where students focus their attention and thoughts on the specified problem, and can participate in group discussions related to the problem, thus developing problem-solving skills. However, not all groups can utilize presentations due to time constraints, and some students may participate passively in learning due to inadequate preparation (Lesi & Nuraeni, 2021).

In Social Studies (IPAS), particularly with content about the cultural diversity of Indonesia, there is a lot of material that needs to be understood by students. To ensure that the material is easily comprehended, an engaging and interesting teaching method is needed. One such method that can be used to support effective communication of the material is mind mapping.

One of the main themes of the Merdeka Curriculum in improving Indonesia's basic education system is the integration of Science (IPA) and Social Studies (IPS) with Natural Sciences and Social Sciences (IPAS). According to Purnawanto (2022), this integration is based on the view that elementary school students perceive everything as part of a whole. This approach is still in a simple/concrete and comprehensive stage but has not yet reached the level of detail. It is hoped that by combining IPS and IPA subjects, students will gain a unified understanding of both natural and social environments. Social Studies (IPS) is one of the subjects taught in elementary schools (Mawarni et al., 2024). IPS is a field that studies various social sciences and humanities, explaining aspects of social, cultural, geographical, historical, and economic life for elementary students. According to Hilmi (2017), the goal of IPS is to develop good citizens who can understand differences and solve problems consistently, supported by information and facts. Setiawati (2018) states that IPS is organized systematically, comprehensively, and integratively in learning, leading to societal maturity and success in life. Pratiwi (2020) adds that the main objective of IPS is to develop students' potential, make them sensitive to community issues, respond positively to existing inequalities, and address both personal and societal problems.

An ideal teaching model is one that reviews effective learning experiences, meaning experiences that

allow students to directly and actively engage in the learning environment (Rokhayati et al., 2020).

According to Rahayu (2021), a mind map is a technique or method for aligning the right or left brain to receive new information. Mind mapping is a way to organize explanations in the brain and retrieve them from it. Mind maps allow individuals to store information using symbols, images, emotional meanings, and colors (Wati, 2022). The mind mapping teaching method makes the learning environment more engaging, thereby stimulating students' interest in learning (Rofisian, 2020). However, Novioleta et al. (2020) note that learning through mind mapping makes the process more enjoyable and less boring, and students are more creative when using mind mapping. Integrating mind mapping into the PBL syntax is expected to provide a focused and effective problem-solving activity to achieve learning objectives under the guidance of the teacher (Tri Pudji Astuti, 2019). According to Rofisian (2020), the mind mapping teaching method can create a more enjoyable learning atmosphere and stimulate students' interest in the learning process. Students are encouraged to create mind maps based on their imagination and knowledge of the taught material. The steps in mind mapping are: (1) communicating competencies and briefly explaining the learning material, (2) dividing students into groups to create mind maps, (3) students create mind maps in groups, (4) students present their discussion results in front of the class, (5) summarizing the ongoing learning, and (6) providing evaluation at the end of the study. Iswati (2021) mentions that mind maps have both advantages and disadvantages. The advantages of mind maps include: (1) freedom of expression; (2) ability to collaborate with others; (3) more concise and clear notes; (4) notes are more focused on the material; (5) easier to see the overall picture; (6) faster review; (7) helps the brain measure, remember, and make connections. The disadvantage of mind maps is that only actively involved students participate, and not all students engage fully in the learning process.

Efforts to enhance student motivation and further develop their creative thinking skills should be supported by the use of new and creative teaching models aimed at identifying students' creative thinking potential. The application of creative teaching models should encourage students who are disinterested in school and guide them to communicate their ideas effectively, thereby achieving the desired competencies (Hughes, 2019). Successful learning is characterized by active engagement between teachers and students, creating a meaningful learning environment (Apriyani et al., 2023).

Suwaib et al. (2020) conducted a study titled "The Implementation of Problem-Based Learning Model Assisted by Mind Mapping to Enhance Activity and Learning Outcomes in Social Studies for Grade IV Students of SD Negeri 002 Sebatik Utara, Nunukan District." Their research found that the application of the PBL model assisted by Mind Mapping significantly improved both teacher activity in Social Studies instruction and the cognitive learning outcomes of Grade IV students at SD Negeri 002 Sebatik Utara, Nunukan District. This improvement was evident from the increase in the percentage of classical learning mastery from 76.19% in cycle I to 95.24% in cycle II, based on the established KKM (Minimum Competency Criteria).

