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PROJECT BASED LEARNING IN NATURAL AND SOCIAL SCIENCE LEARNING: IMPROVING CRITICAL THINKING SKILLS AND SELF EFFICACY OF MADRASAH IBTIDAIYAH STUDENTS

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Abstract

This study aims to describe the improvement of students' critical thinking skills and self-efficacy through the implementation of project-based learning in the independent curriculum for fifth-grade students. It is a field research study using a quantitative approach. The research method employed is pre-experimental with a one-group pretest-posttest design. The subjects of this study are the teachers and fifth-grade students of MI NU Tarbiyatul Islam. The results of the study show that the implementation of the project-based learning model involves several phases, including determining the project, designing the steps to complete the project, scheduling the project implementation, carrying out the project, preparing reports and presenting project results, and evaluating both the process and outcomes of the project. Students' critical thinking skills in science learning using the project-based learning model showed a significant difference between pretest and posttest scores in both critical thinking skills and self-efficacy. This is evidenced by the hypothesis test results, where the value of t-count < t-table = 0.00 < 0.05. This learning model has the potential to serve as a reference in the formulation of more contextual and adaptive educational policies.

Keywords: Project Based Learning, Natural and Social Science Learning, Independent Curriculum, Critical Thinking, Self Efficacy,

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INTRODUCTION

21st century education aims to produce quality human resources who are able to process information appropriately. 21st century skills include critical thinking, creativity, communication, collaboration, and problem solving. Therefore, integrating these skills into the learning process is important to prepare the younger generation to face various challenges in the future (Mantau & Talango, 2023). Learning must prepare the Indonesian generation for technological and communication advances in society (Frananda et al., 2023) order to prepare students for the technological advances that exist, the government issued an independent curriculum policy in response to these demands.

The independent learning curriculum is the latest policy designed and released by the Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi (Kemendikburistek). The independent curriculum has the ability to integrate various disciplines so as to provide opportunities for students to improve their critical thinking skills through interdisciplinary problem solving and use creative approaches in learning (Kollo & Suciptaningsih, 2024). The independent curriculum creates collaborative learning that involves active students in choosing materials, methods, and assessments, thus developing critical thinking skills (Lubis et al., 2023). The independent curriculum emphasizes project-based learning. The success of the teaching and learning process also depends on effective learning management, especially in implementing project-based learning (Rasmani et al., 2023).

Project-based learning is one of the main features of the independent curriculum. In the basic framework of the independent curriculum, there is a project program to strengthen the profile of Pancasila students using the Project- based Learning (PjBL) approach ((Dewi, 2022). Project-based learning involves giving complex tasks that focus on problem solving, design, decision making, and investigation, all of which lead to an independent product (Triastuti et al., 2023). The purpose of project-based learning in the curriculum is for children to develop soft skills, social skills, and character according to the Pancasila Learner Profile (Nisfa et al., 2022). Independent learning also involves independent conditions in meeting the learning objectives, methods, materials and evaluations of both teachers and students (Indarta et al., 2022).

Project-based learning is based on the theory of constructivism developed by Piaget and Vygotsky, as well as 21st century learning theory. Piaget emphasized that knowledge is built through direct experience, while Vygotsky highlighted the importance of social interaction and scaffolding in shaping understanding. The 21st century learning theory emphasizes creative and critical thinking skills develop when students are given opportunities to construct understanding through hands-on experience and problem solving (Puspito et al., 2024). PjBL integrates these principles by placing students at the center of learning through explorative activities and real problem solving.

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Through project learning, it is expected that students have the ability to reason critically in order to be able to process and manage both qualitative and quantitative information objectively, build links between various information, analyze, evaluate, draw conclusions. With this, it can be seen that the learning process in the independent learning curriculum is more directed to the needs of students (student-center) so that students can have critical thinking skills.

Critical thinking skills are very important and must be possessed by learners. Learners who have high critical thinking skills will tend to be able to analyze information to find the truth. With high critical thinking skills, students will be able to solve problems and believe in success in learning (Allanta & Puspita, 2021).

