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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/11016

DOI URL: <http://dx.doi.org/10.21474/IJAR01/11016>



RESEARCH ARTICLE

THE EFFECT OF LEARNING MODELS AND LEARNING INDEPENDENCE ON HIGHER-ORDER THINKING SKILLS IN IPA LEARNING

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Manuscript Info

Manuscript History

Received: 18 March 2020

Final Accepted: 20 April 2020

Published: May 2020

Abstract

This study aims to look for the effect of learning models and learning independence on higher order thinking skills in science learning of elementary school students. This research was conducted in class IV SDN Gandaria 3 Tangerang. The study design used an experimental method with treatment by level 2 x 2. Data analysis used 2-way variant analysis (ANOVA). The results of this study are (1) there are differences in high-level thinking skills of students who learn to use the 7E Learning Cycle Model with the Problem Based Learning Model. (2) There is an interaction between Learning Model and Learning Independence on the high level thinking skills of elementary school students. (3) high level thinking skills of students who have high Learning Independence using the Learning Cycle Model 7E higher than students who have high critical thinking skills who use Problem Based Learning Models. (4) high level thinking skills of students who have low Learning Independence who using the 7E Learning Cycle Model media is lower than students who have low critical thinking skills who use the Problem Based Learning Model.

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Introduction:-

In the life of modern society, science is seen as present-day science which includes knowledge about arithmetic and geometry. 21st Century life skills in the form of 21st Century Lifelong Skills (1) critical thinking, (2) creativity, (3) communication, (4) working together, (5) career and learning independence, (6) cross cultural understanding, and (7) computing / ICT literacy [1]. thinking also needs to be accustomed to in order to produce quality thinking and to make someone think higher-level.

Higher-order thinking skills are usually associated with Bloom's taxonomy [2]. Bloom's taxonomy is the basis for higher-order thinking. This thinking is based that some types of learning require more cognitive processes than others, but have more general benefits. These skills cover six levels with dimensional knowledge and cognitive processes namely remember, understand, apply, analyze, evaluate, and create [3]. This skill is one that is needed to face the current era of globalization which is full of competition. because in addition to the results of science and technology that can be enjoyed, apparently there are also some problems for humans and the environment [4]. In higher-order thinking use thinking widely to find new challenges. high-level thinking requires a person to apply new information or knowledge that he has acquired and manipulated information to reach possible answers in new situations [5].

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Data released by the OECD (The Organization for Economic Co-operation and Development) from the 2015 PISA (Program for International Students Assessment) ranks Indonesia at the bottom of 9th or 64th out of 72 countries in the world. above Brazil and below Jordan with the acquisition of science scores 403, reading 397, and Mathematics 386. Indonesia is still below the average of 500 from the value set by PISA Indonesia only reaches the Low International Benchmark (<https://www.oecd.org/pisa/>). Other international studies besides PISA are Trends in International Mathematics and Science Study or TIMSS Indonesia is ranked 45th out of 48 Countries with a value of 397 points still below the average of 500 from the value set by TIMSS. Indonesia only reached Low International Benchmark [6].

The ability to think that is still low does not match the needs of modern society, that is one of them requires the ability to think at a higher level [7]. Whereas 21st Century Learning places greater emphasis on students' ability to do Higher Level Thinking Skills (HOTS) [8].

Some research results are based on low-level thinking skills that result in the learning process and researchers try to apply several learning methods or models including project-based learning contribute to improving problem solving and higher-order thinking skills of graduates of the Civil Engineering program from Aveiro University [9] HOTS Assessment Development with guided inquiry method which is expected to make students able to process, reason, and serve, act effectively and creatively [10] and the application of PBL models can improve higher order thinking skills in students [11].

