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Increasing Learning Outcomes and Critical Thinking Skills Through Project Based Learning Strategy Integrated with Local Wisdom 'Dangke' Approach in Science Learning

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Abstract

The research aims to determine the effect of the Project Based Learning (PjBL) strategy integrated with the local cultural wisdom of making dangke in improving learning outcomes and critical thinking skills of elementary school students in science material. This type of research is experimental research carried out at SDN 122 Pangbuluran in 2023. The subjects of this research are fourth grade elementary school students, who are divided into an experimental group and a control group. The data analysis techniques used are: descriptive data analysis in the form of: mean, data range, class interval, class length, percentage, variance and standard deviation; and inferential statistical data analysis techniques in the form of: normality test, homogeneity test, and hypothesis test. The instruments used are multiple choice questions to measure student learning outcomes and essay questions that have been validated and declared reliable as test instruments. The results of data analysis obtained hypothesis testing: t_{count} learning outcomes of $10.2 > t_{table}$, until H_0 rejected, while t_{count}critical thinking skills of $9.9 > t_{table}$, until H_0 rejected. It can be concluded that there is an influence of the Project Based Learning (PjBL) strategy integrated with local cultural wisdom in making dangke in improving learning outcomes and critical thinking skills of elementary school students in science material.

Keyword: ***PjBL, Learning Outcomes, Critical Thingking, Local Wisdom***

Introduction

Natural Sciences (IPA) at elementary school level is a subject that studies natural events systematically. Science learning in elementary schools discusses events that occur in nature through observation, experiments, conclusions and theory development so that students have knowledge, ideas and concepts about the natural environment in an organized manner. Through science learning at school, students are expected to be able to have insight, skills and critical thinking skills in solving problems encountered in everyday life. Anggreini, *et al* (2019) stated that teachers must act as facilitators, guiding and directing students to think critically in learning as the focus of the 2013 curriculum is to realize 21st century learning with the skills to think critically and creatively. The results of observations at SDN 122 Pangbuluran provide information regarding

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science learning outcomes, especially in 4th grade, which are still relatively low. This is proven by the majority of students' daily test scores which are still below the Minimum Completeness Criteria (KKM) standards.

There are several obstacles encountered in the science learning process in the classroom, including: the science learning presented to students is still conventional using the lecture method, not using more varied and interesting learning strategies; the use of learning media is still not optimal; and providing examples of the application of science applications to students

tends to be based on the contents of student textbooks which seem abstract because students rarely encounter this phenomenon in everyday life. Wibowo,*et al* (2018) found that several science teaching practices were not running optimally in facilitating students' critical thinking skills because science teaching practices still tended to use lectures and practice questions to complete subject targets.

This has an impact on students' learning conditions who are less enthusiastic and whose learning outcomes are still low. Kurniawati, *et al* (2013) stated that students must also be able to find the answer to "what is the point of studying this subject ?" or “how to use this material in real life?” and then apply it in everyday life. Science learning given in class cannot be separated from students' daily experiences and environment, so that it will make it easier for students to understand the material (Widiya, *et al*, 2021). Project-based learning is a learning model that uses problems as an initial step in collecting and integrating new knowledge based on experience in real activities (Fahrezi, *et al,* 2020), so as to improve students' science process skills (Maria & Maimuna, 2021).

The society of Enrekang Regency have very diverse local wisdom, including the typical foods dangke and palm sugar. This food, which comes from processed cow or buffalo milk (Suryani & Niswah, 2015), has been a traditional food for the Enrekang society since 1905 and has been processed into various types of food such as side dishes and dangke chips. Likewise with the manufacture of palm sugar which is easily found in various areas in Enrekang Regency. The topographic conditions of Enrekang Regency, which mostly consist of hills and green mountain slopes (RPJM Enrekang, 2018), make it possible for many sugar palm trees to grow and be available in the area. This encourages the Enrekang society to process the abundance of palm fruit into very useful food, such as palm sugar.