There have been many studies related to critical thinking skills, including in Indonesia. However, the results of the research still show the low critical thinking skills of students in Indonesia. The low critical thinking skills of students have an impact on the low science abilities of students in Indonesia compared to various students in other countries (Adiwiguna et al., 2019). The Trends in International Mathematics and Science Study (TIMSS) results show that Indonesian students' critical thinking skills are still relatively low. In TIMSS 2015, Indonesia ranked 44th out of 49 countries, which indicates the low critical thinking skills of students (Nurul & Rachmani, 2022). Research related to factors that influence students' critical thinking skills is still rare, especially in science subjects. However, there have been several studies that discuss the factors that influence students' critical thinking skills, including the influence of self-efficacy or self-efficacy (Sukma & Priatna, 2021).

Project-based learning model is able to develop students' self-efficacy in learning (Amanda et al., 2014). Self-efficacy and critical thinking skills are related. Self-efficacy is defined as a person's belief about their own ability to produce a level of performance that affects events that affect that person's life (Nuraeni et al., 2019). Based on the learning outcomes of students in general, it is still not optimal. This is characterized by low self-efficacy. Low self-efficacy can be assessed from the quantity and quality of students' involvement in asking questions, providing responses and answers to problems/issues given by educators while in class.

To develop students' critical thinking skills and self-efficacy, a learning approach that can foster critical thinking and self-efficacy is needed, namely project-based learning. So that learning that emphasizes active and fun students. Based on the above background, this research focuses on discussing "Project Based Learning in the independent curriculum: Improving Critical Thinking Skills and Self Efficacy of Madrasah Ibtidaiyah Students".

METHODS

This research use the type of field research, namely that researchers make observations about a scientific situation and researchers must go directly to the field and engage with local participants. The quantitative approach used in this research is an experimental method with a one group pretest-posttest design. This study aims to examine the effectiveness of project-based learning in the independent curriculum on critical thinking skills and self-efficacy of fifth grade students.

Data collection techniques used tests, interviews, questionnaires, and documentation. The test and questionnaire instruments were tested for validity and reliability first. The validity of the instrument was tested using content validity by learning material experts, while the reliability of the instrument was tested using the Cronbach Alpha method, resulting in a reliability value of 0.85 which shows the instrument is quite reliable. The questionnaire consisted of 20 closed questions designed to measure aspects of students' self-efficacy, with all fifth grade students as respondents. Semi-structured interviews were conducted with the fifth grade teacher and six purposively selected students to explore their experiences and perceptions of the implementation of PjBL.

The data analysis technique used normality test (kolmogorov-smirnov), homogeneity test (levene's test), and hypothesis testing using t-test for paired samples (paired sample t-test) in the experimental group to compare pretest and posttest values, and unpaired t-test (independent sample t-test) to compare results between experimental and control groups.

RESULTS AND DISCUSSION

Implementation of Project Based Learning in the Independent Curriculum for Fifth Grade Students

The implementation of the Project Based Learning model was carried out on fifth grade students of MI NU Tarbiyatul Islam Kudus in Natural and Social Science Learning on the material of changes in the state of objects through making ice cream. The implementation of the project-based learning model applied is carried out using several phases including determining the project, designing the steps for completing the project, preparing a project implementation schedule, implementing the project, making reports and presentations of project results and evaluating the process and project results (Natty et al., 2019).

In the first phase, namely project determination, students identify the topic or theme of the project they will work on. They formulate the essential questions they will explore during the project. The learning process that takes place begins with introductory activities. This activity begins with greetings, praying together, checking the attendance of students, providing apperception and motivation to students, providing an overview of learning,

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conveying learning objectives, learning benefits, learning assessment. The project task used can emphasize research activities based on a theme or topic that has been determined in learning. Projects are guided by inquiry questions that encourage students to conduct research and allow students to apply the knowledge gained (Azizah & Widjajanti, 2019).

In the core learning activities, the teacher provides basic questions, this is started by the teacher by bringing up authentic problems in the surrounding environment through a picture in the natural and social sciences book, why can ice melt? why can water become ice? and how can this process occur? Then the teacher gives a triggering question to provoke students to ask. How to make simple ice cream from the materials around us? To answer this, the teacher and learners discuss with each other and are reinforced by the teacher through activities.

The second phase is designing the steps to complete the project, including students detailing the concrete steps they will take to complete the project, students design the methods or strategies that will be used in the project. In this learning, students can divide tasks among team members if the project is done in groups. The teacher divides learners into groups of 4, each group consists of 4 members heterogeneously to realize good cooperation between learners in one class. By using the PjBL model, students become more active in cooperating with their groups when working on projects. This makes students more confident to show the results of the projects they have made (Ahsani & Taqiyah, 2024; Wijanarko et al., 2017).