Paying close attention to these problems To improve higher order thinking skills (HOTS) is not only centered on students, but also influenced by teacher strategies [12]. So students can succeed in the ability to think at a high level (HOTS) in science learning, it requires process skills, it must be brave to change the learning paradigm from teacher-centered learning to student-centered. Through the improvement of the student-centered learning process by applying innovative and varied learning models so that students become self-learning and in accordance with the conditions of the school so that students are expected to be able to improve their high-level thinking skills (HOTS).

A very important aspect exists in students as subjects in the learning process that is the independence of student learning to achieve a success in learning. Independent learning is an individual's ability and motivation, monitors and controls emotions, thoughts, and actions to achieve one's goals [13]. for ^{that} independence learning becomes very important possessed by students because independent students in learning will bring changes in students' learning attitudes and thinking skills [14], for that independence learning becomes very important owned by students because students who are independent in learning will bring changes in learning attitudes and students' thinking skills.

Learning is always directed by students to become independent in learning, and to become independent students learn to be independent so that learning independence is achieved. Learning independence is one of the most important competencies for lifelong learning [15]. Learning independence is also important for successful mediation in different learning contexts The term 'independent' is important for successful mediation in different learning contexts [16]. Independent learning is also characterized as a process of self-directive and self-confidence that allows students to change their abilities for academic performance skills [17].

Students who have independence in learning are able to analyze complex problems, are able to work individually or cooperate in a group, dare to express ideas of argumentation, defend their position and are able to criticize the ideas of others constructively. Meanwhile students who do not have independence in learning will experience difficulties in learning, do not have the drive to perform as well as possible so that the goals of learning cannot be achieved properly. Based on this student learning outcomes are different between one student and other students, especially in the ability to write a description allegedly because it has to do with student learning independence that is still low [18]. In particular, the perspective of Independence learning takes a much more inclusive perspective on student learning not only including cognitive, but also motivational and affective factors, as well as social contextual factors [19].

Some of the student-centered learning models that exist today so that students learn independently and the teacher is only a facilitator can improve students' high-level thinking skills, one of which is seen as an alternative to be able to improve students' high-level thinking skills, especially in science learning is by using inductive learning. Eggen and Kauchak argue that the inductive learning model is a direct strategy to develop higher-order thinking skills [20],

which are included in the Type of Inductive learning model, namely the Learning Cycle Model and the Problem Based Learning Model.

The Learning Cycle model is one of the approaches advocated by science education reformers and is often used by science educators [21]. The learning cycle learning model has been seen as an effective learning model since the 1970s [22]. The learning cycle when applied will improve scientific achievement (including concept recall) and improve scientific attitudes and processes and positively influence science understanding [23] because this model is based on constructivism. The constructivist approach to education is focused on presenting new information to students, in the context of their prior knowledge will be able to increase students' understanding of concepts and thinking skills through activities and reflection [24].

Stages The learning cycle provides a structure and cognitive framework to involve students in activities that mimic the scientific approach to solving problems [25] because the learning cycle model is designed by active students or learning centered on students (Student Centered) where this model is meaningfully exploring , deepening understanding, and then applying scientific concepts to new situations. This Learning Cycle Model consists of several phases of activities (phases) namely 3E, 5E, and 7E which are then modified into the 8E Learning Cycle Model [26]. Learning Cycle 7E phase is a learning cycle model that actively involves students through 7 phases in learning, namely Electricity, Engage, Explore, Explain, Elaborate, Evaluate, and Extend [27]. Learning method Learning Cycle 7E is one of the learning models that provides opportunities for students to optimize ways of learning and develop students' reasoning power.

In its application, the LC 7E model has advantages and disadvantages. The advantages of this model according to Fajarah and Dasna are 1. Increasing learning motivation because students are actively involved in the learning process. 2. Help develop the scientific attitude of students. 3. Learning becomes more meaningful. Meanwhile, according to Soebagio weaknesses that must be anticipated are estimated as follows: 1. The effectiveness of learning is low if the teacher lacks mastery of the material and learning steps. 2. Demand the seriousness and creativity of teachers in designing and implementing the learning process. 3. Requires more planned and organized classroom management. 4. Requires more time and energy in preparing plans and implementing learning [28].

