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EFFECTIVENESS OF PROJECT BASED LEARNING MODEL (PJBL) BASED ON HIGHER ORDER THINKING SKILL (HOTS) ON PROBLEM SOLVING ABILITY OF GRADE V STUDENTS IN UPT SPF SD

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ABSTRACT

This study aims to determine the application of the Project Based Learning (PjBL) learning model based on Higher Order Thinking Skill (HOTS) to problem solving skills in IPAS learning for grade V students at UPT SPF SD Negeri KIP Maccini and the effectiveness of the Project Based Learning (PjBL) learning model based on Higher Order Thinking Skill (HOTS) on problem solving skills in IPAS learning for grade V students at UPT SPF SD Negeri KIP Maccini Makassar City. This type of research is experimental research with a one group pretest-posttest design with a sample size of 22 students consisting of 15 male students and 7 female students using observation sheet instruments, tests, questionnaires and documentation. In this study using descriptive statistical analysis and inferential analysis with the help of SPSS version 29. The results of this study indicate that after using the Project Based Learning (PjBL) learning model based on Higher Order Thinking Skill (HOTS), the mean posttest test is 76.77 and the mean posttest questionnaire is 45.22. Based on the hypothesis test that has been carried out, it can be concluded that the Project Based Learning (PjBL) learning model based on Higher Order Thinking Skill (HOTS) has an effect on students' problem solving ability after a value of 0.000 <0.05 is obtained so that H0 is rejected and H1 is accepted, which means that there is a significant effect of using the Project Based Learning (PjBL) learning model based on Higher Order Thinking Skill (HOTS) in IPAS learning on the problem solving ability of grade V students.

1. INTRODUCTION

Along with the times, technology continues to advance and bring significant changes in various aspects of life, including in the world of education.

Education is a conscious and planned effort to create a learning atmosphere and a learning process learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence and noble character, as well as the skills needed by themselves, society, nation and State. Efforts to improve the quality of education must be made by mobilizing all components in education. One aspect that must be improved is the learning process (Irviana et al., 2021).

Education is an important part of life that can make a difference for humans with other living things. Education is the most important thing for citizens of a country, because the progress and backwardness of a country will be determined by the high and low levels of education of its citizens (Nurhayati Selvi & Nur Afni, 2021). Education must be given to every human being and is a necessity. Education is not just about school and learning in class, but education can be obtained anywhere through anyone ((Irviana et al., 2021). Education can shape changes in a person's behavior to mature individuals through pedagogy and training. Education is one of the important components in human life that is responsible for fostering students to become mature, brave, independent, and critically reasoned human beings (Wulandari, 2020).

As stated by (Suriansyah, 2020) the concept of education implies a process of experience, because life is growth, education means helping inner growth without being limited by age. The growth process is the process of adjusting to each phase and adding skills in one's development.

The definition expressed (Suriansyah, 2020) emphasizes that educational activities are essentially a process of experience but this experience must direct students to inner growth, so that with this inner growth they can exist in the midst of their environment with various challenges and problems faced without having to always depend on others.

Education in Law Number 20 of 2003 Article 1 paragraph 1 concerning the national education system which states: "Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to represent religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves and society"(Arifin, 2022). Through education, the Indonesian generation is expected to become innovative and qualified people so that they can contribute well to building the nation and solving all the problems that are being faced by the Indonesian people (Irviana et al., 2021).

According to the law, the purpose of education in Indonesia is to create an active learning atmosphere and learning process, so that students can develop their potential. Teachers are an important factor that plays a role in student success, so the quality of teachers needs to be improved and adjusted to the times. The learning process requires an effective strategy. The selection of the right strategy aims to foster students' creativity, ability, and innovative attitude. Therefore, teachers' professional skills in learning and classroom management need to be nurtured and developed. The quality of teaching depends on the learning strategies applied. The learning model is a plan or a pattern that is used as a guide in planning classroom learning. The learning model refers to the learning approach that will be used, including teaching objectives, stages in learning activities, learning environment, and class management (Irviana, I 2020).

According to (Melinda, 2020) the project-based learning model is an innovative learning model centered on students so that they are directly involved in planned projects / activities.

Higher order thinking skills are defined as the broad use of the mind to find new challenges. This high-level thinking skill requires a person to apply new information or prior knowledge and manipulate information to reach possible answers in new situations (Lestari, R. 2021). High-level thinking is thinking at a higher level than just memorizing facts or telling someone information.

