



# Optimizing Collaboration Skills in the 21<sup>st</sup> Century: Recent Innovations in Project Model Differentiated Learning

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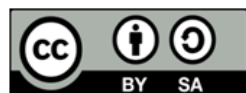
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## ABSTRAK

Keterampilan kolaborasi menjadi penting, sehingga pembelajaran berkelompok perlu diadakan untuk pengalaman langsung dalam kegiatan yang menghasilkan pemahaman dan cara belajar yang efektif. Penelitian ini bertujuan menganalisis pengaruh pembelajaran berdiferensiasi model proyek terhadap keterampilan kolaborasi siswa di kelas V sekolah dasar pada mata pelajaran IPA. Jenis penelitian ini adalah quasi eksperimen dengan desain one group pretest-posttest design. Teknik sampel yang digunakan, yaitu teknik sampling jenuh dengan 26 siswa. Instrumen penelitian yang dipakai dalam bentuk angket gaya belajar, lembar pengamatan proses pembelajaran di kelas, dan lembar observasi untuk mengukur keterampilan kolaborasi siswa terdiri dari lembar observasi awal dan akhir. Analisis data yang digunakan dalam penelitian ini adalah teknik analisis deskriptif dan teknik analisis inferensial dengan uji Paired Sample t-test. Sebelum uji hipotesis dilakukan uji prasyarat mencakup uji normalitas dan uji homogenitas. Rata-rata keterampilan kolaborasi siswa kelas V sebelum diberikan perlakuan menggunakan pembelajaran berdiferensiasi model proyek, tidak ada dalam kategori Sangat Tinggi, ada 9,99% dalam kategori Tinggi, ada 70,76% dalam kategori Sedang, dan ada 19,76% dalam kategori Rendah. Sesudah diberikan perlakuan menggunakan pembelajaran berdiferensiasi model proyek, ada 9,23% dalam kategori Sangat Tinggi, ada 59,23 % dalam kategori Tinggi, ada 31,54% dalam kategori Sedang, dan tidak ada dalam kategori Rendah. Selanjutnya pengolahan data dilakukan dengan  $t_{hitung} \geq t_{tabel}$  ( $39.034 > 2.05954$ ) yang mengindikasikan bahwa terdapat pengaruh positif dari pembelajaran berdiferensiasi model proyek terhadap keterampilan kolaborasi siswa di kelas V sekolah dasar.

## ABSTRACT

Collaboration skills are important. Therefore, group learning needs to be held for hands-on experience that results in understanding and effective learning methods. This study aims to analyze the effect of project model differentiated learning on students' collaboration skills in grade V elementary school in science subjects. This type of research is a quasi-experiment with a one-group pretest-posttest design. The sampling technique used was the saturated sampling technique with 26 students. The research instruments used in the form of learning style questionnaires, observation sheets of the learning process in the classroom, and observation sheets to measure student collaboration skills consist of initial and final observation sheets. Data analysis used in this research is descriptive analysis technique and inferential analysis technique with Paired Sample t Test. Before the hypothesis test, the prerequisite test includes the normality test and homogeneity test. The average collaboration skills of grade V students before being given treatment using the differentiated learning project model were none in the Very High category, 9.99% in the High category, 70.76% in the Medium category, and 19.76% in the Low category. After being given treatment using a differentiated learning project model, there were 9.23% in the Very High category, 59.23% in the High category, 31.54% in the Moderate category, and none in the Low category. Furthermore, data processing is carried out with  $t$ -value  $\geq$  critical  $t$ -value ( $39.034 > 2.05954$ ), which indicates that there is a positive effect of the differentiated learning project model on student collaboration skills in grade V elementary school.

## 1. INTRODUCTION

21<sup>st</sup>-century education refers to an educational system that can accommodate students' needs to acquire specialized knowledge and skills, enabling them to compete in the global world. Beyond acquiring academic knowledge, students need to possess soft skills. This 21<sup>st</sup>-century education focuses on the key soft skill competencies, known as the 4Cs, based on the US-based Partnership for 21<sup>st</sup> Century Skills (P21): communication, collaboration, critical thinking, and creativity (Abaniel, 2021; Firda & Sunarti, 2022; Thornhill-miller et al., 2023). Changes in the approach to learning are also a requirement of 21<sup>st</sup>-century education. Students are no longer limited to conventional classroom learning but must also engage in learning experiences involving direct participation in various group activities leading to real-life projects (Anagün, 2018; Rofik et al., 2022). In this process, students have the opportunity to discover the most effective ways of learning for themselves.

