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The Project based Model Learning and Discovery Learning towards Critical Thinking Ability Children Aged 5-6 Years

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ABSTRACT

This study aims to determine (1) the influence of the project-based learning model on the critical thinking skills of 5-6-year-old children, (2) the influence of the discovery learning model on the critical thinking skills of 5-6-year-old children, and (3) the difference in influence between project-based learning and discovery learning models on the critical thinking skills of 5-6-year-old children. This research was a quasi-experimental study with a nonequivalent controls groups design. The population of this study consisted of all students aged 5-6 years in Wangi-Wangi Island, Wakatobi Regency, with a sample of 99 children selected through a purposive sampling technique. The instruments used was an observation questionnaire for children's critical thinking skills . Data analysis techniques included an independent sample t- test with a significance level of 0.05. The results of the study show that (1) there is a significant influence on the application of the project-based learning model on the critical thinking skills of 5-6-year-old children, with a t- value of -24.578 and a Sig. of 0.000 < 0.05, (2) there is a significant influence on the application of the discovery learning models on the critical thinking skills of 5-6-year-old children, with a t-value of -15,304 and Sig. of 0.000 < 0.05, and (3) there is a significant difference in the influence between the project-based learning and discovery learning (DL) models on the critical thinking skills of 5-6-year-old children , with a Sig . Value of 0.000 < 0.05.

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INTRODUCTION

The early stages of early childhood development are grouped into an age range from birth to 8 years which includes infants, toddlers, preschoolers, kindergartens, and children at the elementary school level (Essa & Burham. MM, 2019: 10). Early childhood, namely children who are in the age range of 0-6 years, experience very rapid development. According to research, about 40% of human development occurs at that age (Khaironi, 2018). According to the Regulations of the Minister of Education and Culture of the Republic of Indonesia No. 137 of 2014 concerning National Standards for Early Childhood Education, it is stated that early childhood is children aged 0-6 years who are in the process of growth and development. Early childhood education is defined as educational efforts provided to children in an integrated manner through the development of all aspects, namely intellectual, emotional, social, and spiritual intelligence. Overall, early childhood refers to those in the 0 to 6 years age range. This is critical period in the process of growth and development of children. During this period, there is rapid and significant physical, cognitive, social, and emotional development.

The Indonesian government has regulated Early Childhood Education through Law No. 20 of 2003 concerning the National Education System. Article 1 paragraph 14 of the law defines Early Childhood Education as coaching effort aimed at children from birth to 6 years of age. This effort is carried out through providing educational stimuli to help children's physical and mental growth and development, so that children are mentally prepared to enter kindergarten as part of preschool education. This kindergarten is one of the early stages of education which is parts of an educational path that provides opportunities from early childhood to primary education (Anzani & Insan, 2020).

Early childhood education involves every effort made by educators and parents to form an environment where children can explore experiences that provide opportunities for them to learn and understand. The learning process, as a form of interaction with children, must consider the characteristics inherent in each phase of child development.

Early childhood education also has a role to play in helping children build their knowledge. Through early childhood education, children can learn through hands-on experience, exploration, and interaction with their environment (Murray, 2021). Early childhood education provides a holistic development for children, including physical, social, emotional intelligence, self-confidence, curiosity, purpose, self-control, communication and cooperation, cognitive and ethical development (Arshad & Zamir, 2018). Early childhood education not only forms the basis for effective primary education, but also provides a solid foundation for future life.

In today's digital age, it is very important for children to have critical thinking skills. 21st century competence has become the main emphasis in increasing the capacity of human resources in Indonesia as it enters the 21st century. Four elements of competence that must be instilled in 21st century children including *critical thinking, creative thinking, communicating skills and collaboration* are able to help children compete in this era (Mustafa & Dwiyogo,

2020). According to (Santrock, 2011) Critical *Thing* is a thought that is always curious and looks for details about a problem with the right guess and understanding.

Thinking skills must be honed as early as possible so that children have problem solving skills can be honed through a series of simple experimental activities at school (Fernández-Santín & Feliu-Torruella, 2020). In addition, critical thinking also involves " thinking about our thinking " by reflecting, analyzing, reasoning, planning, and evaluation (Galinsky, 2010).Furedy & Furedy, (1985) Sternberg, (1986) Sternberg, (1986)(Lally & Valentine-Frence, 2019).

(Kuhn, 1999) states that children's critical thinking is based on theory of mind skills, even younger children can think about thinking. Preschoolers ages 3-6 are successful in thinking about their own behaviour and are interested in observing events in their surroundings. Critical thinking skills of children aged 5-6 years include the abilities to interpret, explain, evaluate, inference, analyze and self-regulation. Children at this age can understand and interpret information, give explanations of their reasons or thoughts, evaluate information or arguments, make inferences or inferences, analyze information or problems, and organize and controls their own thinking and behaviour (Tozduman Yaralı & Güngör Aytar, 2020).

Zone of Proximal Development is a concept in the theory of cognitive development by Lev Vygotsky that refers to the distance between the actual level of development and the level of potential development of the child. This concept explains that children have the abilities to resolve problems and perform more complex tasks with the guidance of adults or peers who are more capable (Vygotsky , 1978). The UK's Content Early Childhood Education policy clearly reflects Isaacs ' values by focusing on the child's uniqueness, supportive environment, play and exploration, creativity and critical thinking, and active learning (Murray, 2021).