This Higher Order Thinking Skill (HOTS) is in accordance with 21st century thinking skills, must be applied as early as possible to foster a generation that is critical and collaborative in all aspects of development. Learners are no longer led to be told, but to find out for themselves. Finding out means requiring a smart and creative thinking process (Afkarina, 2021). Such thinking requires students to be directed from remembering, understanding, and even solving complex problems. Complex thinking skills will make learners accustomed to facing something difficult. To deal with something that is difficult requires higher-level thinking skills.

As explained in Q.S. Al-Hasyr verse 21 as followst:

لَوْ اَنْزَلْنَا هٰذَا الْقُرْاٰنَ عَلٰى جَبَلٍ لَّرَاَيْتَهٗ خَاشِعًا مُّتَصَدِّعًا مِّنْ خَشْيَةِ اللّٰهِ ۗوَتِلْكَ الْاَمْثَالُ نَضْرِبُهَا لِلنَّاسِ لَعَلَّهُمْ يَتَفَكَّرُوْنَ

Meaning: If we had sent down this Qur'an to a mountain, you would have seen it bowed down. We have made these similes for men so that they will think of being divided for fear of Allah.

The meaning of the above verse in the interpretation of Ibn Kathir explains that if a mighty and hard mountain, if it understands the meaning of this Qur'an, then contemplates it, it will undoubtedly bow down divided for fear of Allah SWT. Then what is appropriate for mankind, if

the heart is not soft, submissive and obedient because of the fear of Allah, when humans can understand Allah's commands and contemplate His Book.

Higher Order Thinking Skill (HOTS) is the main focus of efforts to improve the quality of education. HOTS refers to the ability to apply, analyze, evaluate and create information. The integration of HOTS in IPAS learning is expected to produce a generation that is able to adapt and develop in the era of information and technology dynamics (Tasrif, 2022).

Natural and Social Science Education (NSP) is one of the most important subject areas in the basic education curriculum. Studying IPAS is not only about understanding basic concepts about nature and society, but also involves solving problems related to the surrounding environment and social interactions (Nasution, 2018). In the context of modern education, it is important for educators to develop effective and relevant learning approaches to help students hone their problem-solving skills.

Based on observations made at UPT SPF KIP Maccini State Elementary School Makassar City, that during the learning process, active communication is only centered on the teacher or one side only so that students are passive, namely only receiving information conveyed by the teacher, besides that the low learning outcomes of IPAS are due to the lack of learning that can develop problem solving skills, this is due to learning that is still conventional with lecture or discussion methods in delivering material and giving IPAS questions that do not familiarize students to solve problems, so that students' curiosity is still lacking.

Grade V students at UPT SPF SD Negeri KIP Maccini experience difficulties, especially in learning IPAS, for example students have difficulty in identifying the types of animals and plants that are food sources, they have difficulty in understanding the concept and how to identify the types of food. Many students only memorize concepts without deeply understanding their application. For example, students may know the definition of an ecosystem, but do not understand the complex relationships between the components in it. In story problem tasks, students often struggle to identify the main problem that needs to be solved. They don't understand the question or can't determine the right first step. Students showed significant limitations in problem-solving ability in the IPAS subject. Lack of in-depth concept understanding, minimal research skills, inability to identify problems, lack of problem-solving strategies, ineffective collaboration, and low self-confidence are the main factors that cause students to be perceived as lacking in problem-solving ability.

One of the learning models that educators can use to improve students' higher order thinking skills is the Project Based Learning model. This model is very suitable to be applied, with this model can place students as active learners who are directly involved in projects that are relevant to their daily lives. This helps to increase students' learning motivation and understanding as they are actively involved in the learning process. It can also encourage collaboration between students, allowing them to learn from each other and develop social skills and the ability to work in teams.

One prominent learning model is Project Based Learning (PjBL). This model offers a more authentic learning experience, where students engage in real projects that demand active engagement, collaboration and problem solving. By combining the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) model, it is expected to have a positive influence and advantages, one of which is to improve problem solving, make students more active and successfully solve complex problems.

Based on the explanation above, the authors are interested in conducting a study entitled "The effectiveness of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model in IPAS learning on the problem solving ability of Grade V Students at UPT SPF KIP Maccini State Elementary School Makassar City

2. METHODS

This research is an experimental research with pre-experimental design, using one group pretest-posttest design approach. The study aims to measure the effectiveness of the Higher Order Thinking Skill (HOTS) based Project Based Learning (PjBL) learning model on the problem solving ability of grade V students at KIP Maccini State Elementary School, Makassar City. It was conducted in August 2024 with five learning meetings. The population of this study were all grade V students totaling 45 students, and the research sample was grade Vb students consisting of 22 students, selected by purposive

sampling technique because it has characteristics relevant to the research objectives. Data were collected through observation sheets, questionnaire tests, and documentation. Data were analyzed using descriptive and inferential statistics, with a t-test to compare pretest and posttest scores. Instrument validity was tested using SPSS version 29, resulting in several valid items used in the analysis.