The importance of information and communication technology in 21<sup>st</sup>-century education cannot be underestimated. This technology is crucial in facilitating more engaging and relevant learning processes (Worapun et al., 2022; Dagnew, 2023). Furthermore, 21<sup>st</sup>-century education promotes lifelong learning, where students are encouraged to remain actively involved in developing their knowledge and skills in keeping with the times (Malik & Ubaidillah, 2021; Hidayatulloh & Ashoumi, 2022). The primary aim of this research is to identify and analyze the needs in implementing 21<sup>st</sup>-century education, including effective learning approaches for developing these 21<sup>st</sup>-century skills.

One of the key competencies in 21<sup>st</sup>-century education is collaboration (Castañer & Oliveira, 2020; Sholikha & Fitrayati, 2021). Collaboration involves a form of constructive social interaction in solving a problem collectively, making the success of collaboration heavily dependent on the quality of various knowledge, responsibilities, and trust that emerge within the group (Cravens et al., 2022; Kostis et al., 2022). In this context, students learn from each other's experiences and knowledge, thus enabling them to develop critical thinking, creativity, and communication skills (Conklin, 2013; Devi et al., 2023). Collaboration skills are crucial because by using collaboration in learning, students can actively participate in their education. This enables students to engage in discussions, share ideas with their peers, exchange perspectives, and gain a deeper understanding of the learning material (Septikasari & Frasandy, 2018; Adi et al., 2019). Collaboration skills can enhance the quality of learning, as through collaboration, students with lower abilities will be assisted in achieving the expected learning goals by involving active participation in problem-solving together (Huang et al., 2018; Atun & Latupeirisa, 2021). According to a 2002 survey conducted in the United States by the National Association of Colleges and Employers (NACE), it was found that "high GPA" ranked only 17th out of 20 criteria for an individual's success. An individual's success is determined by 80% soft skills in managing oneself and others, while 20% is determined by hard skills. Therefore, one of the most important indicators of a person's success lies in their communication and collaboration abilities (Suharti, 2023). Therefore, collaboration skills need to be developed early on so that students are expected to cooperate with others in various situations, thereby developing the skills required for the future. The key indicators of collaboration skills include cooperation, flexibility, responsibility, compromise, and communication (Pratiwi et al., 2020; Firman et al., 2023).

However, in reality, collaboration skills are relatively low. Based on observations conducted in Grade V at Puren State Elementary School, it was found that some students were less actively involved in group discussions, lacked the ability to share their opinions with each other, and had difficulty in dividing roles and group responsibilities. Consequently, within a single group, only one or two students completed tasks assigned by the teacher, while the others depended on their classmates' answers. This hinders students' collaborative activities because some students feel uncomfortable working together in teams. This indicates that several indicators of collaboration skills, such as cooperation, flexibility, responsibility, compromise, and communication, have not yet developed. In previous research, it was found that when students engaged in group learning, only one or two students actually participated. This suggests that students' collaboration skills are still low. In group learning outcomes, many students have not achieved a score of 4 (very good). Groups consisting of 5-6 individuals had only 2 or 2 students from each group who scored 4. Based on observations, only 40% of students reached the Minimum Competency Criteria (KKM) in collaboration skills (Sunbanu et al., 2019).

One solution to address the issues mentioned above is to implement learning activities that can overcome students' low collaboration skills. One approach that can be taken is by optimizing the learning models applied in the classroom. Project-based learning is a collaborative learning approach where students work together on projects. Project-based learning is a model that can develop 21<sup>st</sup>-century skills (Apriadi et al., 2020; Matahari et al., 2023). This learning model creates student-centered learning, which can lead to collaboration skills and provides students with the opportunity to make learning more meaningful, relevant, and useful in life (Santayasa et al., 2020; Suseno et al., 2022). By implementing this model, it is expected that students will be able to create a project that not only boosts their self-confidence

but also allows them to showcase the group-produced work to their classmates. (Siskawati et al., 2020; Firda & Sunarti, 2022). In the project-based learning model, several steps are as follows: 1) the teacher poses fundamental questions related to the taught material to stimulate students in problem-solving, then divides them into groups. 2) Students, together with their group members, design the project plan, and the teacher guides them to ensure alignment with the material. 3) Students, with their group members, create a project timeline with the teacher's guidance for necessary adjustments. 4) Following that, the teacher monitors the project's activity and progress. 5) Next, the results of the project are tested through group presentations. 6) Finally, an evaluation phase takes place where students express their feelings and experiences during the project's completion. This approach aims to promote collaborative learning and make the educational experience more meaningful and relevant to students' lives.