Another study on Mind Mapping was conducted by Ridwanulloh et al. (2022), titled "The Effect of Problem-Based Learning Assisted by Mind Mapping on Self-Directed Learning in Elementary School Students." The results indicated that PBL with the assistance of mind mapping improved students' self-directed learning. The PBL model encouraged students to participate in group discussions and problem-solving, making them more active and communicative. Mind mapping facilitated problem-solving because it is a simple and easily understandable method for students.

Based on this explanation, the researcher is interested in conducting a study titled "The Effectiveness of the PBL Model Assisted by Mind Mapping in Grade IV at SDN Kalibanteng Kidul 01, Semarang City."

Method

SDN Kalibanteng Kidul 01, located at Jalan WR. Supratman X No. 22-23, Kalibanteng Kidul, Semarang Barat, Semarang City, Central Java, is the data collection site for the 2023/2024 academic year. This research is an experimental study, using a quasi-experimental design. The form of the quasi-experimental design used is the nonequivalent control group design. The study population consists of all Grade IV students at SDN Kalibanteng Kidul 01 for the 2023/2024 academic year, totaling 81 students, with each class having approximately 28 students, forming the study population. Sampling was done using saturated sampling because the population and the sample were the same, using two classes: Grade IV A as the experimental class and Grade IV B as the control class.

The PBL model assisted by mind mapping serves as the independent variable, while learning outcomes are the dependent variable. Educational tools, discussion sheets, and test sheets are instruments used for data collection. Data collection methods include question-and-answer sessions, documentation, and assessment of learning objectives. Data analysis techniques include test analysis (validity, reliability, difficulty level, and

discrimination index) and analysis of student learning outcomes (homogeneity, normality, scores, and hypothesis testing).

Result and Discussion

The essence of the research on the PBL model assisted by mind mapping in Social Studies (IPAS) with the topic "Indonesia's Rich Culture" for Grade IV students at SDN Kalibanteng Kidul 01, Semarang City, lies in the learning outcomes achieved in both the cognitive (knowledge) and psychomotor (skills) domains. This study is based on the implementation of a pretest for both the experimental and control groups. After the pretest, the classes were divided, with Grade IV A selected as the experimental group receiving PBL with the assistance of Mind Mapping, while Grade IV B served as the control group receiving traditional teaching methods such as lectures, discussions, and question-and-answer sessions. At the end of the study, students in each class were given a posttest. The outcomes of this research include the assessment of mind maps and students' learning results, referred to as pretest and posttest scores, along with the gain score (the comparison between pretest and posttest scores). Information about the research includes the results obtained from the pretest and posttest for both classes, which can be seen in the following table:

Table 1. Results of Pretest and Posttest Scores for the Experimental and Control Classes

Learning Outcomes	Experiment IV A		Control IV B	
	Pretest	posttest	Pretest	Posttest
Haighest Value	80	100	75	90
Lowest Value	35	55	35	40
Averrage	58.39	81.60	53.21	60.17

Based on the table 1, it can be concluded that the learning outcomes of students in the experimental class showed improvement in the posttest scores, achieving 81.60, compared to the pretest score of 58.39. In contrast, the control class had posttest scores of 60.17, an increase from the pretest score of 53.21. After receiving the treatment, only 6 out of 28 students in the experimental class initially achieved the Minimum Competency Criteria (KKM) set by SDN Kalibanteng Kidul 01, Semarang City, which is ≥ 75. In the Social Studies subject, after the treatment, 23 out of 28 students in the experimental class achieved a perfect score in the posttest.

For the control class, only 2 out of 28 students initially reached the KKM of ≥ 75. However, in the posttest, 7 out of 28 students in the control class achieved

the KKM. Based on this explanation, it can be observed that the implementation of the PBL model assisted by Mind Mapping significantly improved learning outcomes, with most students in the experimental class reaching the desired level of proficiency. On the other hand, the control class, which used traditional methods, still had some students struggling to reach the learning outcomes or KKM set by the school. The next section is a summary of the pretest and posttest (gain score) for both the experimental and control classes.