The goal of improving early childhood critical thinking skills is to encourage children to ask questions such as "why", "how", or "what will happened in the surrounding environment" (Roche, 2014). The ability to think critically is an importantskills that can help preschool-aged children understand themselves and their environment and improve their abilities to resolve problems (Anggraini et al., 2020). In addition, improving children's critical thinking skills from an early age can help children become conscientious, not easily give up, and responsible (Smith, 2002). For children to be able to think critically is not easy, it requires an ongoing process supported by an environment that supports these abilities. This process should begin at an early age .

Before making further observations, researchers conducted a pre-observation stage at four kindergarten institutions in Wakatobi District. During this pre-observation stage, several problems can be identified. In the context of learning that emphasizes children's critical thinking skills, especially in the fields of science and mathematics, the four institutions still apply classical learning methods. This classical learning includes the use of natural worksheet-based teaching materials (LKA), coloring pictures, and the use of natural

materials. However, this approaches cand to cause boredom in children and has not been given much rooms for innovation in the learning process. During the pre- observation stage, it was observed that the children's critical thinking skills had not experienced adequate development. Of the total of 52 children involved in science learning, only 19 children or about 37% have high critical thinking skills. Meanwhile, the remaining 63% are still in the low categories in terms of critical thinking skills.

The results of direct observation during children's learning activities in the age groups of 5-6 years also identified several things including (1) children still seems to lack the initiative to ask questions, (2) children's interest in activities that require critical thinking skills seems lacking, (3) children's analytical skills in dealing with learning materials are still low, (4) children tend to always wait for directions from the teachers before acting, (5) They have n't been able to produce their own creations or ideas without having to be stimulated by the teachers first. In conclusion, the findings from these pre-observations suggest that there are challenges in developing children's critical thinking skills in learning in the kindergarten institutions studied. Classical learning that is still dominant, lack of initiative to ask questions, and lack of interest in critical thinking activities are some of the problems that need to be considered in an effort to improve the development of these skills in the educational environment. In situations like these, teachers need to urgently find solutions so that children are interested and curious to engage in learning. Teachers can adjust the way of teaching to the characteristics of each child and the learning provided.

Theimplementation of the 2013 Curriculum is recommended to use a scientific approach with learning models, namely *discovery learning, problem-based learning and inquiry-based learning*. These learning models leads to the active roles of students in learning activities. *Discovery learning* is an active process. Students interact with the environment through exploration and manipulation of materials, interactive discussions, conduct experiments, and feel satisfied after successfully solving problems on their own (Bruner, 1961). This model directs students to be active involved in using mental processes to discover concepts according to their abilities through media around the environment (Sugiarti & Husain, 2021). The goal of *discovery learning* is to motivate students to use the information and knowledge they have to resolve problems, and this can be done under a variety of different conditions. The basics principles of *discovery learning* according to Bruner (1961) in (Foti, 2021), As mentioned above, it is for students to interact with the environment, through the exploration and manipulation of materials, interactive discussions, and the conduct of experiments, as well as feel satisfied that they managed to resolve problems on their own.

Project- based learning is a learning approaches that allows children to work independently in building their knowledge and producing tangible results (Nanang Hanafiah and Cucu Suhana, 2009: 71). Project- based *learning* is a learning model that develops a project either individually or in groups to produce a work product. Learning activities using projects can be designed and

packaged more interestingly to increase children's interest and creativity. PBL provides an opportunity for students to become active learners who are required to seek knowledge to resolve problems that may arise in their projects, rather than being passive learners who absorbs knowledge from their teachers (Lim et al., 2023). This is supported by Veena's opinion that project-based learning and literature can enhance the learning experience; Children have developed basic scientific processes as thinking coaches. There is an organized thought process, be careful thinking, creativity, as well as learning environment. Children love learning because they learn what they are interested in (Prachagool, 2021). Literature and project-based learning approaches can be great choice for early childhood education. This approach not only improves reading skills, but also enriches the abilities of projects management and development of children's literature. Thus, this approach has been great potential to inspire more meaningful and holistic learning in the early stages of child development.

Based on this background, researchers are interested in conducting a study entitled "The Effect of *Project- based Learning* and *Discovery Learning* on the Critical Thinking Abilities of Children Aged 5-6 Years". This research is expected to help the implementation of the learning process of ECCE institutions in improving children's critical thinking skills. This study aims to determine Project- based learning and discovery learning have a partial and simultaneous effect on the critical thinking skills of children aged 5-6 years.

This research is expected to increase the contribution of thinking about the effectiveness of *the project-based learning* models and *discovery learning models* on the critical thinking skills of children aged 5-6 years.

THEORETICAL REVIEW

Some previous research that can be used as a reference is as follows:

1. O'Reilly et al., (2022)entitled "*Critical thinking in the preschool classroom - A systematic literature review*". The aim of this research is to report a systematic literature review of 25 empirical studies that address various ways of teaching for thinking that focus on children attending early years services. This review aims to gain insights that lead to a definition of critical thinking in the context of early childhood. To achieve this goal, research conducted during 2015-2021 examined the characteristics of critical thinking in early childhood and the teaching strategies developed to support thinking in early childhood classrooms. Although only a few articles have addressed the questions in this review, there is considerable evidence to suggest that the most commonly explored characteristics of critical thinking in early childhood are reasoning and problem-solving abilities. These findings indicate that effective mediators in developing critical thinking skills include (1) interactions in the classroom, including dialogue and questioning techniques, (2) the use of thinking language, and (3) a story-based approach. Cases investigating critical thinking in early childhood settings are surprisingly few. The journal concludes with a summary of the implications of the findings for the future of learning and

teaching as well as relevant recommendations for advancing the teaching of thinking with young children.