Learning using a project-based model emphasizes student activities that apply research, analysis, creation, and presentation skills to produce products from real-life experiences. This allows students to explore and engage directly in acquiring knowledge. In project-based learning activities, students are presented with real problems that need to be collaboratively solved, providing an opportunity for effective sharing of ideas and information among group members to achieve success (Irman & Waskito, 2020; Owens & Hite, 2020). However, during observations and interviews in Grade V, it was found that the teacher had not fully implemented all the syntaxes of project activities in the classroom. This is because teachers often perceive that project-based activities require a considerable amount of time, leading them to view this learning model as merely a task of producing works without paying attention to each syntax. This is one of the reasons why students' collaboration skills have not developed optimally. Teachers need to thoroughly prepare each step of project-based learning to maximize its effectiveness. The effectiveness of learning is not only related to the use of adequate time but also linked to students' engagement in skill development (Maros et al., 2021).

Another contributing factor where students feel uncomfortable working in teams is that the learning process has not yet addressed each student's individual needs. Study results indicate that education has not seen significant changes, with teachers still using a teaching system that treats all students the same without considering their diversity. In one classroom, teachers seem to be teaching just one student, even though there are approximately 20-30 students in the class, each with their own uniqueness, abilities, and learning experiences. As a result, students experience boredom and lack motivation to learn (Iskandar, 2021; Mastuti et al., 2022). Teachers not paying attention to their students' needs will prevent them from doing their best work. Learning activities in Grade V using project-based learning models have not considered students' diverse learning styles and interests. The project activities provided tend to be uniform and similar, which can impact the outcomes of the project activities. Furthermore, it can also impede the development of students' collaboration skills. Therefore, differentiated learning is needed to accommodate students' individual needs in the learning process (Roiha & Polso, 2021; Smets et al., 2022).

Differentiated learning is when teachers approach education from various perspectives to meet students' needs. This concept doesn't imply individualized learning but aims to ensure that each student receives a learning experience that aligns with their needs and potential (Gheysens et al., 2022; Wulandari, 2022). The effort to provide differentiated learning involves teachers providing individualized treatment to each student while considering their needs to ensure that learning objectives are achieved effectively. Differentiation in education can be regarded as a response to student diversity by adapting both teaching and assessment. The goal is to offer appropriate and relevant opportunities for all students, enabling them to develop their potential optimally and maximize their success in learning (Eikeland & Ohna, 2022; Sitorus et al., 2022).

Student diversity is based on three different aspects: 1) readiness, which refers to how well students' knowledge and skills align with the learning objectives. Teachers should be aware of students' needs to ensure their success in the learning process. Each student's potential for physical, psychological, and intellectual development should closely relate to their readiness. 2) interest, which is crucial for motivating students to learn. Teachers can inquire about students' interests, hobbies, or favorite subjects in class so that students naturally strive to learn anything they enjoy, and 3) a learning style profile, where students refer to the preferred approaches or methods that help them understand the learning material effectively. The five senses play a crucial role in the learning process (Tomlinson et al., 2010; Suwastini et al., 2021). Learning styles influence problem-solving abilities, collaboration in group work, communication, and the capacity to handle learning challenges (Priya et al., 2020; Naibaho. Dwi Putriana, 2023). There are three student learning styles: among them is visual; students find it easier to receive information through illustrations, diagrams, videos, posters, animations, colors, symbols, and graphics. Auditory learners process information well through listening, while kinesthetic learners tend to absorb information through direct hands-on practice.

There are three differentiated learning activities, namely 1) content differentiation, which is a learning activity structured by distinguishing students in the delivery of the material being studied; 2) process differentiation, which is a learning activity structured by distinguishing students in the process of acquiring knowledge, and 3) product differentiation, which is a learning activity structured by distinguishing student learning outcomes such as videos, images, posters, and so on (Purba et al., 2021; Nafa, 2022). In differentiated learning, students develop learning-related skills by being given the freedom and responsibility to learn according to their own ways and learning styles to achieve learning goals (Geletu & Mihiretie, 2022; Mulyawati et al., 2022).