Through the integration of project based learning in science learning with the local wisdom of the Enrekang society, it is hoped that students will not only get an interesting learning experience, improve high-level thinking skills (Hikmawati, *et al*, 2021), increase students' character values (Asrial, *et al*, 2022) , can create products that are useful for life (Mokambu, 2021), increase creativity in work (Hairunnisa, *et al*, 2019), can improve the critical thinking skills of elementary school students (Winarti, et al, 2022), but also have provide students with an understanding of the importance of preserving local wisdom that has been passed down by their ancestors.

Method

The type of research is quantitative research using experimental research methods. The research was carried out at SDN 122 Pangbuluran, Salukanan Village, Baraka District, Enrekang Regency using a Project

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Based Learning (PjBL) strategy through the local wisdom approach of the Enrekang society, namely: making the typical food dangke and palm sugar. The subjects of this research were 36 class V students who would be divided into a control group and an experimental group. The subject in the Natural and Social Sciences (IPAS) subject that will be taught is related to the theme of typical regional food. The research design used is shown in Tabel 1.

Table 1. Research Design

Group	***Pre-test***	**Treatment**	***Post-test***
Experiment	X_1	O_1	X_2
Control	X_1	O_2	X_2

Information:
X_1: Pre-test Learning Outcomes and Critical Thinking Skills
O_1: Learning with PjBL
O_2: Conventional Learning
X_2: Post-test Learning Outcomes and Critical Thinking Skills

The instrument used is a multiple choice test instrument to measure student learning outcomes. As for the instrument to measure students' critical thinking skills, an essay form test instrument is used with assessment guidelines covering aspects:

- Objective: students are able to demonstrate a clear understanding of the objectives of the assignment given
- Key question or problem: students are able to define the problem, as well as identify the core problem accurately.
- Information: students are able to collect sufficient, credible, relevant information, make observations, provide statements, logic, data, facts, questions, graphs, themes and descriptions, including the latest information
- Concepts: students are able to identify and accurately explain/use relevant core concepts in depth
- Interpretation or conclusion: students are able to make logical and consistent conclusions.

These two test instruments are given in the pre-test and post-test activities. The data analysis techniques used are: (1) descriptive statistical data analysis techniques in the form of: mean, data range, class interval, class length, percentage, variance and standard deviation; (2) inferential statistical data analysis techniques in the form of: normality test, homogeneity test, and hypothesis test. The implementation of PjBL can be seen in Figure 1.

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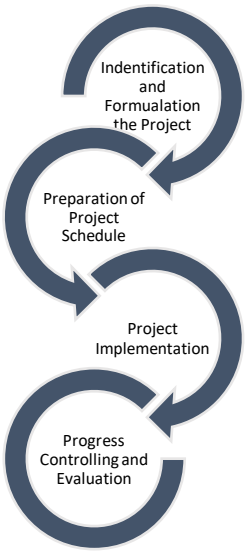

Figure 1. Project Based Learning Implementation Flow

Result and Discussion

Validity and Reliability of the Instrument

Before use, the learning outcomes instrument is validated using the SPSS application to determine which instruments are valid and reliable for use. Based on the SPSS results, it was found that all instruments used were declared valid and reliable. As for the data from the instrument validation results, data was obtained that there were 15 items that were declared valid and 5 items that had to be discarded or repaired because they had a calculated r_{value} that was lower than the r_{table} (0.196) and were declared invalid. Meanwhile, for the instrument reliability test, data was obtained in Table 1.

Table 1. Reliskills Test Result

Cronbach's Alpha	**N of Items**
.901	20

In Table 1, the statistical value of the reliskills test is obtained with a Cronbach's alpha value of 0.901 > r table 90.206). This shows that the instrument that will be used is reliable.