2. Research conducted by Helena Juwita, (2022), with the thesis title "The Influence of *Discovery Methods learning (DL*) on Critical Thinking Abilities in Children Aged 5-6 Years at Pertiwi Batu Sangkar Kindergarten, Lima Kaum District, Tanah Datar Regency," has a background that illustrates the problem of low critical thinking abilities of children at Pertiwi Batusangkar Kindergarten. This reflected in children's difficulties in solving problems, understanding cause and effect, and using monotonous learning methods. This research aims to evaluate the effect of the *discovery method learning (DL*) on the critical thinking abilities of children aged 5-6 years. The research method used was an experiment with a pre-experimental design, and the research sample was taken using a simple random sampling technique. The research results show that the *discovery method is used learning (DL*) is effective in improving children's critical thinking skills, with an increase of 25.67 points. These results indicate that the *discovery method learning (DL*) can be an effective alternative in improving the critical thinking skills of young children at Pertiwi Batusangkar Kindergarten , Tanah Datar Regency.
3. Research conducted by Thea Yuliana Anjari on the Development of the (Anjari & Purwanta, 2020)*Discovery* Learning Model *Environment-based learning* to stimulate the creative thinking abilities of children aged 5-6 years. The main objective of this research is to understand the need for the *Discovery learning model Learning* that can stimulate children's creative thinking abilities, produce appropriate models, and test their effectiveness. This research follows the Borg & Gall development design stages which consist of nine stages. The research participants involved 124 children from Pembina Negeri Kindergarten and Harapan Bunda Kindergarten. Research instruments include expert validation questionnaires and teacher response questionnaires. The research results show that a *Discovery learning model has been successfully developed Environmental-based learning* that is suitable to stimulate children's creative thinking abilities. Validation tests by material experts and media experts gave quite high scores. Additionally, in extensive testing, teachers gave this model good to excellent ratings. This research also succeeded in proving that the *discovery learning model This environment-based learning (DL*) is effective in stimulating the creative thinking abilities of children aged 5-6 years. This can be seen from the increase in stimulation of creative thinking in the experimental class compared to the control class, which is statistically significant. The main conclusion from this research is that the *discovery learning model Environment-based learning (DL*) can effectively improve the creative thinking abilities of children aged 5-6 years.
4. Research conducted by Rifa Zahirah Dzihni in the year (2020)entitled *Project Based* Learning Model *Learning* as a Stimulus for Critical Thinking Skills: A Qualitative Descriptive Study of Learning Models for Early Childhood This is driven by problems surrounding the lack of optimal

critical thinking skills in early childhood, which is reflected in the results of previous research which shows that the ability of Indonesian children to solve problems has not yet reached its potential. To overcome this problem, this research proposes the use of a *Project Based Learning Model Learning* (PBL) as a means to improve children's critical thinking skills. This research involved the participation of two class B teachers at LS Kindergarten as research subjects. The method used is descriptive qualitative, with data collection techniques in the form of observation, interviews and documentation. The results of this research indicate that the application of the *project learning model based learning* (PjBL) at LS Kindergarten provides a significant stimulus for the development of children's critical thinking skills. This is reflected in an increase in children's ability to solve problems, speaking, and a higher level of self-confidence in children. The conclusion that can be drawn from this research is that the *project Learning Model based learning* (PjBL) has the potential to be an effective stimulus in improving critical thinking skills in early childhood.

A. Framework of thinking

Learning activities that are usually carried out generally aim to improve the quality of education. The learning activities provided are expected to stimulate children's development and have skills that are in line with the learning demands of the 21st century. The skills that must be possessed in the 21st century are 4C (*critical) competencies, thinking, creative thinking, collaboration, and communications).* Children have critical thinking skills in making appropriate, careful, systematic, logical decisions and considering various perspectives. This ability can also form good attitudes, personality, values and character. For example, children who are trained in critical thinking from an early age will develop personalities who are careful, responsible and have high levels of perseverance.

Science learning motivates children to develop observation skills, ask questions, conduct experiments or trials, make predictions, and hone problem-solving abilities. This allows them to early observe, analyze, and evaluate information through science experiments and process skills that trigger the development of children's critical thinking abilities.

Science learning can improve children's critical thinking skills through the *project learning model based learning* and *discovery learning* because based on the results of previous research, these two models can develop children's critical thinking skills

1. *projects based learning* (PjBL): The PjBL model engages children in challenging projects, allowing them to plan, implement, and evaluate solutions to problems or questions posed. Learning encourages them to think critically as they must analyze information, make decisions, and solve problems in the context of relevant projects. They also learn from their experiences and mistakes, which enriches the critical thinking process.
2. *Discovery learning* : Model *discovery learning* encourages children to explore and discover their own knowledge through direct experience. In science

learning, this can mean giving children opportunities to investigate natural phenomena, carry out experiments, or observe the environment around them. Through this experience, they can develop the observation, problem-solving, and analytical thinking skills necessary for critical thinking.

Both of these lessons allow children to be actively involved in their learning and develop critical thinking skills in a more natural and fun way. In addition, it is also important to facilitate discussion, questions, and reflection during the learning process to help children further develop their critical thinking skills. This learning model is also adapted to the development level of children aged 5-6 years.