3. RESULTS AND DISCUSSION

1. The application of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model to problem solving skills in IPAS learning for grade V students at UPT SPF KIP Maccini State Elementary School in Makassar City

This research was conducted on August 12, 2024 - August 26, 2024 at UPT SPF SD Negeri KIP Maccini Makassar City, the subjects of this research were Vb class students with 22 students. On Monday, August 12, 2024, the researcher made an introduction to the homeroom teacher Vb and informed that the researcher wanted to conduct research in his class. Before the implementation of the study, the researcher prepared everything related to the material, both teaching modules, questions and props. The instruments to be collected in this study are observation sheets, questionnaires and tests. In this study the researcher as a teacher. The first meeting was held on Thursday, August 15, 2024, the researcher made introductions to Vb class students and explained the purpose of the study. After introducing and explaining the objectives, an initial test (pretest) was conducted to determine the students' initial understanding of IPAS learning. The time used for the pretest was around 1 hour and 20 minutes with 10 essay questions and 12 statements. After completing the pretest, the researcher gave an overview of what would be done at the next meeting.

On the second meeting, Monday, August 19, 2024, researchers carried out the learning process with the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model. When students entered the classroom, researchers asked students to sit on their respective benches. The process began with the researcher displaying Power Point then providing relevant and challenging fundamental questions, which became the basis of the project. This question should encourage students to think critically and motivate them to explore more deeply. After the fundamental question is posed, students work together with the teacher to develop a project plan. The researcher formed groups of 4, 2 groups of 6 people and 2 groups of 5 people. The total number of students in class Vb is 22 people, so there are 4 groups formed. The researcher explained about the project activities that would be carried out. The researcher asked students to sit with their groups then the researcher displayed a Power Point related to the material provided, namely the food chain. While paying attention to the Power Point, students were also directed to note important points. Students and teachers set a schedule for the project by considering stages such as data collection, and presentation preparation. This schedule helps students manage their time and responsibilities. They learn to divide time for each stage of the project and manage the process independently. The researcher also distributed the LKPD to each group.

At the third meeting, on Thursday, August 22, 2024, when entering the class, the researcher directed to sit with the groups that had been formed at the previous meeting. Each group carried out the project in accordance with the steps listed in the LKPD while the researcher monitored student progress throughout the project. The researcher acts as a facilitator who continues to monitor student progress during the process of making food chain dioramas. Students were directed to reflect at each stage of the project, and the researcher provided feedback on how to describe the interactions in the food chain. For example, if there were errors in depicting the role of certain species in the food chain, the researcher provided guidance to correct them.

After the diorama is completed, students are asked to test the results by explaining in front of the class how the food chain in their diorama works. Students are also asked to explain what if one of the components in the food chain is missing, and what impact it will have on the ecosystem as a whole with the aim of encouraging students to take responsibility for the solutions they make and assess the effectiveness of the diorama project in describing the food chain. The final stage is the overall project evaluation, where students are invited to reflect on their experience during the project. Students were encouraged to discuss what they have learned about the food chain, what challenges they faced during the making of the diorama, and how they overcame them. In addition, the researcher also provided an evaluation of the process and results of the project, as well as providing suggestions for future improvements.

At the fourth meeting, August 23, 2024, researchers conducted a posttest with a total of 10 essay questions. At the last meeting on August 26, 2024, researchers conducted a posttest with a 12-number questionnaire instrument.

a. Observation result

1) Teacher Observation Results

Based on the results of observations made at UPT SPF KIP Maccini State Elementary School Makassar City on August 15, 2024 - August 26, 2024 in the implementation of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model on students' problem solving ability, it was found that there were very positive results. This observation aims to evaluate the effectiveness of the Project Based Learning (PjBL) learning model based on Higher Order Thinking Skill (HOTS) in improving students' ability to solve complex problems in IPAS learning, especially related to the material provided.

During the observation process, the teacher noted that most students were able to understand and identify the problems presented quickly. They were actively involved in group discussions and started to develop their project plans using the materials provided by the teacher. During the observation, the teacher provided guidance and assistance when students encountered difficulties, but most students were able to be independent in doing their tasks.

The observation score conducted at the initial meeting showed a remarkable achievement, with a score of 14 out of 15 or equivalent to a percentage of 93.33%. This reflects significant success in the application of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model, which successfully encourages students to think more deeply, analyze, and apply the concepts learned to real projects. In the implementation of this model, they are able to identify challenges that exist in the project, analyze the causal factors, and formulate effective solutions. This process shows that students' critical thinking skills are well developed during the learning process..

