Literature Review: Student's Collaboration Skills in Science Learning

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Abstract: Collaboration skills are one of the skills that are needed in 21st Century learning. The research method used is a literature study that examines collaboration skills in science learning. A total of 15 articles that examine collaboration skills are collected and then analyzed so as to get recommendations regarding literature studies. The results of the study can be concluded that applying several learning models such as problem-based learning (PBL), Project-Based Learning (PjBL) can increase productivity, efficiency, and quality of teamwork results. In addition to learning models, the right teaching materials can affect the ability of collaboration skills in science learning. The types of teaching materials that should be used are STEM and discovery-based teaching materials.

Keywords: Collaboration skills; science learning; learning model

Introduction

Collaboration skills are one of the important competencies in the 21st century learning framework (Sufiyah, F and Wijaya, B.F., 2024). This competency involves the ability to work together, share responsibilities, organize tasks, and reach a common understanding in a team or group context. Collaboration skills help students learn and adapt to change, and develop students' character and potential through teamwork. However, a common challenge in the field is the low level of student collaboration, where group tasks are often done by only one or two people, while other members do not contribute actively. 21st century learning is learning designed for learners to be able to keep up with the times. The rapid development of science and technology requires the younger generation to have a variety of skills that are contained in the 21st century learning.

Advanced technology makes information from various sources accessible easily and quickly by anyone and from anywhere. Collaboration activities can also be carried out easily, anytime and anywhere with this 21st century learning (Aripin et al., 2020). Collaboration in groups allows learners to participate in a democratic data analysis process to improve critical thinking skills and collaboration skills (Lusk & Conklin, 2003). Furthermore, the social interaction and mentoring that occurs between peers during collaboration can motivate to continue learning. This is in accordance with Vygotsky's learning theory which emphasizes the need for collaboration so that learning is not fully implemented by an individual. Debates and discussions among peers in the classroom can enhance the learning experience and allow groups to socially construct their own concepts and knowledge with guidance from an educator. Collaboration between learners provides opportunities for learners to work together to solve problems. Thus, learners perceive the

educator's role as a facilitator, organizing the learning, and assisting reflection (Duane & Satre, 2014).

Collaboration skills are skills that build good relationships with others to achieve the same goals in a group. According to Laelasari, et al. (2017), collaboration skills refer to the ability to communicate dialogically to exchange opinions, ideas, or ideas.

Collaboration skills for students are a design to develop group cooperation in the science learning process which will later be used as a reference to be able to compete, the existence of effective collaboration will create competitiveness for students. Collaboration skills will run well if several learners participate actively in group work (Redhana, 2019). Collaborative learning can bring many added values for learners and teachers. According to Marisda & Handayani (2020), collaborative learning is a learning skill where learners of varying levels work together in small groups of learners helping each other towards one goal.

The purpose of this research is to provide an overview of collaboration skills in science learning. This research will examine various types of learning media and learning models that can improve students' skills in science learning.

Collaboration skills in science education have several shortcomings that need to be addressed. First, many studies do not consider the local context, making the results potentially inapplicable universally. Second, the measurement of collaboration skills is often not comprehensive, relying on instruments like surveys without direct observations that could provide deeper insights. Third, definitions of collaboration skills vary across studies, complicating the comparison of results. Fourth, many studies overlook group dynamics, such as the roles of members in collaboration, which can significantly impact outcomes. Fifth, aspects of student motivation are often not taken into account, even though intrinsic and extrinsic motivation can greatly influence student participation in group tasks. Addressing these shortcomings is crucial for developing more effective learning strategies that support the development of students' collaboration skills.

Method

This research is included in the literature study. The type of data collected is secondary data from previous research results from various types of articles that are in accordance with the theme of collaboration skills in science learning. The data obtained is then collected, analyzed and concluded so as to get recommendations regarding literature studies. The research targets are articles that examine collaboration skills in science learning at both elementary and junior high school

levels. In this study found 15 *(fifteen)* appropriate articles published in the last 5 years.

Result and Discussion

The use of student worksheets (LKPD) based on scientific principles and the STEM (Science, Technology, Engineering, and Mathematics) approach has been shown to significantly enhance students' collaborative skills. Research by Marisda & Handayani (2020) indicates that learning integrating STEM components encourages students to collaborate in solving real-world problems, thereby improving their communication and teamwork skills. Additionally, a study by Redhana (2019) suggests that LKPD designed with a scientific approach not only facilitates the understanding of scientific concepts but also promotes more active interaction among students. Through these collaborative activities, students learn to share responsibilities, discuss ideas, and complete tasks together, all of which are key elements in developing collaboration skills. Concrete evidence from the research shows that students engaged in learning based on scientific LKPD and STEM experience improvements in critical thinking and social skills, which are essential in the context of 21st-century learning.

The research results are presented in 2 tables that display the journals analyzed. Table 1 displays the results of the research including the year of publication of the article, journal name, and type of publication. Table 2 will display the results of the literature review analysis including article titles, research designs and research results.