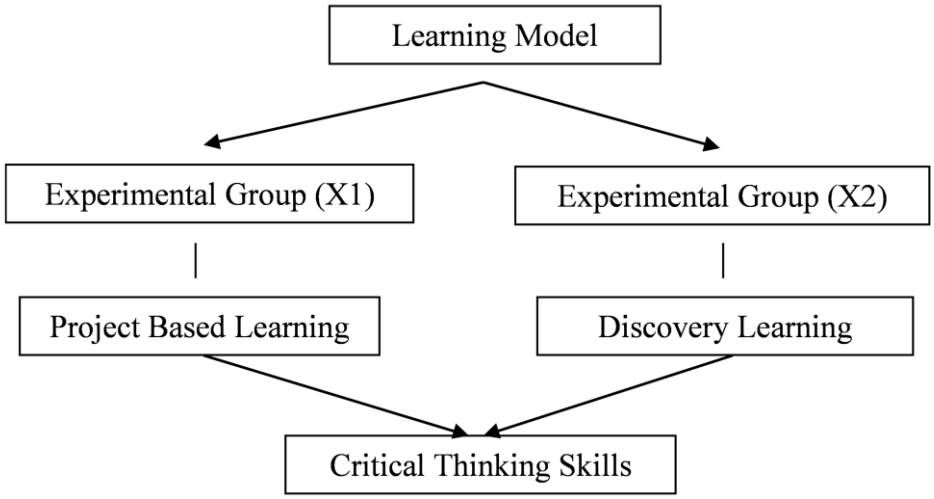


Figure 1. Thinking Framework Chart

Based on relevant research, and the framework of thinking above, the research hypothesis can be formulated as follows:

1. There are influences before and after using the *project model based learnig* on the critical thinking abilities of children aged 5-6 years.
2. There is an influence before and after using the *discovery model learning* on the critical thinking abilities of children aged 5-6 years.

There is a significant difference in the critical thinking abilities of children aged 5-6 years using the *project model based learning* and *discovery learning*

METHODOLOGY

In this study, the method chosen is an experimental method , where the research method to be used is *quasi-experimental* , with a *nonequivalent controls groups design research design* . Where neither the experimental groups nor the controls groups was randomly selected . This research design was chosen because it aims to determine the effect of *project-based learning* and *discovery learning* models on the critical thinking skills of children aged 5-6 years . This research has an experimental groups that uses *project-based learning* and *discovery learning models*.

Before initiating the research trial, researchers run a pretest or initial evaluation to evaluate the initial conditions of subjects related to the dependent variable, namely the critical thinking abilities of children aged 5-6 years. Furthermore, researchers provided treatment, applying the *projects based learning* (PjBL) learning model in experimental group 1 and *discovery learning model* in experimental group 2. After the experiment was carried out in both experimental classes, a posttest or final test was carried out in the form of observation or observation to assess the impact of *the projects based learning* (PjBL) model and *discovery learning* (DL) model on the critical thinking skills of children aged 5-6 years.

The stages of this research include 1) instrument making and instruments trials, 2) conducting pre-surveys and obtaining permission from schools, 3) coordinating with educators, 4) running pretests, 5) providing experimental actions to experimental groups through learning model practices, 6) carrying out posttests in each research group, and finally 7) analyzing information. In each experimental group, researchers always coordinates with educators well to explain the research design and make agreements with teachers regarding the implementation and application of learning activities.

This study was conducted on group B children aged 5-6 years at Al-Mawaddah Kindergarten and Trustee of 1 State Kindergarten, Wakatobi Regency. The experimental class (X1) was conducted in Almawaddah Kindergarten in groups B1 and B2 totaling 51 children while the experimental group (X2) was carried out at TK Negeri Pembina 1 Wangi-wangi in groups B1 and B2 totaling 48 children. This research will be conducted from October 2023 to January 2024. Data Collection Techniques and Instruments. Then data collection is carried out with observation and documentation. To test the validity of the instruments, researchers carried out the validity of the contents and constructs, followed and ended with a reliability test. Data analysis techniques in this study consist of analysis prerequisite tests and hypothesis tests.

RESULTS

A. *Description of Research Results*

Data collection in this study involved pretest and posttest on the effect of *the projects based learning* (PjBL) model and *discovery learning (DL) model* on the critical thinking skills of children aged 5-6 years in Al Mawaddah Kindergarten and Trustee of 1 Wangi-wangi State Kindergarten , Wakatobi Regency, Southeast Sulawesi. The pretest is carried out as a treatment while the posttest is carried out after the treatment , namely , using *the projects based learning* (PjBL) model in the experimental group (X1) and *the discovery learning (DL)* model in the experimental group (X2). The study runs from October 2023 to January 2024.

1. Data Description of Project *Based Learning* (PjBL) Experiment groups

The data obtained came from the assessment of children's critical thinking skills consisting of two stages , namely *pretest* and *posttest* . *Pretest* is done before giving treatment to assess the child's critical thinking skills . While *the posttest* was carried out after giving treatment to the experimental groups using the *projects based learning* (PjBL) model. The following are the results of assessing children's critical thinking skills using instruments adapted to the *projects based learning* (PjBL) model:

Table 1. Pretest and posttest data on children's critical thinking skills through Model learning *Project Based Learning* (PjBL)