Normality Test

Table 2. Normality Test Result

	Group	**t_{count}**	**t_{tabel}**	**Conclution**
Experiment	Critical Thinking Skills	0,1437	0,1766	Normal
	Learning outcomes	0,1636	0,1766	Normal
Control	Critical Thinking Skills	0,1285	0,1766	Normal
	Learning outcomes	0,125	0,1766	Normal

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Based on Table 2, the calculation of the normality test for learning outcomes instruments, it can be seen that the significance value (2-tailed) in the control class and experimental class is greater than 0.05, so it can be said that the learning outcomes instrument data has a normal distribution.

Homogeneity test

Table 3. Homogeneity Test

Group		Lavene Statistic	DF_1	DF_2	Conclution
Learning Outcomes	Based in Mean	1.239	1	54	.271
Critical Thinking Skills	Based in Mean	.099	1	51	.755

Table 3 shows the calculated value of the homogeneity test of the instrument for learning outcomes and critical thinking skills which has a significance value greater than 0.05, so that the instrument is declared to have homogeneous data. The average value of student learning outcomes in the experimental class and control class is shown in Figure 2.

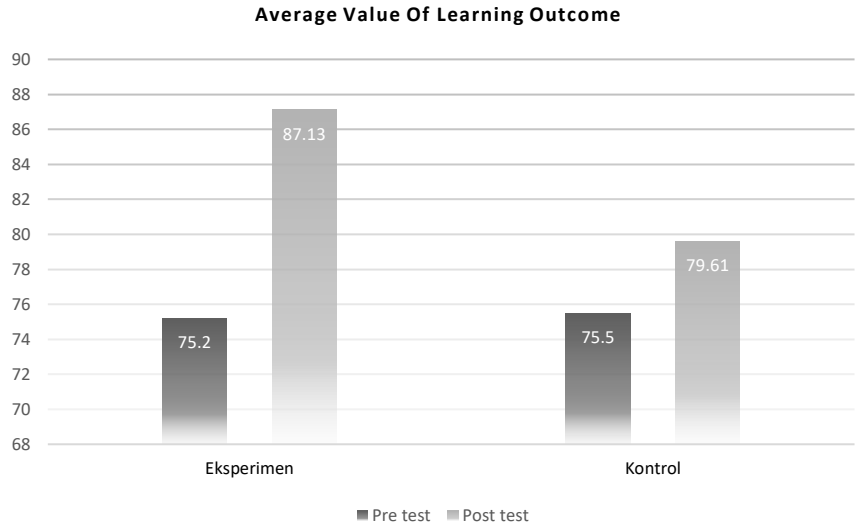

Figure 2. The Average Value of Student Learning Outcome

The data above shows that the maximum score obtained by students in the experimental class post test reached 100, and the lowest score was 76.47. The average student learning outcome score in the experimental class is 86.40. In the control class, the maximum value obtained was the same as the experimental class and the lowest value was 64.71. The average post test score for students in the control class was 78.04. Meanwhile, the average score of students' critical thinking skills test results in the experimental class and control class is shown in Figure 3.

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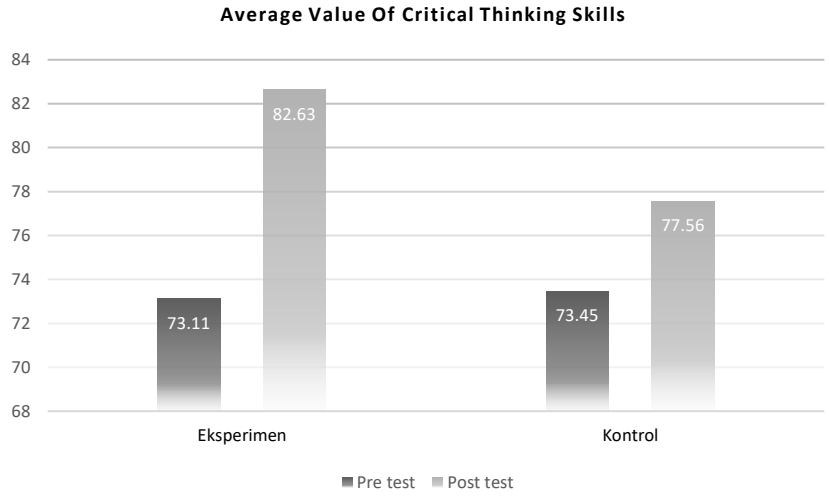