Based on theoretical and empirical studies, the implementation of differentiated project-based learning can enhance students' collaboration skills. Previous research findings have explained that project-based learning models have a positive impact on students who actively engage in group tasks, express their opinions, actively present the group's results, actively participate in problem-solving, and consistently consider the opinions of other group members (Rasyid & Khoirunnisa, 2021; Sirait & Amnie, 2023). Furthermore, differentiated learning aligned with students' learning styles is an effective approach to enhancing students' collaboration skills. When engaging in differentiated learning activities, students interact in a collaborative context, are more sociable, and create learning experiences that stimulate the interest and desire of students to actively engage and mutually depend on each other (Ismail & Al Allaq, 2019; Cahya et al., 2023). Therefore, this research aims to analyze the effect of project-based differentiated learning on students' collaboration skills in the 5<sup>th</sup>-grade elementary school for the subject of Science.

## 2. METHOD

This research was conducted in Grade V at Puren State Elementary School in the Depok District, Yogyakarta, during the academic year 2022/2023. The sample of this study comprised all Grade V students, selected using a nonprobability sampling technique. The nonprobability sampling technique used in this research was a saturated sampling approach, wherein all population members were included as samples. Therefore, the total number of samples used in this study was 26 students.

The type of research used in this study was quantitative research with an experimental method involving a single class. The method used in this research was an experiment using a one-group pretest-posttest design. The one-group pretest-posttest design was a technique used to determine the effect of activities before and after the treatment (Sugiyono., 2019).

This research consists of an independent variable (X), which is project-based differentiated learning, and a dependent variable (Y), which is collaboration skills. The instruments used to collect data were a learning-style questionnaire and observation sheets. The learning style questionnaire was used to identify students' learning style preferences. Classroom observation sheets and instruments used to measure students' collaboration skills were non-test instruments comprising initial observation sheets and final observation sheets filled out by observers. Before administering the treatment, students' observation skills were initially assessed. The observation was conducted over the course of 2 class sessions with the classroom teacher without the presence of any treatment in the form of project-based differentiated learning. This was carried out to ascertain the students' initial collaboration skills. Following the initial observation, students were then subjected to the treatment, consisting of project-based differentiated learning, for a total of 3 class sessions.

To assess students' collaborative skills, observation sheets were used, employing a rubric assessment with indicators for collaboration skills, namely cooperation, flexibility, responsibility, compromise, and communication (Pratiwi et al., 2020; Firman et al., 2023). The assessment of collaboration skills utilized a Likert scale ranging from 1 to 4. As for the collaboration skills instrument, it comprised in the Table 1.

**Table 1.** Instruments for Students' Collaboration Skills

Collaborative Indicator	Observed Aspect
Collaboration	Students can collaborate with diverse team members to solve existing problems.
Flexibility	Students can adapt to each group when solving problems.
Responsibility	Students take the initiative to self-organize within the group to work together to solve existing problems.
Compromise	Group members engage in discussions and make joint decisions to solve existing problems.



Collaborative Indicator	Observed Aspect
Communication	All group members are well-connected (communicate) within the group to solve existing problems.

The data analysis techniques used in this research included descriptive analysis and inferential analysis using the t-test. Descriptive analysis was used to describe the data obtained, while inferential analysis was utilized to test research hypotheses. Before hypothesis testing, prerequisite tests, including normality and homogeneity tests, were conducted.

### 3. RESULT AND DISCUSSION

#### Result

The research data, in the form of student collaboration skills scores, were analyzed using both descriptive statistics and inferential statistics. The analysis results using descriptive statistics are presented in a summary of initial and final observation observations, which are served in [Table 2](#) and [Table 3](#).

**Table 2.** Summary of Initial Observation of Collaboration Skills

Category	Before the Treatment is Given									
	Collaboration		Flexibility		Responsibility		Compromise		Communication	
	F	%	F	%	F	%	F	%	F	%
Very High (ST)	0	0	0	0	0	0	0	0	0	0
High (T)	4	15.38	4	15.38	3	11.54	2	7.69	0	0
Moderate (S)	17	65.38	20	76.92	20	76.92	18	69.23	17	65.38
Low (R)	5	19.23	2	7.70	3	11.54	6	23.08	9	34.62

**Table 3.** Summary of Final Observation of Collaboration Skills

Category	After the Treatment is Given									
	Collaboration		Flexibility		Responsibility		Compromise		Communication	
	F	%	F	%	F	%	F	%	F	%
Very High (ST)	3	11.54	2	7.69	3	11.54	2	7.69	2	7.69
High (T)	19	73.08	21	80.77	18	69.23	13	50	6	23.08
Moderate (S)	4	15.38	3	11.54	5	19.23	11	42.31	18	69.23
Low (R)	0	0	0	0	0	0	0	0	0	0

[Table 2](#) and [Table 3](#) show that the collaboration skills of Grade V students underwent significant changes both before and after the application of project-based differentiated learning. The hypothesis testing began with the analysis of prerequisite tests, namely normality and homogeneity tests. The results of the normality test indicated that collaboration skills data before and after the treatment followed a normal distribution. The test results are presented in [Table 4](#).