The teacher instructs students to bring the tools and materials used in the practicum of making ice cream. as for the tools and materials that students must bring in making ice cream, namely ice cubes, salt, pop ice powder, water, spoons, plastic cups and vegetable jars/wafers. Students work together to support the completion of this phase of activities. Group members discuss with each other to divide the job desk of each students in bringing the tools and materials and determine the price of the tools/materials needed to be purchased as well as the costs incurred by each learner then collected by the group treasurer.

The third phase is the preparation of the project implementation schedule. In this learning, students create a schedule detailing when and how each step of the project will be carried out. This schedule becomes a reference for students to manage their time and resources efficiently during the project.

The fourth phase, in project implementation, students carry out the project according to the steps they have planned with their respective groups. PjBL is designed to be used on complex problems that require students to investigate and understand them (Wahyu et al., 2018). The teacher together with the students check the tools and materials that will be used in making the ice cream making project, if it is complete then the learners in one group are ready to start working on the project. In the process, the teacher accompanies learners and assesses

activeness. The teacher goes around to open opportunities for groups that need help, guidance and direction if there are obstacles to making projects. Learners in the group collect data, information, or experimental results according to the plan. Learners are active in project implementation and enthusiastic. In line with the research of Mashfiya & Ahsani (2024) that the application of project-based learning model encourages students to be more active, involved in communication, and able to solve problems (Mashfiya & Ahsani, 2024).

The fifth phase is the creation of reports and presentations of project results, among others, students by compiling project reports that cover all aspects of the project, including objectives, methods, results, and conclusions. Students also make presentations of project results to the class or other groups.

The final phase is the evaluation of the project process and outcomes where learners describe how their project went, including any obstacles or barriers they faced and how they overcame them. Learners, assisted by the teacher, evaluate the project outcomes to ensure that the essential questions have been answered properly and that the learning objectives were achieved. Learners can also provide feedback on their learning experience and make recommendations for similar projects in the future.

This is done through giving feedback on the work by the teacher. Give positive appreciation to the efforts made by the learners. Then other groups can also try the project results in the form of ice cream products belonging to other groups and provide suggestions and input as a consideration for assessment by the teacher.

Improving Critical Thinking Skills and Student Self Efficacy by Implementing Project Based Learning

This study aims to determine the improvement of critical thinking skills and student self-efficacy through the implementation of the Project Based Learning (PjBL) model. To measure the effectiveness of the implementation of PjBL, prerequisite tests and hypothesis tests were used on pretest and posttest data.

1. Prerequisite Test

a. Normality Test

The purpose of this test is to determine whether the research data obtained is normally distributed or not. In this normality test using the Kolmogorov Smirnov test with the help of the SPSS version 16 program. The decision-making provisions are if the Sig value> 0.05, it means that the data has a normal distribution, while if the Sig value <0.05, it means that the data is not normally distributed. The test results can be seen in table 1.

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Table 1. Normality Test of *Pretest - Posttest* Results of Critical Thinking Skills

	Shapiro-Wilk		
	statistic	**df**	**Sig.**
Pretest	0,912	16	0,53
Posttest	0,916	16	0,63

Source: Primary data *Spss* version *22*

Based on Table 1, it shows that the data on the initial ability of Critical Thinking Skills pretetst and posttest scores are normally distributed. Where the pretest learning outcomes have a Sig. of 0.53 and the posttest has a Sig. 0.63 which means> 0.05. So it can be concluded that the pretest and posttest scores are normally distributed at the 0.05 significance level.

Table 2. Normality Test of *Pretest - Posttest Self-Efficacy* Results

	Shapiro-Wilk		
	statistic	**df**	**Sig.**
Pretest	0,803	16	0,55
Posttest	0,911	16	0,61

Based on Table 2, it shows that the data on the initial ability of Critical Thinking Skills pretetst and posttest scores are normally distributed. Where the pretest learning outcomes have a Sig. of 0.53 and the posttest has a Sig. 0.63 which means> 0.05. So it can be concluded that the pretest and posttest scores are normally distributed at the 0.05 significance level.

b. Homogeneity Test

The purpose of this test is to determine whether the research data obtained is homogeneous or not. The provisions for withdrawing this test decision are if the Sig value is> 0.05, meaning that the data is homogeneous, while if the Sig value <0.05, meaning that the data is not homogeneous. The test results can be seen in table 3 below.