Table 2: Pretest and Posttest Differences (Gain Score) for Experimental and Control Classes

Class	Average Score		N-Gain Value	Criteria
	Pretest	Posttest		
Experiment	1635	2285	0.5682	Quite effective
Control	1490	1685	0.1343	Not effective

The table 2 shows the differences between pretest and posttest results. Generally, the pretest score for the experimental class was 16.35, and the posttest score was 22.85, resulting in an average gain of 56.82. In comparison, the control class had an average pretest score of 14.90 and an average posttest score of 16.85, yielding a difference of 13.43. Based on this conclusion, it is evident that students who received the PBL model assisted by mind mapping showed a more significant improvement in their learning outcomes compared to those in the control class, which used a lecture-based method. Therefore, the use of the PBL model supported by mind mapping for Social Studies (IPAS) on the topic of "Indonesia's Rich Culture" can enhance students' learning outcomes.

Table 3: Results of t-Test and t-Test Gain Score (Differences)

Class	t count	Level of Significance	t table
Posttest Value	6.362	0.000	1.701
Gain Score (difference)	5.682	0.000	1.701

According to the analysis of the posttest t test, the t count is 5.682 with sig. (0.000) while the t table is 1.701. So, it can be concluded that H_0 is rejected, H_a is accepted because t-test> 0.05, namely 0.000> 0.05 and t_{count}> t_{table}, namely 6.362> 1.701. Although the gain score description obtained t count 5.682 with sig. 0.000. Finally, t_{table} 1.701 and sig 0.05 were obtained. Because it is known that the acquisition, Ha is accepted, H_0 is rejected because t-test <0.05, namely 0.000 <0.05 and t_{count}> t_{table}, namely 5.628> 1.701. It can be concluded that there is an influence of the use of the PBL learning model accompanied by Mind Map on the learning outcomes of

class IV students of SDN Kalibanteng Kidul 01, Semarang City. From this study, it can be concluded that the effectiveness of the PBL learning model assisted by Mind Map in class IV SDN Kalibanteng Kidul 01 Semarang City in the subject of Science with the topic of Indonesia is rich in culture.

The Problem Based Learning model is a form of learning that provides real-world experiences, encourages students to take the initiative in learning, creates knowledge, and integrates learning in school and real life naturally (Al-Fikry et al., 2018). Mind mapping represents various learning processes that use images to understand the relationships between words as a supportive learning tool. Mind maps are an excellent example of how they enhance human memory (Hikmawati, 2020).

Conclusion

Based on the discussion in the study, it can be concluded that the effectiveness of the PBL model assisted by Mind Mapping in Grade IV at SDN Kalibanteng Kidul 01, Semarang City, has a significant impact. The experimental class, which received the treatment, showed meaningful improvements in learning outcomes compared to the control class, which used the lecture method. Generally, the average learning outcome for the experimental class in the posttest was 81.60, while the control class had an average of 60.17. This indicates that the experimental class, using the Problem-Based Learning (PBL) model assisted by Mind Mapping, significantly outperformed the control class that used traditional lecture methods. It can be concluded that the use of the PBL model assisted by Mind Mapping is much more effective, as it improves understanding, skills development, and problem-solving abilities during the learning process. Based on the research findings, the following recommendations are provided: 1. Schools are encouraged to use PBL with mind mapping as an alternative model for Social Studies (IPS) or other subjects. 2. To improve student learning outcomes, it is necessary to test the effectiveness of PBL-assisted mind mapping in other subjects. 3. Future experimental research should consider varying PBL models or other approaches to make learning more engaging and to avoid student boredom. 4. A challenge encountered during the experiment was that students did not fully understand or know how to use mind mapping effectively, requiring extra time to explain it. Therefore, future researchers should pay closer attention to time management and student creativity in the use of mind mapping.

Author Contributions
Diah Ayu Safira contributed to conducting the research, creating, analyzing, and writing the article. Teguh Supriyanto served as the advisor for the research activities and article preparation.

Conflicts of Interest
The author declares that there are no conflicts of interest.

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