One of the more widely known Inductive learning models that is appropriate for this learning and can be applied to science learning in elementary schools is Problem Based Learning. The Problem Based Learning model was introduced in the late 1960s by McMaster University Medical School in Canada, as a teaching and learning approach, and included in the literature. In the 1970s, it was applied in several medical schools [29]. Problem Based Learning has become one of the learning models that might facilitate HOTS students [30], because Problem Based Learning is a model for constructivist learning in education. According to constructivist learning theory students seek their own knowledge and to obtain essential knowledge and concepts from subject matter [31]. Through this learning model students are more active, creative and the learning process is not boring so learning is more meaningful.

Problem Based Learning is one of the innovative learning models that can provide active learning conditions for students. Involving students to solve problems through stages of the scientific method so students can learn knowledge related to problems and have skills to solve problems [32]. Whereas According to Boud and Feletti Problem Based Learning is a method of developing learning abilities from different sources, comparing information, problem solving skills and self-efficacy [27]. By requiring students to solve problems as the main format of instruction, Problem Based Learning can improve their abilities and skills in applying knowledge, solving problems, practicing high-level thinking, and reflecting their own learning [28]. Studies show that problem-based learning increases some abilities in higher student education building student arguments, and developing creative thinking and problem solving skills [29]. Thus Problem Based Learning can be an alternative as a learning model on Science Materials and can increase higher-order thinking skills.

According to the Arends Stages of the Problem Based Learning Model namely Phase 1: Provide orientation about the problem to students, Phase 2: Organizing students to research, Phase 3: Assisting independent and group investigations, Phase 4: Developing and presenting artifacts and exhibits, Phase 5 : Analysis and evaluation of the process of overcoming the problem [30].

Each model has advantages and disadvantages. The advantages of the PBL model according to include: 1) students are trained to have the ability to solve problems in real situations, 2) have the ability to build their own knowledge through learning activities, 3) learning focuses on problems so that material that is not related does not need to be studied by students. This reduces the burden on students by memorizing or storing information, 4) there is scientific activity in students through group work, 5) students are accustomed to using sources of knowledge, both from the library, the internet, interviews, and observation, 6) students have the ability to assess the progress of their own learning, 7) students have the ability to conduct scientific communication in discussions or presentations of the results of their work, and 8) learning difficulties individually can be overcome through group work in the form of peer teaching (Ceker, E. & Ozdamli, 2016). While, the shortcomings of the PBL model include: 1) problem-based learning (PBM) cannot be applied to every subject matter, there is a part of the teacher playing an active role in presenting the material. more suitable for learning that requires certain abilities related to problem solving, and 2) in a class that has a high level of diversity of students there will be difficulties in the division of tasks. Meanwhile, the shortcomings of the PBL model include: 1) problem-based learning (PBM) cannot be applied to every subject matter, there is a part of the teacher playing an active role in presenting the material. more suitable for learning that requires certain abilities related to problem solving, and 2) in a class that has a high level of diversity of students there will be difficulties in the division of tasks.

Some of the results of research on the application of inductive learning models can improve higher-order thinking skills (HOTS), namely Lika Mariya), Engagement (involving), Exploration (investigating), Explanation (explaining), Elaboration (outlining), Evaluation (assessing), and Extending (extending), (Mariya & Suyatna, 2015), Kani Ulger Problem Based Learning can help students with no routine problem. by maintaining uncertainty and increasing creative thinking. However, similar conclusions cannot be reached for critical thinking disposition [31].