**Table 4.** Normality Test Results

Group	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Before	0.158	26	0.096	0.925	26	0.059
After	0.163	26	0.072	0.908	26	0.024

The homogeneity test conducted was the test of variance homogeneity. The results of the variance homogeneity test indicated that the data analyzed in this research showed homogeneity. The test results are presented in [Table 5](#).

**Table 5.** Variance Homogeneity Test Results

Variable	Statistics View	Levene Statistic	df1	df2	Sig.
	Based on Mean	0.057	1	50	0.812
	Based on Median	0.018	1	50	0.893

Statistics View	Levene Statistic	df1	df2	Sig.
Based on the Median and with adjusted df	0.018	1	49.267	0.893
Based on trimmed mean	0.066	1	50	0.799

**Table 6.** Paired Sample t-Test

Paired	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Before - After	-4.423	0.578	0.113	-4.656	-4.190	-39.034	25	0.000

Table 6 indicates that the t-value is -39.034. The negative t-value is due to the fact that the average score before the treatment is lower than after the treatment, which means the negative t-value is meaningful in a positive direction. The significance value (2-tailed) is 0.000, which is less than 0.05. Based on the t-value of 39.034, which is greater than the critical t-value of 2.05954, it indicates that  $H_0$  is rejected and  $H_1$  is accepted. Therefore, there is an influence of using project-based differentiated learning on the collaboration skills of Grade V students.

### Discussion

Based on the data analysis results, there is a significant improvement in students' collaboration skills after the treatment. This can be observed from the comparison between the initial and final observations, which indicate improvements in aspects such as cooperation, flexibility, responsibility, compromise, and communication. The enhancement of collaboration skills occurred at each stage of differentiated learning, taking into consideration students' learning styles (Kakoura & Driga, 2023). In the first stage, diagnostic tests were conducted, both cognitive and non-cognitive. Cognitive tests were conducted to identify the students' initial knowledge levels, while non-cognitive tests aimed to determine their learning styles. In the second stage, learning objectives were set, such as the ability to analyze the differences between clean and dirty water quality, factors influencing water quality, and designing and creating a simple water purification device. During this phase, the project-based learning model was selected as the appropriate approach because it allowed students to actively engage and gain real-world experience (Fauzia & Kelana, 2020; Ardianti & Raida, 2022). Next, the third stage involves determining and designing learning activities based on learning style profiles (content, process, and product) (Purba et al., 2021; Nafa, 2022). For the visual group, students will design schematic drawings of the water purification device, while for the auditory group, students will create a recording of the device's construction, and the kinaesthetic group will directly construct a simple water purification device through experimentation. This approach ensures differentiation of content, process, and product to meet the learning needs of students based on their learning styles.

Content differentiation occurs in the first sentence, where the teacher poses fundamental questions about the taught material to stimulate students in problem-solving. Students are presented with images of a dry environment lacking a water source and images of an environment affected by flooding (visual). They are also shown a news recording regarding areas experiencing drought and flooding (auditory) and presented with two glasses containing clean and dirty water. Students with a kinaesthetic learning style can directly see and touch both glasses. Students are then asked questions about the differences between clean and dirty water, leading to a Q&A session between students and the teacher. Communication between students and the teacher goes smoothly in resolving the issue (Nilsook et al., 2021; Iskandar et al., 2022). Process differentiation occurs in the second sentence, where students, along with their group members, design the project plan. This activity begins with students engaging in discussions within their groups. Before this, the teacher provides worksheets and explains the tasks to be carried out within the groups (visual, auditory, kinaesthetic). Students are tasked with designing the project plan, encouraging them to collaborate with group members. In this phase, students are capable of respecting the opinions or ideas put forth by their group members, taking responsibility for designing the product's blueprint and making joint decisions to complete the task (Palmér & Johansson, 2018; Sandrayati, 2021). In the third syntactic structure, students, along with their group members, create a project work schedule. Similar to the product design activity, the process of crafting the project work schedule also requires students' collaboration skills, particularly in the aspect of cooperation during discussions to determine the project's timetable. This trains students to appreciate the opinions/ideas of their group members, take responsibility for organizing the project work schedule through effective communication, and demonstrate self-awareness in adhering to