Variables	Critical Thinking Skills

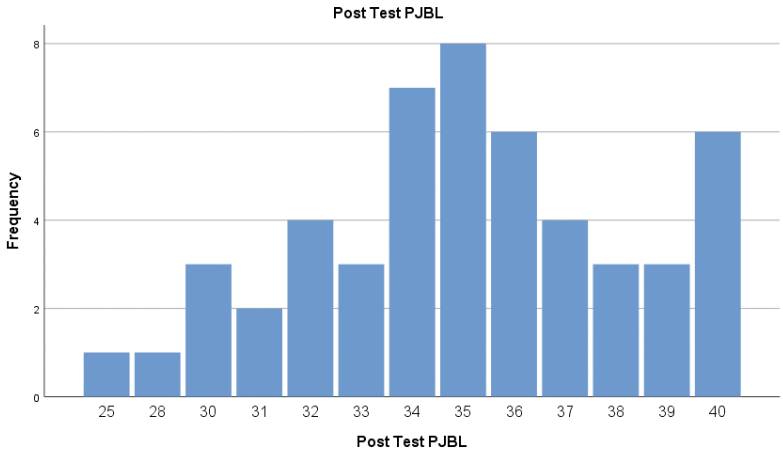
	Pretest	**Posttest**
Mean	19.45	35.00
Median	20.00	35
Std Deviation	4,370	3,341
Variance	19,093	11,160
Minimum	10	25
Maximum	33	40

Based on the summary of the results of descriptive statistical analysis of critical thinking skills (N) of 51 children , the results of observation before treatment / *pretest* obtained the lowest scores of 10 and the highest scores of 33, standard deviation (SD) of 4.370 and average score (mean) of 19.45 and variance of 19,093. While the *posttest* results after being treated using the PjBL model obtained the lowest scores of 25 and the highest scores of 40, standard deviation (SD) of 3.341, average score (mean) of 35.00 and variance of 11,160.

Table 12. ***Frequency data on children's critical thinking skills scores using the PjBL model***

Post PJBL Test					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25	1	2.0	2.0	2.0
	28	1	2.0	2.0	3.9
	30	3	5.9	5.9	9.8
	31	2	3.9	3.9	13.7
	32	4	7.8	7.8	21.6
	33	3	5.9	5.9	27.5
	34	7	13.7	13.7	41.2
	35	8	15.7	15.7	56.9
	36	6	11.8	11.8	68.6
	37	4	7.8	7.8	76.5
	38	3	5.9	5.9	82.4
	39	3	5.9	5.9	88.2
	40	6	11.8	11.8	100.0
	Total	51	100.0	100.0	

Furthermore, the frequency data of children's critical thinking abilities scores using the PjBL models are presented in the following histogram:



Figures 2. Histogram Data frequency score of children's critical thinking skills using the PjBL model

Data Description groups Discovery learning (DL) experiments

The data obtained is the results of assessing children's critical thinking skills in two stages, namely pretest and posttest. Pretest is done before giving treatment to assess the child's critical thinking skills. Posttest, on the other hand, was done after giving the experimental groups treatment using the *Discovery Learning (DL) models*. The following are the results of assessing children's critical thinking skills using instruments that have been adapted to the *Discovery Learning (DL) model*:

Table 3. Results of Descriptive Analysis of Pretest and Posttest Data for Children's Critical Thinking Skills through the Discovery Learning (DL)

Variable Model	**Critical Thinking Skills**	
	Pre-test	**Post-test**
Mean	19.04	31.56
Variance	19,190	19,060
Std Deviation	4,381	4,366
Median	19.00	32.00
Minimum	10	22
Maximum	27	40

Based on the summary of the results of descriptive statistical analysis , critical thinking skills (N) of 48 children can be seen the results of observation before treatment / *pretest* obtained the lowest scores of 10 and the highest scores of 27, standard deviation (SD) of 4.381 and average score (mean) of 19.04 and variance of 19,190. While the *posttest* results after being treated using the *discovery learning* model obtained the lowest scores of 22 and the highest scores of 40, standard deviation (SD) of 4.366, average score (mean) of 31.56 and variance of 19,060.

Table 4. ***Frequency data on children's critical thinking skills scores using discovery learning models***

Post DL Test					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	22	1	2.0	2.1	2.1
	24	2	3.9	4.2	6.3
	25	1	2.0	2.1	8.3
	26	4	7.8	8.3	16.7
	27	2	3.9	4.2	20.8
	28	2	3.9	4.2	25.0
	29	4	7.8	8.3	33.3
	30	4	7.8	8.3	41.7
	31	2	3.9	4.2	45.8
	32	5	9.8	10.4	56.3
	33	2	3.9	4.2	60.4
	34	5	9.8	10.4	70.8
	35	4	7.8	8.3	79.2
	36	5	9.8	10.4	89.6
	37	1	2.0	2.1	91.7
	38	2	3.9	4.2	95.8
	39	1	2.0	2.1	97.9
	40	1	2.0	2.1	100.0
	Total	48	94.1	100.0	
Missing	System s	3	5.9		
Total		51	100.0		

Furthermore, the frequency data of children's critical thinking abilities scores using the *discovery learning models* are presented in the following histogram:

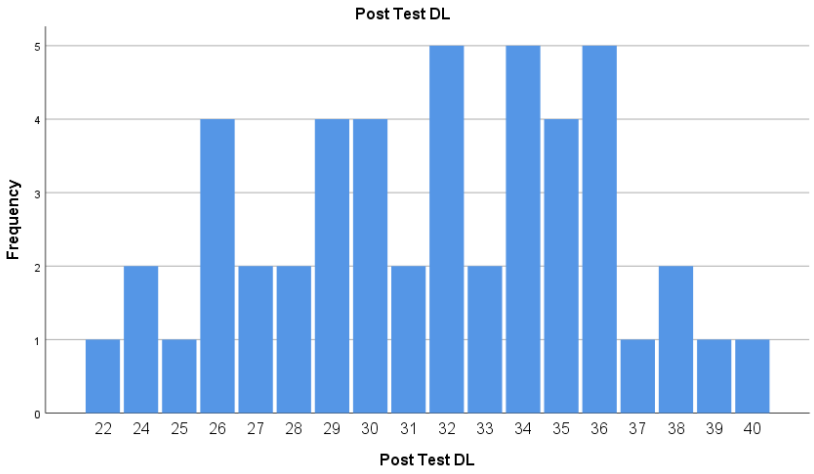


Figure 3. Histogram Frequency data scores children's critical thinking skills using ***discovery learning model***