2) Student Observation Results

Based on the results of student observations conducted at UPT SPF KIP Maccini State Elementary School Makassar City, the application of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model in improving students' problem solving skills showed good results. This observation aims to evaluate the effectiveness of the Project Based Learning (PjBL) model in helping students develop critical, analytical, and creative thinking skills in solving problems relevant to the learning context.

In the implementation of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model, students are given projects that require active involvement and collaboration in groups. The learning material is focused on the concept of food chains in ecosystems, where students are faced with challenges to create projects based on trigger questions that encourage them to think more deeply. Students are assigned to work in groups to develop a diorama of the food chain, and formulate the impact of changes that occur in one of the components of the chain.

From the observation results, students managed to achieve a score of 12 out of 15, with a percentage of 80%, which is categorized as good. This achievement shows that students are able to respond to the challenges given with the success set by the teacher. Students showed developing skills in terms of problem solving, although there is still room for further improvement. Some students had difficulty in detailing the more complex impacts associated with changes in the food chain, but overall, they managed to understand the basic concepts and complete the project well.

b. Pretest and Posttest Results

1) Pretest Results

In this study, the first meeting was conducted on August 15, 2024 to evaluate students' abilities before they were treated with 10 questions and 12 questionnaires. On August 19 and 23, students were treated with project-based learning (PjBL) model based on higher order thinking skills (HOTS). On the last meeting, a posttest was conducted to find out how effective the learning model is. By using the Project Based Learning (PjBL) learning model based on higher order thinking skills (HOTS), the data obtained were calculated as follows: average, median, mode, standard deviation, variance, maximum score, range, and maximum score.

Table 1 Pretest Descriptive Statistical Data

Test		Poll	
Statistics	Skor	Statistics	Skor
N	22	N	22
Mean	60.636	Mean	36.09
Median	61	Median	36
Mode	61	Mode	36
Maximum Score	75	Maximum Score	43
Minimum Score	41	Minimum Score	29
Standard Deviation	8.521	Standard Deviation	4.297
Variance	72.623	Variance	18.467
Range	34	Range	14
Sum	1334	Sum	794

Source : IBM SPSS Versi 29

Based on the table above, it can be seen that the mean or average value of student pretest test results is 60.636 out of an ideal score of 100, Std. Deviation 8.521, these results show the distribution of pretest scores, from a minimum score of 41 to a maximum score of 75 with a range or range of 34, a mode of 61 and a median of 61. While in the pretest using a questionnaire the mean or average student score is 36.09 from an ideal score of 48. Standard deviation 4.297, these results show the distribution of pretest scores, from a minimum score of 29 to a maximum score of 43 with a range or range of 14, a mode of 36 and a median of 36.

Based on the tests and questionnaires given in this study, the frequency data obtained consists of student data before (pretest) given treatment, namely:

Table 2 Pretest Frequency Data

No	Test			Poll			Category
	Interval	Frequency	Percent	Interval	Frequency	Percent	
1	41 – 47	2	9%	29 – 31	4	18%	Very low
2	48 – 54	1	5%	32 – 34	2	9%	Low
3	55 – 61	10	45%	35 – 37	9	41%	Enough
4	62 – 68	5	23%	38 – 40	3	14%	High
5	69 – 75	4	18%	41 – 43	4	918	Very High
Jumlah		22	100%	Jumlah	22	100%	

Based on the table above, it can be seen that the highest frequency distribution on the test instrument is in interval number 5 which has a range of 69 - 75 with a total of 4 students. While the highest frequency distribution in the questionnaire instrument is in interval number 5 which has a range of 41 - 43 with a total of 4 students.

2) Posttest Results

After applying the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model in IPAS learning to students' problem solving skills, posttest data is presented to compare with pretest data obtained before treatment.

Taable 3 Posttest Statistical Data

Test		Poll	
Statistics	Skor	Statistik	Skor
N	22	N	22
Mean	76.772	Mean	45.22
Median	77	Median	45
Mode	75	Modus	47
Maximum Score	94	Maximum Score	48
Minimum Score	60	Minimum Score	40
Standard Deviation	10.093	Standard Deviation	2.223

Variance	101.870	Variance	4.945
Range	34	Range	8
Sum	1689	Sum	995

Source : IBM SPSS Versi 29

Based on the table above, it can be seen that the mean or average value of the student test posttest results is 76.772 from the ideal score of 100, standard deviation 10.093, these results show the distribution of posttest scores, from a minimum score of 60 to a maximum score of 94 with a range or range of 34, mode is 75 and median 77. While the mean or average of posttest results using a questionnaire is 45.22 from an ideal score of 48. Std. Deviation 2.223, these results show the distribution of posttest scores, from a minimum score of 40 to a maximum score of 48 with a range or range of 8, mode is 47 and median 45. Based on the tests and questionnaires given in this study, the frequency data obtained consists of student data after (posttest) is given treatment, namely:

Table 4 Posttest Frequency Data

No	Test			Poll			Category
	Interval	Frequency	Percent	Interval	Frequency	Percent	
1	60 – 66	5	23%	40 – 41	1	5%	Very Low
2	67 – 73	1	5%	42 – 43	4	18%	Low
3	74 – 80	9	41%	44 – 45	8	36%	Enough
4	81 – 87	4	18%	46 – 47	5	23%	High
5	88 – 94	3	14%	48 – 49	4	18%	Very High
Amount		22	100%	Amount	22	100%	

Based on the table above, it can be seen that the highest frequency distribution on the test is in interval number 5 which has a range of 88 - 94 with 3 students. While the highest frequency distribution in the questionnaire instrument is 48 - 49 with a total of 4 students.

2. **Effectiveness of Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) Model in IPAS Learning on Problem Solving Ability of Grade V Students at UPT SPF KIP Maccini State Elementary School Makassar City.**

Project Based Learning (PjBL) learning model based on Higher Order Thinking Skill (HOTS) is an approach that focuses on problem solving through projects, where students are faced with challenges that require active participation in critical, creative, and collaborative thinking. In this study, the application of the HOTS-based PjBL model in IPAS (Natural and Social Sciences) learning aims to improve the ability of grade V elementary school students to solve problems. Each stage of the PjBL model was evaluated to assess its effectiveness in achieving this goal.

Through the effectiveness indicators of teaching quality, appropriate teaching level, incentives, and time, it can be stated that the application of Project Based Learning (PjBL) based on Higher Order Thinking Skill (HOTS) is effective in learning IPAS. It is effective because of the quality of teaching, which is reflected in students' deep understanding of the material and their ability to apply the knowledge in a real context. The appropriate level of instruction indicates that it is appropriate to the students' abilities, where they are able to complete the project without feeling overwhelmed, reflecting the suitability of the learning to the students' needs. In addition, learning is effective when the incentives provided, both in the form of rewards and a sense of achievement, successfully motivate students to actively and independently participate in the learning process. Time management also plays an important role, learning is considered effective when each stage of Project Based Learning (PjBL) based on Higher Order Thinking Skill (HOTS) is implemented with sufficient time allocation, so that students can plan, implement, and reflect on their projects optimally. With the fulfillment of these four indicators, it can be concluded that the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model is effective in improving students' problem solving skills, because students are able to think critically, work together, and produce innovative solutions to the problems faced.

The effectiveness of the application of Project Based Learning (PjBL) based on Higher Order Thinking Skill (HOTS) can be analyzed through each structured Project Based Learning (PjBL) steps,

with reference to the effectiveness indicators. The following is an explanation of the effectiveness of Project Based Learning (PjBL) in each step:

a. Determination of the Fundamental Question

The fundamental questions given in this study were very effective. Effective teaching quality can be seen in the formulation of questions that are relevant and challenging, thus stimulating students to think critically and analytically. The questions provided should trigger students to dig deeper into the problem, connect the material to everyday life, and require them to use Higher Order Thinking Skills (HOTS). With the right questions, students will be interested and motivated to start the project.

b. Developing a Project Plan

Effectiveness can be seen from the appropriate level of teaching, where teachers facilitate students to design projects according to their abilities. The project designed should be adjusted to the cognitive level of grade V students, so that they do not feel too burdened but still challenged. Success at this stage is reflected in the students' ability to plan the steps to complete the project in groups, showing good engagement and understanding of the given problem.

c. Planning the Schedule

Time management is a key indicator at this stage. Learning is effective when teachers and students can design a realistic schedule, allowing enough time for each phase of the project. Students should have adequate time to conduct research, discussion and solution development. If time is well managed, students will be able to work unhurriedly and produce quality projects.

d. Monitoring Learners and Project Progress

Project monitoring is very effective in keeping students motivated and focused. Teachers can provide immediate feedback on students' work, helping them overcome obstacles that arise during the project. Through consistent guidance, students can correct their mistakes faster and produce better projects. It also helps students learn how to solve problems that arise during the work process.

e. Testing Results

The quality of teaching and the appropriate level of teaching are again evident at this stage. Learning effectiveness is achieved because students' project outcomes are assessed not only in terms of the final product, but also the thinking process, teamwork and problem-solving skills demonstrated during the project. If students manage to come up with innovative and justifiable solutions, then the learning is said to be effective in encouraging students' higher order thinking.

f. Evaluating the Experience

At this stage, incentives in the form of reflection and rewards for student achievement are important. The effectiveness of PjBL can be seen in how students are able to evaluate their experience, both in terms of the learning process, teamwork, and the end result of the project. Effective learning will motivate students to realize their strengths and weaknesses, thus spurring them to do better in the future.