the schedule they have developed (Aufa et al., 2021; Cravens et al., 2022). Through interactive activities during the project preparation process, collaboration skills can be enhanced (Irwan et al., 2023; Hasan, 2023). In this project-based differentiated learning, the teacher provides flexibility in completing the project and sets deadlines for project submission. In the fourth structure, the teacher monitors the progress of the projects undertaken by the students. The teacher offers guidance and assesses students' involvement in the learning process. At this stage, students cooperate and actively take responsibility for project work. Furthermore, they gather information through questioning and answering based on a set of worksheet questions through discussions to convey knowledge. This represents their interaction in problem-solving (S. U. Putri & Hidayat, 2019; Al-Qora'n et al., 2023). 3 The fifth syntactic structure involves product differentiation, wherein the results of the projects that have been completed are tested through group presentations. The teacher instructs each group to present the products they have created based on their learning styles and provide answers to several worksheet questions. During this activity, all group members actively participate in presenting their project outcomes and explaining their responses to the worksheet questions. This enhances cooperation and responsibility among each group member when presenting their project results. Additionally, clear and effective communication is essential to ensure that both the teacher and other groups or the audience can understand the discussions presented by the presenting group (Sagala et al., 2020; Tika & Agustina, 2021). In the final syntactic structure, students are evaluated by being asked to reflect on their feelings and experiences during the learning process. During this stage, students listen to each other, show appreciation, and share experiences with members of other groups (Saenab et al., 2018).

The findings of this research support previous studies that have indicated that project-based learning models enhance collaboration skills in the science learning process (Saenab et al., 2019; Syafii, 2023). The project-based learning model provides opportunities for students to improve their learning outcomes by building student understanding (learning to know) through scientific processes (learning to do) conducted collaboratively (learning to live together), enabling students to learn independently (learning to be). The project-based learning model fosters student interaction through group discussions to express opinions and exchange information, ultimately leading to improved learning outcomes through created products (Putri et al., 2019; Soleh & Arifin, 2021). Moreover, this research aligns with the perspective that differentiated learning, considering learning styles, contributes to high-quality education by enhancing understanding, motivation in learning, and interpersonal interactions among students in the classroom (Marlina et al., 2022; Dariyani et al., 2022). Because during the learning process, all students with diverse backgrounds feel accepted valued, and have the expectation to grow. Thus, implementing differentiated learning not only enhances students' academic achievements but also creates an inclusive learning environment, fosters mutual respect, and encourages important social skills development in students (Demir, 2021; Miqwati et al., 2023). Project-based differentiated learning allows students to learn personally according to their individual needs. In previous research, it has been found that by considering student diversity, including learning styles, this approach can enhance students' collaboration skills. Students collaborate in groups based on their abilities, creating a comfortable atmosphere and high motivation for active participation. Additionally, project-based differentiated learning provides an enjoyable learning experience. (Brungel et al., 2020; Wahyuni et al., 2023).

The strengths of this research are located in the application of differentiated learning that considers students' learning styles. This enables the adaptation of learning content, processes, and products to meet students' learning needs, increase student engagement, and enhance the relevance of learning in their daily lives. Its contribution lies in providing empirical evidence regarding the effectiveness of project-based differentiated learning in improving students' collaboration skills. Furthermore, project-based differentiated learning serves as an effective alternative for enhancing students' collaboration skills in elementary science education. However, this study has several limitations, such as a limited sample size, a restricted school context, and a focus on short-term impacts. Therefore, future research is expected to involve a larger sample size, various schools, and learning contexts, expand the observed variables, and compare with other learning approaches. Furthermore, it is hoped that teachers or educators can implement project-based differentiated learning in the learning process, thus improving students' collaboration skills in the science subject.

#### 4. CONCLUSION

Based on the analysis conducted, it can be concluded that the implementation of project-based differentiated learning has a positive impact on improving the collaboration skills of Grade V students. There was a significant change in students' collaboration skills before and after the learning intervention. These results provide support for the effectiveness of differentiated learning in stimulating student collaboration, which better accommodates the diversity of readiness, interests, and learning styles among

students. Therefore, the concept of project-based differentiated learning can be considered an effective alternative in addressing challenges in developing students' collaboration skills.

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