B. *Testing Analysis Assumptions*

a. Data Normality Testing

Testing of critical thinking skills data of children aged 5-6 years using *the projects based learning* (PjBL) model and *discovery learning* (DL) model was carried out by testing *Lilliefors Significance Corrections* from *Kolmogrov-Smirnov* against the sig level. (α) 0.05. The thing tested is H0 which causes that the samples is sourced from a population whose distribution is normal. Such refusal or acceptance shall be based on: a) if sig. > 0.05 the distribution is normal and b) if the GIS < 0.05 the distribution is abnormal.

After normality testing with the use of *Lilliefors Significance Correction testing* from *Kolmogrov-Smirnov* (KS), data on children's critical thinking skills calculated with the help of computers application *SPSS statistics release 25* on learning activities using *projects based learning (PiBL)* models and *discovery learning (DL)* models are presented with tables as below :

Table 5. One-sample Kolmogorov -Smirnov test results

Learning Outcomes	Group	Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig	Statistics	df	Sig
	Preetest PjBL	0.109	51	0.182	0.976	51	0.399
	Posttest PjBL	0.108	51	0.196	0.959	51	0.074
	Preetest DL	0.110	48	0.194	0.973	48	0.326
	DL posttest	0.108	48	0.200	0.978	48	0.503

Based on the results of the *Kolmogorov simirnov one samples* normality test or *the Shapiro Wilk* test above, it can be concluded that all research data in Al Mawaddah Kindergarten and Pembina 1 Wangi-wangi State Kindergarten are normally distributed. This can be seen from the Sig. (2-tailed) values of 0.182, 0.196, 0.194, and 0.200 is > 0.05, so all data is normally distributed. Thus statistical data processing to find t- test results can be carried out next.

1. Samples homogeneity testing

The homogeneity test was carried out on data on critical thinking skills of children aged 5-6 years who were treated using *the projects based learning (PjBL)* model and *discovery learning (DL)* models. A homogeneity test is a test performed to determine that two or more groups of sample data comes from populations that have the same variance (homogeneous). The basis for decision making in the homogeneity test is if the Sig value > 0.05, then the variance of the study is homogeneous. Below is a homogeneity test using the *Levene statistical test*.

Table 6. Statistics Levene homogeneity test results

Test of Homogeneity of Variances					
		Levene Statistics	df1	df2	Sig .
Students Learning Outcomes	Based on Mean	5,878	1	97	.017
	Based on Median	5,256	1	97	.024
	Based on Median and with adjusted df	5,256	1	95.163	.024
	Based on trimmed mean	5,656	1	97	.019

Based on the table above , the homogeneity of variance of this study is homogeneous . It is proven that the value of Sig . is greater than 0.05, so that the sample data groups derived from the population of experimental classes 1 and 2 are homogeneous .

By considering the test results of the two assumptions , namely the homogeneity test and the normality test , it can be concluded that testing with the t test can be carried out

RESULT

The research hypothesis test was carried out on the results of data on critical thinking skills of children aged 5-6 years using *the projects based learning* (PjBL) model and *discovery learning* (DL) models. This test is carried out to prove the correctness of the hypothesis to be proposed . These hypothesis include : 1) There is an influence before and after using the *projects based learning* (PjBL) model on the critical thinking skills of children aged 5-6 years . 2) There is an influence before and after using *the discovery learning models* on the critical thinking skills of children aged 5-6 years . 3) There is a significant difference in the influence of critical thinking skills of children aged 5-6 years using *the projects based learning* model and *discovery learning*.

1. ***The influences of the projects based learning (PjBL) model on the critical thinking abilities of children aged 5-6 years in Al Mawaddah Kindergarten , Wakatobi Regency***.

The data used in this *paired sample t- test* test are the average pretest and posttest scores in experimental class 1 students of TK Negeri Pembina 1 Wangi-wangi with a total of 51 children . This test is carried out to determine whether there is an average difference in two paired groups samples . The following are the results of the *paired simple t- test* in experimental class 1.

The hypothesis test was conducted to analyze data on critical thinking skills of children aged 5-6 years using a *project based learning (PjBL) learning model. After calculations were carried out using t- test analysis techniques with a significant level of 0.05 using the SPSS statistics release 25 applications* so that the results were described in the table below:

Table 7. *Paired Sample T-Test* Results

	Paired Differences					t	df	Sig (2-tailed)
	Mean	Std . Deviation	Std . Errors . Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair test 1 Preetest (PjBL)- Posttest (PjBL)	-15,549	4,518	,633	-16,820	-14,278	-24,578	50	,000

Paired test results sample t test experimental class of students in classes B1 and B2 at Kindergarten Al Mawaddah. From the results of these calculations it is stated that t is -24.578 in sig. (2tailed) is 0.000 < 0.05, then the research hypothesis is accepted. So it can be interpreted that there is an influence of using the *project model based learning* on the critical thinking abilities of children aged 5-6 years.