1. Instrument Test

a) Validity Test

Before the data was collected, a validity test was conducted to assess the extent to which the questionnaire and test research instruments were able to measure what should be measured. The validity test was carried out using the Pearson Product Moment correlation method with the help of SPSS. Each item of question or statement in the questionnaire and test was correlated with the total score, and the results of the validity test are presented in the following table

Table 5 Test validity

No	R_{count}	R_{tabel}	Description
1	0,446	0,422	Valid
2	0,438	0,422	Valid
3	0,347	0,422	Invalid
4	0,378	0,422	Invalid
5	0,342	0,422	Invalid
6	0,106	0,422	Invalid
7	0,485	0,422	Valid
8	0,566	0,422	Valid

9	0,464	0,422	Valid
10	0,475	0,422	Valid
11	0,654	0,422	Valid
12	0,537	0,422	Valid
13	0,467	0,422	Valid
14	0,028	0,422	Invalid
15	0,499	0,422	Valid

Based on the table above, it shows that of the 15 essay questions there are 10 valid question items. Because the product moment correlation value (r count) for each question is greater (>) than r table of 0.422 (5% significance level and N = 22). And 5 questions are invalid because the product moment correlation value (r count) for each question item is smaller (<) than the r table of 0.422. Question items that are declared valid can be used in research, because these items are significantly able to measure the variable under study, namely students' problem solving ability. In contrast, invalid items will be evaluated further. If necessary, these items will be revised or removed from the research instrument.

Table 6 Questionnaire Validity Test

No	R_{count}	R_{tabel}	Description
1	0,385	0,422	Invalid
2	0,636	0,422	Valid
3	0,504	0,422	Valid
4	0,358	0,422	Invalid
5	0,490	0,422	Valid
6	0,457	0,422	Valid
7	0,427	0,422	Valid
8	0,599	0,422	Valid
9	0,467	0,422	Valid
10	0,565	0,422	Valid
11	0,456	0,422	Valid
12	0,456	0,422	Valid
13	0,285	0,422	Invalid
14	0,381	0,422	Invalid
15	0,484	0,422	Invalid
16	0,490	0,422	Valid
17	0,354	0,422	Invalid
18	0,148	0,422	Invalid
19	0,010	0,422	Invalid
20	0,113	0,422	Invalid

Based on the table above, it shows that of the 20 questionnaire statement items there are 12 valid statement items. Because the product moment correlation value (r count) for each statement item is greater (>) than r table of 0.422 (5% significance level and N = 22). And 8 statement items are invalid because the product moment correlation value (r count) for each statement item is smaller (<) than the r table of 0.422. Items that are declared valid indicate that the questions are able to measure exactly the aspects related to students' problem solving ability. Meanwhile, invalid items indicate that the question does not have a significant relationship with the variable being measured, so it needs to be corrected or removed from the instrument.

b) Reliability Test

After conducting the validity test, the next step is to conduct a reliability test. The reliability test aims to determine the consistency of the instrument in measuring the same variable repeatedly. This reliability shows whether the instrument can provide stable and consistent results when used in similar conditions. The reliability test was carried out using the Cronbach's Alpha technique with the help of IBM SPSS Version 29. The following are the results of the test and questionnaire reliability tests:

Table 7 Test Reliability

Case Processing Summary

		N	%
Cases	Valid	22	100.0
	Excluded[a]	0	.0
	Total	22	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.721	15

The Cronbach's Alpha value of 0.721 indicates that the test used in this study has good reliability. This value indicates that the instrument has an adequate level of consistency in measuring the variable in question, namely students' problem solving ability. Good reliability means that the items in the tea consistently measure the same variable. Because the Cronbach's Alpha value is above 0.7, this instrument is declared sufficiently reliable and suitable for use for research data collection. This indicates that the results obtained from using this instrument will be similar if applied repeatedly, thus providing confidence that the data obtained are reliable for analysis purposes.

Table 8 Questionnaire Reliability Test

Case Processing Summary

		N	%
Cases	Valid	22	100.0
	Excluded[a]	0	.0
	Total	22	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.729	20

The Cronbach's Alpha value of 0.729 indicates that the instrument used in the study has good reliability. Reliability in this context refers to the internal consistency of the question items in the instrument, namely the extent to which the items consistently measure the same variable. The value of 0.729 is above the commonly used threshold of 0.7. This means that the instrument has a fairly good level of reliability and can produce consistent.