Table 3. Homogeneity Test

	F	**df1**	**df2**	**Sig.**
Critical thinking skills	3.231	1	16	.080
Self_efficacy	1.029	1	16	.382

Based on Table 3, the homogeneity test with SPSS 16 using Levene's Test with a significance level of 5% obtained that the significance value in the Levene's Test for Equality of Variances column in the Independent Sample Test on critical thinking skills is 0.080> 5% then H 0is accepted. This indicates that the critical thinking skills data is homogeneous. While the self- efficacy data shows a value of 0.382> 5% then H 0is accepted. This indicates that the self-efficacy data is homogeneous.

2. Hypothesis Test

Furthermore, hypothesis testing was carried out using paired sample t- test to determine the significant difference between pretest and posttest results on two variables, namely critical thinking skills and student self-efficacy.

Hypothesis testing is used to prove whether or not there is an increase in critical thinking skills and self-efficacy by applying project-based learning, and to determine whether or not the hypothesis that has been proposed by the researcher is accepted. The calculations carried out using statistical analysis with the t-independent test formula.

Hypothesis testing criteria

a) If the Sig. (2-tailed) value <0.05, then there is a significant difference between critical thinking skills and self-efficacy pretest and posttest.
b) If the Sig. (2-tailed) > 0.05, then there is no significant difference between critical thinking skills and self-efficacy pretest and posttest.

Table 4. Hypothesis Testing Results Critical Thinking Skills

Statistical Value	Class		Sig. (2-tailed)	Sig.
	Pretest	Posttest		
Average (*Mean*)	67	85,3	0,00	0,05
Standard Deviation	10,1	12,4		
Sample Quantity	16	16		

Source: Primary data *Spss* version *22*

Based on Table 4, shows that the results of hypothesis testing on the data obtained t count< t table= 0.00< 0.05. So it can be concluded that there is a significant difference in students' critical thinking skills on the pretest and posttest. Based on the questionnaires that have been distributed, the average results of pretest and posttest self-efficacy are presented in Table 5.

Table 5. *Self Efficacy* Hypothesis Testing Results

Self Efficacy	**Class**	**Sig. (2-tailed)**	**Sig.**
Pretest	0.561	0,00	0,05
Posttest	10,3		
Sample Quantity	16		

Source: Primary data *Spss* version *22*

Based on Table 5, shows that the results of hypothesis testing on the data obtained t count< t table= 0.00< 0.05. So it can be concluded that there is an increase in the self-efficacy skills of fifth grade students between the control class and the experimental class.

Implementing project-based learning in the independent curriculum can be an effective approach to improve critical thinking skills in fifth grade students. The improvement

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in critical thinking skills can be seen from several indicators, such as students' ability to identify problems, analyze information, evaluate various solutions, and conclude findings logically. In the context of science learning, especially material about changes in the shape of objects, this approach encourages students to conduct simple experiments, observe the process of changing shape, and explain the causes of these changes based on the data obtained, so that their critical thinking skills are honed through an active and meaningful learning process. In learning using the project-based learning model, students will play an active role in the learning process both in discussion activities and in product making activities. Learning that produces valuable products requires a rich and real learning environment that can provide learning experiences (Murniarti, 2021).

Project-based learning model can support the achievement of science components, which include process and product. Teachers give projects to students, and provide opportunities for them to plan, implement and present the results of their work, starting from the tools and materials used, how to make, uses, improvements, as well as responding and commenting on the results of the project. Thus, it can shape critical thinking in students. This is in line with Jumrodah (2021) that critical thinking skills can be improved through learning activities by designing projects (Jumrodah et al., 2021).

Critical thinking skills on the material of changes in the form of objects in the aspect of providing simple explanations, students can give opinions about involving the ability to analyze, connect, and communicate concepts related to changes in the form of objects clearly. Students have a strong understanding of the basic concepts related to changes in the form of objects, such as changes from solid to liquid, liquid to gas, or vice versa. Students can also identify the types of changes in the form of objects and the factors that affect them. Furthermore, students are able to connect the concept of changes in the form of objects with real-world situations by describing examples of changes in the form of objects that are often encountered in everyday life, such as changes in ice to water or water to steam.

The aspect of building basic skills in project-based learning is students' activities in understanding the role of the reliability of information sources and ensuring that in observing and analyzing data carefully, they can understand the concept of changes in the form of objects. In this case, students become independent and critical of the material of changes in the form of objects. Project- based learning can facilitate student learning by utilizing tools and materials found around the environment where students live (Norhikmah et al., 2022).