2. *The influence of model discovery learning (DL) on the critical thinking skills of children 5-6 years old at the Pembina 1 Wangi-wangi Selatan District Kindergarten. Wakatobi.*

Hypothesis testing was carried out to analyze data on critical thinking abilities of children aged 5-6 years using the *discovery model learning* (DL). After calculations were carried out using the t-test analysis technique using the *SPSS statistical application release 25* so that the results obtained are as below.

The data used in the *paired test This sample t- test* is the average score of the pretest and posttest in the experimental class 2 of the Pembina 1 Wangi-wangi State Kindergarten with a total of 48 children. This test was carried out to find out whether there was a difference in the average of two paired sample groups. Following are the results of *the paired* test *simple t- test* in experimental class 2.

Table 8. *Paired Sample T-Test* Results

	Paired Differences					t	df	Sig (2-tailed)
	Mean	Std . Deviation	Std . Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair test 1 Pretest (DL)- Posttest (DL)	-12,521	5,668	,818	-14,167	-10,875	-15,304	47	,000

Paired test results *sample t test* experimental class of students in classes B1 and B2 at the Pembina 1 Wangi-wangi State Kindergarten. From the results of these calculations it is stated that t is -15.304 on sig. (2tailed) is 0.000 < 0.05, then the research hypothesis is accepted. So it can be interpreted that there is an influence of using the *discovery model learning* on the critical thinking abilities of children aged 5-6 years.

3. Differences in the influence of project models based learnig (PjBL) with model discovery learnig (DL) on the critical thinking abilities of children aged 5-6 years in Kab. Wakatobi.

From the results of data calculations on the critical thinking abilities of children aged 5-6 years using a *project model based learning* (PjBL) and *discovery learning* (DL) with the help of *the SPSS computer program statistics release 25* which is displayed in table form as below:

Table 9. *Independent Sample T-Test* Results

Learning outcomes		Lavene's Test		T- test for Equality of Means						
		F	Sig	t	df	Sig . (2 tails)	Mean Difference	Std . Error Difference	95% Confidence Interval	
									Lower	Upper
	Equal variances assumed	5,878	.017	4,415	97	,000	3,438	,779	1,892	4,983

The table above shows that the Sig value. (2 tailed) is 0.000 smaller than 0.05, then H0 is rejected and Ha is accepted. This means that there is a significant difference regarding the influence of the PjBL and DL learning models on the critical thinking abilities of children aged 5-6 years at Almawaddah Kindergarten and Pembina 1 Wangi-wangi Kindergarten. With the average value of critical thinking observation results showing an average value of the PjBL model of 35.00 and the DL model of 31.58, it can be concluded that in general applying these two learning models can influence children's critical thinking abilities.

DISCUSSION

21st century education requires human resources to have skills. The skills that children must have in facing 21st century education are that children have critical thinking skills, problem solving, creative thinking, communication and collaboration. These four skills are known as 21st century skills, namely 4C *(critical thinking and problem solving , creative thinking , communicating , and collaboration)*. In order to welcome 21st century education, learning innovation is needed, especially for preschool education. Teachers' efforts to maximize the quality of learning include implementing learning models that are suitable for children so that they can develop 21st century skills.

This research aims to determine and test the hypothesis of the influence of the *project model based learning* and *discovery learning* on the critical thinking skills of children aged 5-6 years at Al Mawaddah Kindergarten and Pembina 1 Wangi-wangi State Kindergarten. *Quasi* Research *This experiment* used 99 children as research subjects consisting of 51 children in the experimental class which used the *project model based learning* (PjBL) and 48 in experimental group 2 which used treatment with the *discovery model learning* (DL) on the critical thinking abilities of children aged 5-6 years in Kab Wakatobi.

The test results as initial data on children's critical thinking abilities are normally distributed. Normality test *The pretest* and *posttest* in experimental class 1 obtained a Sig value. pretest 0.182 dang posttest 0.196. while testing normality *The pretest* and *posttest* in experimental class 2 obtained a Sig value. pretest 0.194 and posttest 0.200. Therefore, it can be concluded that the significance value for experimental classes 1 and 2 is greater than the 0.05 significance level. So that all the data taken comes from a normally distributed population .

1. ***The project model based learning (PjBL) on the critical thinking abilities of children aged 5-6 years at Kindergarten Al Mawaddah Kab. Wakatobi.***

Obtaining hypothesis testing using *paired tests T- test sample* obtained a calculated t value of -24.578 and a Sig value. (2tailed) 0.000 < 0.05. It can be concluded that the *project model based learning* (PjBL) influences the critical thinking abilities of children aged 5-6 years. This finding is in line with the results of other research which shows that the use of the *Project based model learning* (PjBL) has a positive influence on children's critical thinking abilities. This development includes the ability to solve problems, express opinions, and increase children's self-confidence (Matondang et al., 2024).

Learning models *projects based learning:* children are actively involved in choosing learning topics that are interesting for them to explore both individually and in groups. By using this learning, children are directly involved in learning, resulting in more meaningful learning for children. by implementing the *project model based Learning* can develop children's thinking abilities (Mitchell et al., 2009:339).

This is in line with research (ISSA 2021) showing the effectiveness of the model *projects based learning* in developing students' critical thinking skills starting from selecting projects according to students' wishes, encouraging students to explore with the knowledge they have. Apart from that, the *project model based learning* can meet students' needs with skills and positive learning styles as well as collaboration between groups. This is because critical thinking can help students convey various ideas, evaluate their own ideas and ideas proposed by others, and find solutions to solve problems (Suteja & Setiawan, 2022).

