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The Effect of Jigsaw Cooperative Learning on the Fourth Grade Students' Collaborative Skill and Science Literacy in Science Learning

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Abstract

This study aims to determine the effect of jigsaw cooperative learning on the fourth grade students' collaborative skill and science literacy in science learning. The research was a quasi-experimental method with non-equivalent control group design. Classes IV A and B SDN 21 Tanjungpandan were selected as the experimental group, while IV A and B SDN 30 Tanjungpandan were the control group. The results indicate that the jigsaw cooperative model significantly impacts collaboration and science literacy skills with a significance value of 0.000 (Manova test, significance level 0.05). The results of this study show that the jigsaw cooperative learning model significantly impacts students' collaboration and science literacy skills in science learning in fourth grade. This study is expected to enrich theoretical studies on the application of the jigsaw cooperative learning model in the context of IPAS learning, as well as contribute to improving science literacy and collaboration as 21st century skills.

Keywords: *collaborative skill, jigsaw cooperation, science literacy*

Introduction

The Merdeka Curriculum, now known as the National Curriculum, is a curriculum that must be implemented in all schools in Indonesia. The Merdeka Curriculum offers various types of learning outside the classroom, giving students enough time to understand concepts and improve their abilities (Fauzi, 2022). This curriculum is expected to overcome weaknesses in education and lead to the development of students' potential and competencies (Simbolon *et al*., 2024). Education must be carefully adapted to meet the demands of the contemporary era (Dikdik *et al*., 2025). One of the implementations of the Merdeka Curriculum is the combination of science and social studies into one subject called IPAS. The IPAS subject aims to improve science literacy and enhance students' understanding of natural and social phenomena (Wijayanti & Ekantini, 2023).

Science literacy refers to a set of scientific skills that enable individuals to interpret natural phenomena, collect new data, and draw conclusions based on existing information (Limiansih *et al*., 2024). Furthermore, science literacy means deeply understanding the nature of science, recognizing how science and technology affect the world physically, intellectually, and culturally, and actively participating in scientific issues (Nudiati, 2020). Effective science education in elementary schools should stimulate students' interest in science, develop a deep understanding, and improve critical thinking skills (Pangestu *et al*., 2024).

In today's era of globalization, collaboration skills are important for students. Collaboration skills are the skills of students in working as a team and being able to appreciate the various opinions of group members in order to achieve predetermined goals (Mansur *et al*., 2022). The ability to work together is key to effective learning; these collaborative skills are needed in the world of work and education (Masruroh & Arif, 2021). Collaboration skills are included in the four core competencies (4Cs) along with creativity, critical thinking, and communication (Trilling & Fadel, 2009).

Despite the objectives of the Merdeka Curriculum, the implementation of IPAS learning still faces critical challenges. Students often show low engagement and limited participation in grasping key concepts, which hampers the development of their conceptual mastery (Shasliani *et al*., 2023). Classroom disruptions and lack of focus further exacerbate the problem, leading to learning outcomes that do not meet the minimum mastery criteria (Yeni *et al*., 2020). In addition, many students fail to achieve the expected competencies due to insufficient motivation and difficulties in responding to the lessons provided by teachers (Mustajab *et al*., 2023; Ramadani *et al*., 2023). These conditions indicate that IPAS learning has not yet fulfilled its intended role in enhancing students' scientific literacy and conceptual understanding. Consequently, there is an urgent need for effective learning strategies supported by systematic evaluation procedures to improve student achievement (Banawi *et al*., 2023).

To address these challenges, teachers must adopt learning strategies that allow students to achieve the intended learning objectives (Darmawati & Mustadi, 2023). Learning models provide essential frameworks for structuring classroom activities in order to meet these objectives (Fajrin *et al*., 2021). Among various models, cooperative learning—particularly the jigsaw type—has the potential to improve students' engagement and conceptual understanding. The jigsaw model encourages each group member to contribute actively by sharing knowledge, skills, ideas, attitudes, and capacities, thereby fostering collaboration and deeper learning (Asmara, 2020).