Critical thinking skills in summarizing material changes in the form of objects help students combine and summarize information in a way that illustrates a deep understanding of the material changes in the form of objects. This can help students communicate their knowledge to others and apply concepts in context in everyday life. PjBL model learning

allows students to collaborate in research. Students can interact with the environment to create challenging projects and find solutions to real-world problems (Lestari & Ilhami, 2022).

The project-based learning model involves students in solving problems and other tasks, and provides opportunities for students to work independently, thus producing valuable work from students. In line with Lapse (2021) that projects can help equip students with the skills needed to compete in the world of work, because they not only learn theory, but also have practical experience in solving problems in the field (Lapase, 2021). This learning model is effective and challenging as a tool for active student learning because students are encouraged to be more independent, by not relying entirely on the teacher, but are directed to be able to learn independently (Sari et al., 2021).

The implementation of the project based learning model is that students are more enthusiastic and interested in participating in the learning process, because students are motivated to create something that has never been done before (Saputro & Rayahub, 2020). So that the project-based learning model can improve students' critical thinking skills (Wicaksana & Sanjaya, 2022). Developing learning designs with the implementation of project-based learning- based science models in students' critical thinking in the learning process, teachers also use the concept of project learning. So that learning is effective and efficient with students' critical thinking skills (Ramadhani et al., 2021).

Providing treatment with the implementation of PjBL in the experimental class can increase students' self-efficacy. Through this learning, students are given challenges to be able to complete the project. Based on the results of hypothesis testing, it is known that the self-efficacy skills obtained a sig value. 0.000, if the sig level. $\alpha = 0.05$, it can be seen that the sig value. $0.000 < 0.05$. So it can be concluded that there are differences in the self efficacy skills of fifth grade students between the control class and the experimental class.

The implementation of PjBL can develop students' self-efficacy skills so that they feel confident in working on projects. Teachers in this case play an important role in creating an environment that supports the development of students' self- efficacy. Based on the learning steps, this model is included in systematic learning. Where learners are directly involved in learning activities. Through making projects, students are challenged to complete tasks, answer questions and be able to design and produce products well. Various student self-development efforts to foster self-efficacy are very important to improve product quality (Martanto et al., 2022). Students' self-development efforts to foster self-efficacy are also very important to support product quality in the learning process.

Self-efficacy itself means firm belief in the beliefs possessed in performing or completing a task. That way, indirectly the implementation of learning through the PjBL model can develop self-efficacy in students. The increase in learning self- efficacy is realized, because students feel very confident in their abilities (Herzamzam, 2021). The increase in

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student self-efficacy can be seen from most students being able to solve problems given by the teacher through props. Students do not hesitate in making ice cream projects with group members. The above statements are also supported by Saepuloh's research (2020) that there is an increase in the self-efficacy of experimental class students who apply the project-based learning model. (Saepuloh, 2020). Ulfah (2020) also revealed that the PjBL model can increase self-efficacy and creative thinking skills followed by increased teacher activity and student activity(Martanto et al., 2022).

The implementation of Project-Based Learning contributes to the improvement of self-efficacy significantly to the improvement of critical thinking skills. High self-efficacy makes learners more confident in facing challenges and solving complex problems, so they are more motivated to use critical thinking strategies in evaluating, analyzing, and integrating information. Critical thinking skills that are continuously honed through authentic projects can strengthen students' confidence in their intellectual abilities, so that self-efficacy also increases. Thus in PjBL, these two skills form a positive impact that mutually supports the learning environment so that it can develop the ability to think independently and innovatively. Nuraeni's research (2019) states that students who have high self- confidence will be better able to develop their thinking towards critical thinking so that they can complete tasks well (Nuraeni et al., 2019).

CONCLUSION

The implementastion of project-based learning models in science and social studies learning is carried out using several stages, including determining the project, designing project completion steps, preparing a project implementation schedule, project implementation, compiling reports and presenting project results, and evaluating the process and results of the project. Students' critical thinking skills in science learning on the material of changes in the state of objects by implementing the Project Based Learning model can be concluded that there are significant differences in students' critical thinking skills and self-efficacy abilities in the pretest and posttest. It is hoped that this study can provide an important contribution in supporting the implementation of an independent curriculum that focuses on learning that is more student-centered, creative, and relevant to students' needs.

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