Table 1. indexed journal publications

No	Year	Journal Name	Amount Of Article	Sinta
1	2024	*Journal of Education for All*	1	Jurnal Nasional
2	2021	*Jurnal Karya Ilmiah Guru*	1	Sinta 3
3	2020	*Jurnal Pendidikan dan Pembelajaran Kimia*	1	Sinta 4
4	2022	*Jurnal Cakrawala Pendas*	1	Sinta 3
5	2023	*Academy of Education Journal*	1	Sinta 4
6	2023	*Jurnal Pendidikan dan Pembelajaran Biologi*	1	Sinta 3
7	2023	*Jurnal Pendidikan*	1	Sinta 5

		dan Konseling		
8	2021	*Reflection Jurnal*	1	Jurnal Nasional
9	2023	*Jurnal Pendidikan Indonesia*	1	Sinta 2
10	2020	*Educate Jurnal Teknologi Pendiidkan*	2	Jurnal Nasional
11	2024	*Jurnal Karya Ilmiah Guru*	1	Sinta 3
12	2022	*Jurnal Ilmu Pendidikan*	2	Sinta 2
13	2024	*Jurnal Pemikiran dan Pengembangan Pembelajaran*	1	Jurnal Nasional
14	2023	*Journal of Elementary Education*	1	Sinta 3
15	2020	*Jedagogia Jurnal Ilmu Pendidikan*	1	Jurnal Nasional

Table 2. Data Analysis Results of Research Articles

No	Title Of Article	Method	Findings
1	Pengembangan Lembar Kerja Peserta Didik IPA Berbasis Model *Project Based Learning* untuk Meningkatkan Keterampilan Kolaborasi dan Komunikasi Peserta Didik Kelas VII	*Research and Development*	The results showed that the application of Project Based Learning in science learning increased students' collaboration skills.
2	Pengaruh Model PjBL terhadap Keterampilan Kolaborasi Siswa pada Pembelajaran IPA di Kelas V	Quasi experimen	The Project Based Learning model affects the ability of student cooperation (collaboration) in science learning in class V.
3	Efektivitas LKPD Berbasis *Discovery Learning* untuk Meningkatkan Keterampian Kolaborasi dan Penguasaan Konsep Peserta Didik	Quasi experimen	The application of discovery learning-based LKPD and conventional LKPD shows significant differences in science learning collaboration skills. The activities in the developed science learning worksheet
4	Kelayakan LKS Pembelajaran IPA Berbasis STEM untuk Meningkatkan Keterampilan Kolaborasi Siswa SD/MI	Research and Development	Implementation of class action research on the application of project-based learning models in improving collaboration skills, self-regulation abilities and creative thinking skills in student biology learning in class XII IPA XYZ School, North Jakarta.
5	Penerapan Model Pembelajaran *Project- Based Learning* dalam Meningkatkan Keterampilan Kolaborasi, Kemampuan Regulasi Diri dan Keterampilan Berpikir Kreatif pada Pembelajaran Biologi Pada Siswa SMA Kelas XII IPA	*Classroom Action Research*	The collaboration skills of students in class XI MIPA 1 are in the very good category with the application of the Project Based Learning model.
6	Analisis Keterampilan Kolaborasi siswa SMA pada Pembelajaran Biologi	Pendekatan Kuantitatif	Science learning experiences positive changes after learning is carried out in groups or collaboration using the teacher's room application.
7	Meningkatkan Keterampilan Kolaborasi dalam Pembelajaran IPA Menggunakan Aplikasi Ruang Guru Pada Siswa SDN Mayangan 1	deskriptif kualitatif	The application of cooperative learning model type group investigation can improve the communication and collaboration skills of science learning of fifth grade students of SD Kanisius Jomegatan.
8	Peningkatan Keterampilan Komunikasi dan Kolaborasi dengan Menggunakan Model Pembelajaran Kooperatif Tipe Group Investigation Materi IPA pada	Classroom Action Research	The application of cooperative learning model of group investigation type can improve communication and collaboration skills in science learning for fifth grade students of SD Kanisius

	Siswa Kelas V SD Kanisius Jomegatan		Jomegatan.	15	Profil Keterampilan Kolaborasi pada Mahasiswa Rumpun Pendidikan MIPA	Deskripti f Kuantitat if	Based on the information provided, the research findings show that Mathematics and Natural Sciences Education students at one of the universities in Surakarta have very high collaboration skills.
9	Penerapan Pembelajaran IPA Melalui *Project Based Learning* Berbasis Kontekstual untuk Meningkatkan Nilai Kognitif dan Kolaborasi Siswa Kelas V di SDN Bulugunung I Tahun Pelajaran 2022/2023	Classroo m Action Research	Classroom action research shows an increase in cognitive scores and student collaboration in science learning grade V SDN Bulugunung I.				
10	Pengaruh Model Pembelajaran *Team Games Tournament* (TGT) terhadap Keterampilan Kolaborasi Peserta Didik pada Pembelajaran Geografi SMA	*Quasi Eksperime nt*	This study shows that there is an effect of Team Games Tournament (TGT) learning model on students' collaboration skills in geography learning in high school.				
11	Pengaruh PjBL terhadap Keterampilan kolaborasi Siswa pada Pembelajaran IPA di Kelas V	Deskripti f Kuantitat if	The research findings show that the PjBL model affects students' cooperation skills.				
12	Pengembangan E-LKPD untuk Meningkatkan Kolaborasi Siswa SMP pada Pembelajaran IPA	*Education al Design Research*	The findings of this study show that the collaboration skills of students at SMP Negeri 1 Wuluhan are still low.				
13	Peningkatan Keterampilan Kolaborasi dengan Penggunaan Aplikasi PhET Simulasi dalm Pembelajaran IPA SMP	Deskripti f Kuantitat if	The findings of this study indicate that the application of the PhET simulation application can improve students' collaboration skills.				
14	Pengembangan Modul Pembelajaran IPA Berbasis *Project Based Learning* untuk Meningkatkan Kemampuan Kolaborasi Siswa Kelas 5 SD/ MI	Research and Develop ment	The PjBL-based science learning module to improve students' collaboration skills is declared effective based on the results obtained in the field test, namely individual test, small group test, and large group test, there are differences in the results of the initial observation and final observation.				