2. Inferential Analysis

1) Normality Test

The normality test is carried out to determine whether the data is normally distributed or not. Normality test data obtained from pretest and posttest using test instruments and questionnaires were carried out using IBM Statistical Pachage For Social Science version 29 with the test criteria that the data is normally distributed if the significance obtained is> 0.05 on the contrary, it is said that the data is not normally distributed if the significance obtained is <0.05. The following are the results of the pretest and posttest data normality test.

Table 9 Normality Test Results of Pretest and Posttest Questionnaire Data

Data	Sig	Keterangan
Pretest	0,363	0,363 > 0,05 Normality
Posttest	0,082	0,082 > 0,05 Normality

Source : IBM SPSS Version 29

Based on the results of the normality test, the pretest value is 0.363> 0.05, while the posttest value obtained is 0.082> 0.05, thus it can be concluded that the data obtained from the normality test is normally distributed. Normal distribution is an important assumption in some parametric statistical

tests, such as the t test. With normally distributed data, the results of statistical analysis will be more valid and reliable. Therefore, the normality test is carried out before further statistical analysis to ensure that the data meets the normal distribution assumption.

2) Homogeneity Test

Homogeneity test is conducted to determine whether the data in variables X and Y are homogeneous or not. The data to be tested for homogeneity are the results of the pretest and posttest using test instruments and questionnaires. The homogeneity test was carried out using the Statistical System Pachage For Social Science (SPSS) version 29 with the criterion that the data is not homogeneous if the significance obtained <0.05, otherwise it is said to be homogeneous if the significance obtained <0.05, the following data are the results of the pretest and posttest homogeneity test using the questionnaire instrument.

Table 10 Homogeneity Test Results Pretest and Posttest Questionnaire

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Hasil	7.764	1	42	.016

Source : IBM SPSS *Version 29*

Based on the table above, it shows that the results of the pretest and posttest homogeneity test are at a significance level of 0.016. With Degree Of Freedom (df 1) of 1 and Degree Of Freedom (df 2) of 42. From the table it can be concluded that the pretest and posttest homogeneity test is said to be homogeneous because 0.016> 0.05. The pretest and posttest homogeneity test is said to be homogeneous because 0.016> 0.05 "means that the data can be considered to have the same variance, thus fulfilling one of the important assumptions for further parametric statistical analysis.

3) Hypothesis Test

Testing the hypothesis using the Paired Samples Test. This analysis was carried out by testing the pretest and posttest results using the Statistical Packhage for Social Science (SPSS) version 29 system to determine the difference in pretest and posttest results using test and questionnaire instruments. Data requirements are said to be significant if the sig value <0.05.

Table 11 Hypothesis Test Results Questionnaire

Paired Samples Test

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest - Posttes	39.227	5.374	.810	37.593	40.861	48.421	43	.000

Based on table 11, it can be seen that the sig value (2-tailed) 0.000 <0.05 is known that there is a significant difference between the pretest and posttest. Based on the results of these data, it can be concluded that the hypothesis test has an effect with H1 accepted and H0 rejected, with Thitung (0.05) and Ttabel (0.05). On the questionnaire test instrument Thitung (48.421) and Ttabel (0.294). So it can be concluded that H1 is accepted, because the significance value of 0.000 is smaller than 0.05 (0.000 <0.05). This shows that there is a significant effect of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model on the problem solving ability of grade V students at UPT SPF KIP Maccini State Elementary School Makassar City.

Discussion

The Project Based Learning model is a learning model that uses a variety of intelligences needed to confront real world challenges, the ability to deal with everything that is new and the complexity that exists ((Syarif et al., 2024) . Some of the advantages of the Project Based Learning (PjBL) learning model, namely the Project Based Learning (PjBL) learning model can increase students' motivation to learn and encourage them to do important work, improve students' ability to solve problems, make students more active in solving complex problems, improve students' ability to work together, encourage students to practice communication skills, improve students' skills in managing resources, provide experience to students in organizing projects, allocating time, and managing resources such as equipment and materials to complete tasks, provide learning opportunities for students to develop according to real world conditions, besides the Project Based Learning (PjBL) learning model involves students to solve problems in the real world, and makes the learning atmosphere fun.

Higher Order Thinking Skill (HOTS) is a thinking process that goes beyond memorizing and retelling known information and the ability to connect, manipulate, and transform existing knowledge and experience to think critically and creatively in an effort to make decisions and solve problems in new situations.