The jigsaw model is designed to foster students' sense of responsibility not only for their own learning but also for the learning of their peers. In this model, students are required not only to master the assigned material but also to be prepared to explain and teach it to other members of their group (Slavin, 2018). The cooperative jigsaw approach consists of two types of groups: the home group and the expert group (Savage & Armstrong, 1996). In its implementation, the learning material is divided into several sections, and each student is assigned one section according to their ability to study within the expert group. Afterwards, they return to their home group to share and teach the material to their peers (Slavin, 1980).

Such a structure can be particularly beneficial in IPAS learning, where students are expected to understand and connect both scientific and social phenomena. By engaging in collaborative knowledge sharing, students not only strengthen their own conceptual mastery but also develop communication, critical thinking, and collaborative skills. This process helps overcome issues of low motivation, passive participation, and limited conceptual understanding that have been identified in IPAS classrooms. Therefore, the jigsaw model holds strong potential as an effective learning strategy to enhance both cognitive and social dimensions of student learning outcomes.

Previous studies have demonstrated that the jigsaw cooperative learning model is effective in enhancing various 21st-century skills, such as students' collaboration and communication abilities (Akbar, 2022; Indrawan *et al*., 2021; Sutarto, 2023), critical thinking skills (Ali *et al*., 2024; Ibrahim *et al*., 2023; Saputra *et al*., 2019), problem-solving skills (Utomo *et al*., 2020), and creative thinking skills (Dewanto *et al*., 2023; Nurmalia *et al*., 2020). In addition, the jigsaw model has been shown to improve students' mathematical abilities (Poerwati *et al*., 2021) as well as overall learning outcomes (Kahar *et al*., 2020; Latumakulita *et al*., 2023; Odja, 2023; Rosvadiana *et al*., 2023; Seto *et al*., 2021; Widayanti, 2019).

Although numerous studies have demonstrated the effectiveness of the jigsaw model in enhancing 21st-century skills such as collaboration, communication, and critical thinking, most of these studies have been conducted in non-IPAS subjects or at the secondary education level. Research specifically examining the impact of the jigsaw model on scientific literacy and collaboration in IPAS learning at the elementary school level, particularly in the Indonesian context, remains limited.

Given these conditions, it is important to explore the application of the jigsaw cooperative learning model in IPAS classrooms at the elementary school level. This study seeks to fill the research gap by examining how the jigsaw model can improve students' scientific literacy and collaboration skill. The findings are expected to provide meaningful contributions to the development of effective learning strategies in IPAS and offer practical insights for teachers in enhancing student engagement and achievement within the framework of the Merdeka Curriculum.

Research Methods

This study employed a quantitative approach with a quasi-experimental research method. The research design used was a non-equivalent control group design, consisting of two groups: an experimental group and a control group. In this design, the researcher provided treatment to the experimental group (Creswell, 2009). The sampling technique applied was non-probability sampling, specifically purposive sampling. SD Negeri 21 Tanjungpandan and SD Negeri 30 Tanjungpandan were selected as research sites because they share similar student characteristics and have teachers with comparable teaching experience. The data were analyzed using MANOVA.

Results and Discussion

1. Results

This study employed a MANOVA test to determine whether the jigsaw cooperative learning model had an effect on students' collaboration skills and scientific literacy. The decision criterion for the MANOVA test was that if the significance level was less than 0.05, the null hypothesis (Ho) would be rejected and the alternative hypothesis (Ha) would be accepted.

Hypotheses

Ho : There is no significant effect of the jigsaw cooperative learning model on students' collaboration skills and scientific literacy.

Ha : There is significant effect of the jigsaw cooperative learning model on students' collaboration skills and scientific literacy.

Table 1. Manova Tests

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power[d]
Kelas	Pillai's Trace	0,631	33,818	6,000	440,000	0,000	202,905	1,000
	Wilks' Lambda	0,375	46.129[b]	6,000	438,000	0,000	276,775	1,000
	Hotelling's Trace	1,645	59,777	6,000	436,000	0,000	358,663	1,000
	Roy's Largest Root	1,634	119.849[c]	3,000	220,000	0,000	359,547	1,000

Based on the results of the multivariate tests, it can be concluded that the implementation of the jigsaw cooperative learning model had a significant effect on students' collaboration skills and scientific literacy. The multivariate tests of Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root all showed a significance value of 0.000, which is lower than 0.05.