Based on the table above, it is obtained that the use of scientific-based media and LKPD, STEM, and discovery learning-based E-LKPD is proven effective in improving collaboration skills. Example: STEM-based LKPD for seventh grade students resulted in a significant improvement with a very good validity value. The use of E-LKPD in science learning based on the Plomp model improves collaboration skills through observation and learning outcomes. Additional media such as animated videos and PhET simulations support collaboration by increasing student interaction in learning.

Based on the articles that have been collected, the learning models that can train collaborative skills are cooperative (NHT, TGT, Group Investigation type) Group Investigation and NHT type cooperative models provide significant improvements in student collaboration in science materials. TGT also proved to be effective in learning geography, with significant improvement in collaboration level. In addition, the Project-Based Learning (PjBL) model had a significant positive impact on student collaboration with high N-Gain values, demonstrating the effectiveness of this model in various indicators of 21st century skills (collaboration, creative thinking, and self-regulation).

From the articles that have been analyzed, it was also found that the Measured Collaboration Skills Indicators are; (1) Group Work and Responsibility Most studies show the group work indicator as the most prominent, such as the results at SMA Negeri 1 Wonomulyo with an average score of 3.55. (2) Interaction and Communication, the improvement of students' interaction skills is seen through cooperative and project-based learning models. (3) Compromise and Accountability, it was found that the indicators of compromise and accountability were the indicators that still needed to be improved because the average score was lower than the other indicators.

Based on the articles that have been analyzed, it is also found that the percentage of collaboration skills has increased, namely in learning with scientific-based LKS. In cycle 1, the percentage of collaboration skills

was 62.5% and in cycle 2 it increased to 75.6%. Similarly, in learning with the PjBL model, the average value of students' collaboration skills increased from 50.0 (cycle 1) to 88.9 (cycle 2).

In the articles that have been analyzed, it is also found that there are differences in the results of collaboration skills between the experimental and control classes. Collaboration skills have increased significantly especially in the implementation of the PjBL or cooperative model. The PjBL model can significantly improve collaboration skills with a value of 0.79.

It was found that students' collaboration skills were in the good to excellent category. At SMA Negeri 1 Wonomulyo, the average score of collaboration skills reached 83.88, this average value is categorized as very good. However, it was also found that the most difficult indicator for students to practice was the compromise indicator. This was found especially for students at the elementary level.

Collaboration skills are effectively trained through scientific-based, PjBL and cooperative learning models, but can also be through STEM-based science teaching and learning modules. It is known that LKPD and science learning modules that can train collaboration skills must be reviewed from several aspects, namely aspects of design, language, and presentation design, language, and presentation reach.

This study found that learning that trains collaboration skills can have a big impact if the learning is supported by the use of technological media (animated videos, PhET simulations), direct interaction with the surrounding environment (contextual learning). Especially in project-based and collaborative learning that improves collaboration skills on the indicators of responsibility and communication of students. In addition, this study also found that online learning causes low collaborative activities (practicum/discussion is rarely done). This makes it difficult to train.

According to Alia et al. (2020), problem-based learning can significantly improve collaboration skills. The indicators of cooperation and mutual respect are the most well-trained indicators in this learning which are categorized as very good. While the indicators of the Ability to Compromise and Individual Responsibility also increased but only in the good category.

Conclusion

Based on the analysis of various articles, the use of learning media such as scientific-based LKPD, STEM, and discovery learning-based E-LKPD has been proven effective in improving students' collaboration skills. Learning models that support collaboration, such as Project-Based Learning (PjBL), Group Investigation, and other types of cooperative learning, have a significant impact on various indicators of 21st century skills, including collaboration, creative thinking, and self-regulation.

In addition, research shows that technology-based learning such as PhET simulations and animated videos strengthen student interaction and communication in groups. Collaboration skills are also effectively developed through contextualized learning and direct interaction with the environment. However, online learning faces challenges in improving collaborative activities, especially in practicum and discussion. Indicators of cooperation and mutual respect are the most practiced aspects, while individual responsibility and the ability to compromise are still in the good category.

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