Based on the problems and research results that have been explained, the researcher is very interested in conducting research on the Effect of Learning Models and Learning Independence on Higher Order Thinking Skills (HOTS). Thus this research can prove the truth of a theory and existing phenomena.

the formulation of the problem in this research is:(1) what there is difference Comparison of Science Literacy Capabilities Between ICT Flash (A1) Media and ICT Power Point (A2) Media; (2) what the Effect of Interaction Between Learning Models And Student Learning Independence On Students' high-level Thinking Skills; (3) what there is difference High Level Thinking Skills of Elementary School Students Who Have High Learning Independence Given Learning Using the 7E Learning Cycle Model (A1B1) with Problem Based Learning (A2B1) Models; (4) what there is difference High-level Thinking Skills of Elementary School Students Who Have Low Learning Independence Given Learning Using the 7E Learning Cycle Model (A1B2) with Problem-based Learning Model (A2B2).

Research Method:-

The study was conducted using the experimental method The experimental method. The design used in this study is an experimental method with a 2 x 2 treatment by level design which is the development of the true village experiment design. The population in this study were all students of SDN Gandaria III Kab. Tangerang. In this study the sampling technique used was simple random sampling. Types of instruments Students' higher-order thinking skills using essay questions based on the results of the construction of theories while the Type of Learning Independence test used in this study was a questionnaire using an assessment rubric. This data analysis technique will be analyzed using descriptive statistical analysis and inferential statistics. The Test Requirements Analysis used is the Nominality Test of Liliefors Test, Homogenittas Test Bartlett Test and for the Hypothesis Test the two-way ANAVA test is used.

Testing the validity of the instrument items using the Pearson product moment correlation formula, the processing of data using the Microsoft Excel program. The function of this formula is to determine the validity of each item in the research questionnaire.

The Pearson product moment correlation formula is as follows:

$$r_{xy} = \frac{n \sum XY - (\sum X)(\sum Y)}{\sqrt{\{(n \sum X^2 - (\sum X)^2)(n \sum Y^2 - (\sum Y)^2)\}}}$$

From the calculation produces items that are valid and invalid (drop), by comparing r count (r count $< r_{table}$), the instrument items are invalid (drop), and are not used in research. Conversely, if r count is greater than or equal to r table (r count $\geq r$ table), then the item of the instrument is valid and will be used later for data collection research. To find out which research instruments are used reliably or not, this study uses the Cronbach Alpha coefficient formula as follows:

Information:

r = instrument reliability

k = Many valid statement items

$\sum si^2$ = Number of item score variances

st^2 = Variant of total score

This data analysis technique is quantitative research. These activities include managing data and presenting data, calculating to describe data, and testing hypotheses using statistical tests. Technical analysis of the data is required to test the hypothesis of this research there are stages carried out, namely:

Making descriptive statistics: intended to present data descriptively to make it easier for readers to follow and examine the statistical data (quantities) that have been obtained based on statistical calculations.

Inferential statistical prerequisite test by analyzing the normality test using the Liliefors test, homogeneity using the Barlett test, both of these requirements (homogeneity) are carried out in each row column and each cell.

Hypothesis testing uses the two way Anova and continued with the Tukey test. The Tukey test was used for the same sample size for each treatment. This data analysis technique is supported by Microsoft Excel and SPSS applications.

Results And Analysis:-

Based on calculations that have been carried out manually using ANAVA two-way analysis obtained such. In the following table:

Table 1:- ANAVA Interaction Results of Learning Models and Learning Independence of Students' Higher Level Thinking Skills.

Source of Variance	Df	SS	MS	$F_{\text{calculation}}$	F_{table}
Between Group	1	42,025	42,03	9,45	4,11
Within Group	1	27,22	27,22	6,12	4,11
Interaction	1	126,03	126,03	28,34	4,11
In Group	36	160,10	4,45		
Reduced Total	39	355,375			

The results of testing in all four groups using the Kolmogorov Liliefors test with a significance level of $\alpha = 0.05$ can be presented as follows:

Comparison of Science Literacy Capabilities Between ICT Flash (A1) Media and ICT Power Point (A2) Media:

Results of Variant Analysis (ANAVA) in table 4.9, obtained $F_{\text{count}} = 9.45$ in $F_{\text{table}} (0.05) = 4.11$, then H_0 is rejected. Then, there are differences in students' higher order thinking skills using the 7E Learning Cycle Model (A1) and the Problem Based Learning (A2) Model. The average value of the group of students using the Learning Cycle 7E (A1) Model is $XA_1 = 23.4$ with the group of students using the Problem Based Learning Model (A2) is $XA_2 = 21.35$.