Figure 3. The Average Value of Student Critical Thinking Skills

Hypothesis testing

Table.4 Hypothesis Testing Results

Group	***t count***	***t table***	***Conclusion***
Critical Thinking Skills	9,9	1,67	H_0 Rejected
Learning Outcomes	10,2	1,67	H_0 Rejected

Based on the results of the hypothesis test, it was found that H_0 rejected, which means there is an increase in learning outcomes and critical thinking skills of students who are taught with the Project Based Learning Strategy integrated with local wisdom in science learning.

Discussion

The results of observations related to science learning, especially in class V at SDN 122 Pangbuluran, found that students' science learning outcomes were still low. This is because the strategies used by teachers do not attract students' attention. Besides that, giving examples of science applications to students is only based on textbooks, not yet contextual to the environment around the students, so that students do not understand the concepts being studied well. Furthermore, the learning atmosphere is monotonous and only carried out in the classroom, its causing students to not be enthusiastic about following lessons. This affects the potential for students' critical thinking skills not to be developed well, so that their critical thinking skills are still relatively low. The various problems that have been described, inspired researchers to conduct a research using a Project Based Learning (PjBL) strategy with an approach to the local wisdom of the Enrekang society, in this case making "dangke" and "palm sugar". Dangke and palm sugar are local superior products of the Enrekang Regency which are highly sought after by the society.

The research was carried out by dividing the student group into an experimental group and a control group. Students in the experimental group were given learning experiences using the PjBL strategy which was integrated with the local wisdom approach of making dangke and palm sugar. Meanwhile, students in the control group were given learning experiences using conventional

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strategies, according to the strategies used by teachers at school. The aim of dividing student study groups is to find out whether there is an increase in student learning outcomes taught using the PjBL strategy through the local wisdom approach of making dangke and palm sugar.

Before the research was carried out, pre-test activities were carried out in the control and experimental classes to determine the students' initial abilities. The implementation of research in the experimental class was carried out in several stages. In the first stage, students are involved in identifying and formulating the project to be implemented. The project in question is the manufacture of 'dangke' and palm sugar which are local superior products of the Enrekang society. The project identification and formulation process includes identifying: selecting a dangke and palm sugar production location as a visiting location, recording how to make dangke and palm sugar, determining tools and materials used when making dangke and palm sugar, as well as how to package dangke and palm sugar products.

The second stage, students are directed to prepare a schedule for visiting dangke and palm sugar production locations (home industry), as well as create a practice schedule for making dangke and palm sugar at school. In the third stage, students begin to carry out project activities, where first students are directed to take part in visiting dangke and palm sugar production locations. This activity aims to provide real learning experiences to students regarding how to make dangke and palm sugar, so that students can be motivated after directly experiencing the subject matter they will study in class. Kurniawati, *et al* (2013) stated that students must also be able to find the answer *"what is the point of studying this material?"* or "*how to use this material in real life in everyday life"*.

After visiting the dangke production location, students were directed to be directly involved in the practice of making dangke and palm sugar in class through group work. Students who were directly involved in preparing the schedule, designing procedures for making dangke and palm sugar seemed very motivated and enthusiastic in the learning process. Asrial ,*et al* (2022) stated that the PjBL learning process could increase students' character values. This can be seen when students work together and help each other in teams, so that they can produce the desired product. Mokambu (2021) also said that through PjBL, students can create products that are useful in everyday life. The result product will certainly increase students' creativity in creating work (Hairunnisa, *et al*, 2019).