In the implementation process, students engage in a series of project-centered learning activities that are relevant to everyday life, such as environmental problems or social phenomena that occur around them. The teacher guides students in identifying problems, collecting information, analyzing data, and formulating solutions based on IPAS concepts that have been learned.

From the data obtained, it can be seen that students who learn using the learning model show an increase in Project Based Learning (PjBL) based on Higher Order Thinking Skill (HOTS) in critical thinking ability. Students can more quickly identify the main problem, understand the root of the problem, and propose innovative solutions. They are also more independent in finding the necessary information and working in groups to solve the given problems.

This is in accordance with the problem solving theory proposed by Jonassen (2021), which states that learning that encourages student involvement in the process of analyzing and evaluating information will improve higher order thinking skills (HOTS) and help students to become effective problem solvers (Wulandari, 2021).

From the pretest results, students' problem solving skills are still relatively low, especially in terms of identifying problems and formulating creative and applicable solutions. After the implementation of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model, the posttest results showed a significant improvement. Students who initially had difficulty solving problems independently are now able to think critically and logically to develop more complex solutions.

The subjects of this study were fifth grade students in the 2024/2025 school year, totaling 22 students. The results of this study are the results of field studies taken by tests and giving questionnaires to students. Tests are used to be able to directly observe the state of students during the learning process, while the questionnaire instrument is used to measure students' problem solving skills.

Based on the results of data analysis in this study, it shows that student learning outcomes in IPAS learning obtained an average score on the test of 76.81 with the highest score of 95 and the lowest score of 60 while the average using a questionnaire is 4

The use of the Project Based Learning (PjBL) learning model can improve student learning outcomes, because if the learning model used is always repeated, students will also get bored quickly. With a different model, it can trigger improved student learning outcomes. Therefore, it is very important for teachers to improve learning outcomes in learning.

Based on the research analysis, it is known that there is an effect of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model on the problem solving ability of grade V students at UPT SPF SD Negeri KIP Maccini. Overall, this study proves that the application of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model provides effective results in improving the problem solving skills of grade V students. This model not only improves students' cognitive abilities, but also social skills such as collaboration, communication, and responsibility, which are very important in developing students as individuals who are ready to face future challenges. The effectiveness measurement is based on the improvement of students' problem solving ability test results before and after the application of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) model.

This increase shows that Project Based Learning (PjBL) based on Higher Order Thinking Skill (HOTS) is effective in training students to think more deeply and develop appropriate strategies in solving problems. Bloom's taxonomy (Ansari, 2020) classifies thinking skills in six levels, namely remembering, understanding, applying, analyzing, evaluating, and creating. In this study, the project-based learning model applied allows students to reach higher levels of thinking, such as analyzing, evaluating, and creating, which are the core of HOTS.

4. CONCLUSIONS AND SUGGESTIONS

Based on the results of the research and discussion in the previous chapter, the researcher draws the following conclusions:

1. The application of Project Based Learning (PjBL) learning model based on Higher Order Thinking Skill (HOTS) in IPAS learning is proven to be able to increase students' active involvement. Through the Project Based Learning (PjBL) learning model, students are more actively involved in the learning process, where they design and complete projects that are relevant to everyday life, such as food chain dioramas. This encourages students to develop critical, creative, analytical and evaluative thinking skills. In addition, the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model also increases participation and collaboration among students, as they work in groups to identify problems and find solutions together. This model does not only focus on memorization, but also helps students analyze and evaluate information in depth, thus improving understanding of the concept of IPAS, especially related to ecosystems, food chains, and the impact of human activities on the environment. Thus, the application of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model in IPAS learning can significantly improve the higher order thinking skills and conceptual understanding of grade V students.

2. The effectiveness of the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model is proven to be effective as measured through several indicators, namely teaching quality, appropriate teaching level, intensive, and time. The results of this study indicate that there is a significant increase in students' problem solving ability after the Higher Order Thinking Skill (HOTS)-based Project Based Learning (PjBL) learning model. Students became more skilled in identifying complex problems, formulating research questions, and finding innovative solutions, as seen from the posttest results which showed an increase in student learning outcomes in problem solving ability. The application of this model also contributes to the development of 21st century skills, such as critical thinking, communication, collaboration, and technological literacy. In this study, it is clear that there is a significant effect of using the Higher Order Thinking Skill (HOTS) based Project Based Learning (PjBL) learning model, this is evidenced by the significant use of the Higher Order Thinking Skill (HOTS) based Project Based

Learning (PjBL) learning model in IPAS learning, this can be seen in the sig value (2-tailed) > 0.05.

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