The findings obtained in this hypothesis are the differences in high-level thinking skills of students who use the 7E Learning Cycle Model and the Problem Based Learning Model which is very significant. Higher level thinking skills of students with 7E Learning Cycle Model are higher than those of students who learn to use Problem Based Learning Model media.

This is because the 7E Learning Cycle Model is one of the learning models that provides opportunities for students to optimize ways of learning and develop students' reasoning power. Interactive communication media that make students not bored and bored. This learning model suggests that the learning process can involve students in active

learning activities so that the process of assimilation, accommodation, and organization in the cognitive structure of students is achieved. Learning Cycle 7E is one of them is a learning model that is used to help teachers in learning. The use of the 7E Learning Cycle Model complements the delivery of material provided by the teacher. Teachers can expand the interests of students.

While the Problem Based Learning Model is a learning model that seems too broad in its learning process so that it does not focus on the problem so that unrelated material is studied by students.

Thus, it can be concluded that the students' higher order thinking skills learned through the 7E Learning Cycle Model are higher than those learned through the Problem Based Learning Model.

The Effect of Interaction Between Learning Models And Student Learning Independence On Students' high-level Thinking Skills:

Results of Variant Analysis (ANAVA) in table 4.9, obtained $F_{count} = 28.34$ in $F_{table} (0.05) = 4.11$, then H_0 is rejected. Then, there is a very significant interaction effect between the learning model and learning independence on students' high-level thinking skills.

After knowing the interaction between the learning model and the learning independence of students, further testing is needed. further tests used are the Tukey test. With the Tukey test it can be stated that there is an interaction effect between the provision of Learning Models and Learning independence. This can be seen from the image below:

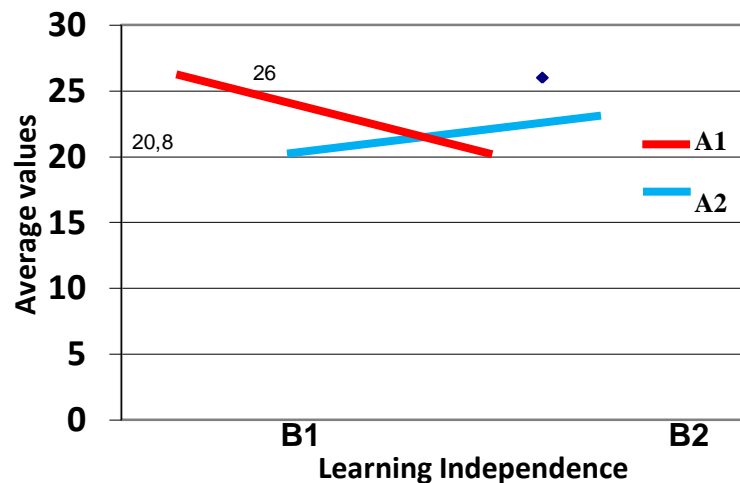


Figure 1:- Graph of Interaction between Learning Model and Learning Independence on Higher Level Thinking Skills.

Information:

A1 = 7E Learning Cycle Model

A2 = Problem Based Learning Model

B1 = Higher Learning Independence

B2 = Low Learning Independence

Based on a statistical analysis of high-level thinking skills of elementary school students that are mutually influenced by two independent variables in this study, namely, the Learning Model and Learning Independence lead to an interaction effect.

A teacher must have an understanding of the importance of using a variety of Learning Models. This is to make it easier to determine which model is considered appropriate in the delivery of learning material in accordance with the learning objectives and conditions of students, including students' learning independence. Each student has been gifted with independence, independence in learning able to analyze complex problems, able to work individually or cooperate in a group, dare to express ideas of argumentation, defend their position and be able to criticize the ideas of others constructively.