The final stage of this project is the teacher monitor project progress and carry out evaluation activities. Monitoring and evaluation is carried out not only during the process of making dangke and palm sugar in class, but also when students presenting the dangke and palm sugar products that have been made in front of the class. At this stage, students are required to be able to communicate verbally regarding: tools and materials used, procedures for making dangke and palm sugar based on their experience when making these products, explain the benefits of dangke and palm sugar in everyday life, and be able to introduce dangke and palm sugar as a product of local wisdom in their regency. The final stage is evaluation through post test activities given to students. The post test is given in the form of multiple choice questions to measure student learning outcomes and essay questions instrument to measure students' critical thinking skills. As for the control class, students are given learning experiences in the form of a learning process in class using textbooks that have been used by teachers at the school.

The research results showed that students who were taught using the PjBL strategy using a local wisdom approach, had higher learning outcomes and critical thinking skills, when compared with the

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learning outcomes and critical thinking skills of students taught using conventional methods in the control class. This can be seen in the comparison of the average learning outcomes scores and critical thinking skills of students in the experimental class of 87.13 and 82.63. The average learning outcome scores and critical thinking skills of students in the control class were 79.61 and 77.56. The high value of students' learning outcomes and critical thinking skills in experiment class is influenced by the learning strategies used. Project-based learning (PjBL) is understood to be a promising approach that improves student learning in education because PjBL not only focuses on the final product, but also about students' learning processes (Guo, *et al,* 2020).

Students who gain learning experience using the PjBL strategy will be directly involved in preparing and working on projects, as well as making observations in dangke and palm sugar production locations. Barak & Shiran (2021) found that the process of working on a project in a team encourages students to get new ideas by observing and asking questions intensively. This supports students in understanding the concepts of the material being studied so that it has an impact on improving their learning outcomes. Besides that, direct involvement in working on a given project will train students' critical thinking and creative thinking skills. Grant (2001) states that project based learning can be used to improve students' metacognition. Furthermore, by increasing students' metacognition, this also means increasing students' abilities in solving problems logically and reflectively, which abilities are part of critical thinking indicators (Gotoh, 2016).

Several indicators of critical thinking skills achieved by students during project work, namely:

- Objective: students are able to demonstrate a clear understanding of the objectives of the assignment given. Based on these indicators, students are able to formulate and design projects for making dangke and palm sugar.
- Information: students are able to collect sufficient, credible, relevant information, make observations, provide statements, logic, and facts. In this indicator, students look for information regarding the sequence of steps for making dangke and palm sugar, as well as the materials and tools used in making the project through visits to home industry locations where dangke and palm sugar have been produced. This is in line with the findings of Sumarmi (2012) who stated that the learning environment in the PjBL learning model is an authentic learning environment so that it is more contextual to students' daily lives in the real world.
- Concepts: students are able to identify and accurately explainor use relevant core concepts in depth. In this indicator, students are able to explain several local wisdom products of the Enrekang society, including: dangke and palm sugar. Next, students in groups made dangke and palm sugar based on information obtained from previous observations. Oktavianto (2017) explained that by providing learning experiences through PjBL, students will feel challenged to solve real problems, students will become more active in learning, and students' performance during project implementation will be more regular.
- Interpretation or conclusion: students are able to make logical and consistent conclusions. In this indicator, students are able to present in front of the class about how to make dangke and palm sugar as the final product of their project are working on. Critical thinking is an effort to increase awareness and intelligence by comparing several problems to produce conclusions and ideas that can solve the problem (Zulfaneti, *et al*, 2018). Through critical thinking activities, students will be able to provide

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arguments using reliable scientific evidence and logical reasoning, so that they can formulate or solve problems and make decisions as a conclusion.

The various experiences gained by students at each stage of the dangke and palm sugar making project have a positive impact in increasing their learning outcomes and critical thinking skills. Kurubacak (2007) also said that PjBL can improve critical thinking through material that is contextual to everyday life.

Conclusion

The Project Based Learning (PjBL) strategy which is integrated with the local wisdom of the Enrekang society can improve elementary school students' learning outcomes and critical thinking skills in science material. It is recommended for future researchers to create science material teaching modules that are integrated with the local wisdom of the society.

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