(Gandi et al., 2019) Shows the effectiveness of the *project* model *based learning* on students' critical thinking abilities with the results of data analysis using the *N-gain increase score test* and t test. The t test results show a significance (2-tailed) of 0.002, which means there is a significant average difference in critical thinking skills between the experimental class and the control class. Thus, the learning program is based on a *project model based learning* (PjBL) can facilitate students to improve scientific skills, one of which is critical thinking.

(Hatuwe et al., 2023b)*Project* models *based learning* has been proven to be an effective learning model in improving critical thinking skills in young children. By implementing carefully planned PjBL model activities , children show significant progress in recognizing problems, creating creative solutions,

and considering various points of view. Apart from that, PBL also encourages the development of social skills, cooperation and creativity through teamwork and discussions in groups.

Thus, the *project learning model based learning* shows the influence in improving the critical thinking abilities of young children. Project models based Learning provides opportunities for children to plan activities according to their wishes, collaborate, ask questions and submit opinions.

2. *The influence of model discovery learning (DL) on the critical thinking skills of children 5-6 years old at the Pembina 1 Wangi-wangi Selatan District Kindergarten. Wakatobi.*

Obtaining hypothesis testing using *paired tests T- test sample* obtained a calculated t value of -15.304 and a Sig value. (2tailed) 0.000<0.05. It can be concluded that the *discovery model learning* (DL) influences the critical thinking abilities of children aged 5-6 years. In line with research Mulyadi et al., (2021), children's critical thinking abilities increase 85% by implementing the guide model *discovery learning* proven by the child's ability to find errors in pictures, recognize cause and effect, make simple decisions when carrying out simple science experiments.

Guided discovery learning where teachers provide support such as instructions, directions and examples to children. This helps children develop a discovery mindset and be ready to discover knowledge on their own (Parker & Thomsen, 2019:34). Prairie, (2005:83) explains that the teacher's role is to observe what naturally interests children and guide children to explore or learn more about it, either through teacher observation or encouragement from other adults who notice interesting situations. In the learning process, the teacher acts as a guide, not as an instructor. The mentor helps the group understand and relate concepts by organizing information, providing direction, strengthening understanding, and introducing various information. In addition, the mentor encourages the group to reflect on the process and results of their work. The discovery learning model can help children develop critical thinking skills. They start by making guesses about what they observe. Then observe the process, try to understand what they see, express it, and finally reach the right conclusion from what they found (Chusni et al., 2020).

2. *Differences in the influence of project models based learnig (PjBL) with model discovery learnig (DL) on the critical thinking abilities of children aged 5-6 years in Kab. Wakatobi.*

The calculation results show that the Sig value. (2tailed) is 0.000 greater than 0.05, then H0 is rejected and Ha is accepted, meaning that there is a significant difference regarding the influence of the *project learning model based learning* (PjBL) with the *discovery* learning model *learning* on the critical thinking skills of children aged 5-6 years in the district. Wakatobi, however, these two learning models can influence children's critical thinking abilities.

Based on research that is confirmed by other research, it can be concluded that the stages of the *project model based learning* (PjBL) and model *discovery learning* (DL) applied in the learning process influences the

development of children's critical thinking abilities. So that these two learning models are very suitable to be applied in the learning process which focuses on children being actively involved directly in the learning process in the classroom.

The planning stages for these two learning models involve key steps such as determining learning objectives, choosing interesting topics, providing materials and media that are interesting to children, providing support and guidance and determining assessment criteria so as to create an interesting and effective learning environment. In the implementation phase, teachers play an important role in selecting relevant and interesting projects or topics, ensuring the availability of adequate resources, providing appropriate guidance, facilitating cooperation and communication among students, and evaluating learning outcomes (Hatuwe et al., 2023). These factors contribute to the successful improvement of critical thinking skills in early childhood.

RESEARCH LIMITATIONS

Based on the researchers' experience in the field during this research process, there are various research limitations and various factors that can be of concern to future researchers. These weaknesses include :

1. The object of research is only focused on children's critical thinking abilities.
2. The process of assessing research subjects cannot be carried out optimally, considering that the number of children in one class is more than 20.
3. Limited research staff in carrying out observations and documenting research implementation so that during the research the researcher was assisted by the teacher to make observations.
4. Various factors outside of research might trigger research results such as child characteristics, learning styles, psychological conditions, and so on
5. Requires quite a lot of money and takes a long time

CONCLUSIONS AND SUGGESTION

Based on the research results and discussion above, the conclusions of this research can be formulated as follows:

1. There is a significant influence before and after using the project model based learning (PjBL) on the critical thinking abilities of children aged 5-6 years. This is proven by the results of the paired t-test of children's critical thinking abilities. Where the value of Sig . (2tailed) is 0.000 smaller than 0.05, so the research hypothesis Ha is accepted and Ho is rejected.
2. There is a significant effect before and after using the *discovery model learning (DL)* on the critical thinking abilities of children 5-6 years old. This is proven by the results of the paired t-test of children's critical thinking abilities. Where the value of Sig. (2 tailed) is 0.000 smaller than 0.05, so the hypothesis Ha is accepted and Ho is rejected.

There are significant differences in influence between *project learning models based learning* (PjBL) and model *discovery learning (DL)* on the critical

thinking abilities of children 5-6 years old. This result is shown by the Sig value. 0.000 is smaller than 0.05, then H0 is rejected and H1 is accepted.

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