In addition, the MANOVA test also provided the Tests of Between-Subjects Effects, which serve to confirm that the jigsaw cooperative learning model indeed had a significant influence on both variables measured. The results of the Tests of Between-Subjects Effects are presented as follows:

Table 2. Tests of Between-Subjects Effects

Tests of Between-Subjects Effects								
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[c]
Corrected Model	Scientific Literacy	12481.161[a]	3	4160,387	12,664	0,000	37,991	1,000
	Collaboration Skill	1315.656[b]	3	438,552	115,170	0,000	345,509	1,000
Intercept	Scientific Literacy	799455,018	1	799455,018	2433,457	0,000	2433,457	1,000
	Collaboration Skill	31801,612	1	31801,612	8351,541	0,000	8351,541	1,000
Kelas	Scientific Literacy	12481,161	3	4160,387	12,664	0,000	37,991	1,000
	Collaboration Skill	1315,656	3	438,552	115,170	0,000	345,509	1,000
Error	Scientific Literacy	72275,821	220	328,526				
	Collaboration Skill	837,732	220	3,808				
Total	Scientific Literacy	884212,000	224					
	Collaboration Skill	33955,000	224					

The results of the Tests of Between-Subjects Effects showed that the implementation of the jigsaw cooperative learning model had a significant effect on both variables, with a significance value of 0.000 for collaboration skills and 0.000 for scientific literacy. Therefore, Ho is rejected and Ha is accepted, indicating that the jigsaw cooperative learning model has a significant effect on students' collaboration skills and scientific literacy.

2. Discussion

The jigsaw cooperative learning model had a significant effect on students' collaboration skills. This finding is consistent with previous studies, which reported a positive influence of the jigsaw cooperative learning model on students' collaboration skills (Raditya *et al*., 2023). The jigsaw cooperative learning model has a significant effect on individual learning within groups (Chang & Benson, 2020). Each member plays a vital role, and the success of the group depends on the contributions of all its members. This structure encourages students to support one another, value different perspectives, and work collaboratively toward common goals (Astuti, 2025). Cooperative learning also promotes the development of organizational and planning skills in dividing group tasks (Cohen & Lotan, 2014). The jigsaw model is specifically designed to foster students' sense of responsibility not only for their own learning but also for the learning of their peers. Students are expected not only to master the assigned material but also to be prepared to present and teach it to other group members (Slavin, 2018; Wati & Anggraini, 2019). Furthermore, positive interactions among students in cooperative learning foster constructive interdependence, which in turn cultivates teamwork skills and social empathy (Johnson & Johnson, 2009).

This finding is consistent with previous research, which indicated that the jigsaw cooperative learning model can enhance students' scientific literacy (Hariyati, 2023). The ability to explain scientific phenomena is a fundamental aspect of scientific literacy, as it reflects the extent to which students understand scientific principles and are able to communicate them rationally (OECD, 2023). Cooperative learning approaches such as the jigsaw model encourage students to actively engage in discussions and articulate their understanding verbally, making the concepts learned more meaningful. Furthermore, the ability to design and evaluate scientific experiments represents a higher-order scientific skill that is crucial in shaping students as problem solvers (Bybee, 2013). Group activities in cooperative learning provide opportunities for students to participate in experiment planning and critical discussions of the results, directly fostering these abilities. Scientific literacy not only requires conceptual understanding but also the

ability to apply knowledge in real-life contexts and to take scientifically responsible action (Holbrook & Rannikmae, 2009).

Conclusion

Overall, the findings of this study demonstrate that the jigsaw cooperative learning model is effective in improving both collaboration skills and scientific literacy among elementary school students. The model not only fosters active participation and shared responsibility within groups but also strengthens students' ability to explain scientific phenomena, plan experiments, and critically discuss results. These outcomes align with previous research highlighting the benefits of the jigsaw model in promoting 21st-century skills such as communication, critical thinking, and problem solving. Importantly, this study extends the application of the jigsaw model to the context of IPAS learning in Indonesian elementary schools, where research remains limited. Thus, the results provide valuable empirical evidence that the jigsaw cooperative learning model can serve as an effective instructional strategy to address current challenges in IPAS education and to support the objectives of the Merdeka Curriculum.

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