Learning Independence is a very important aspect that exists in students as subjects in the learning process, namely student learning independence to achieve a success in learning. Independent learning is an individual's ability and motivation, monitors and controls emotions, thoughts, and actions to achieve one's goals. In addition, students are also able to develop themselves in making decisions and solving problems.

learners who have high learning independence have the ability to find new ways and relate it to knowledge and understanding independently of those who have low learning independence. This is possible because those who have high learning independence are faster in receiving and capturing subject matter. Conversely with those who have low learning independence will have difficulty in the learning process.

Thus it can be concluded that in the provision of learning models must be adjusted or seen adari aspects of learning independence of students that will help in increasing the high level of Thinking Skill of elementary school students.

High Level Thinking Skills of Elementary School Students Who Have High Learning Independence Given Learning Using the 7E Learning Cycle Model (A1B1) with Problem Based Learning (A2B1) Models:

Testing using Tukey's test of differences in Higher Level Thinking Skills of students who have high Learning Independence given learning using the 7E Learning Cycle Model with students who have High Learning Independence using the Problem Based Learning Model shows that $Q_{count} = 8.40$ and $Q_{table} = 2.042$, then H_0 rejected, meaning that there is a significant difference in higher-order thinking skills in the 7E Learning Cycle Model with Problem Based Learning Models in groups of students who have high critical thinking skills or $A1B1 > A2B1$ because $XA1B1 = 26$ and $XA2B1 = 20.4$.

Based on the results of data analysis above, a very important aspect exists in students as subjects in the learning process, namely student learning independence to achieve a success in learning learning independence is the behavior given by students on student independence in learning activities with activities carried out on their own initiative. Independence of learning is measured by indicators 1) not dependent on others. 2) exercise self-control, 3) Have confidence, 4) behave in discipline, 5) have a sense of responsibility, 6) behave based on your own initiative.

In learning, with high learning independence tends to be able to feel and observe problems, make guesses, assess and test hypotheses, test them and submit conclusions without the help of others so as to facilitate him in learning the material presented by the teacher. In addition, with high Learning Independence will be more meaningful if given a learning treatment with the Learning Cycle 7E learning model and Problem based Learning. 7E Learning Cycle Model is one of the learning models that provides opportunities for students to optimize learning and develop students' reasoning power, so that it will encourage students to connect the knowledge they get with their daily lives. Differ from the use of the Problem Based Learning Model, students with High critical thinking skills will not focus on learning because of the lack of control at each stage of learning and have difficulty in solving problems.

Thus, it can be concluded that the high-level thinking skills of students who have high learning independence using the 7E Learning Cycle Model are higher than those of students who have high learning independence using the Problem based Learning model.

High-level Thinking Skills of Elementary School Students Who Have Low Learning Independence Given Learning Using the 7E Learning Cycle Model (A1B2) with Problem-based Learning Model (A2B2):

Testing using Tukey's test of differences in high-level thinking skills of students who have low learning independence given learning using the 7E Learning Cycle Model with students who have low learning independence using the Model Problem Based Learning shows that $Q_{count} = 2.25$ and $Q_{table} = 2.042$, then H_0 rejected, meaning that there is a significant difference in high-level thinking skills in the 7E Learning Cycle Model with the Problem Based Learning Model in groups of students who have low learning Independence or $A1B2 < A2B2$ because $XA1B2 = 20.8$ and $XA2B2 = 22.3$.

Based on the above data analysis results In learning, students' low learning independence has the characteristics of being unable to optimize existing knowledge and understanding as a whole. All information received will be partially digested and even just missed. In learning, those who have low learning independence will have difficulty sensing / observing problems, making guesses, assessing and testing hypotheses, testing them and delivering conclusions. Through the assistance of the teacher, with low learning independence will be trained to develop their abilities through the Model of Problem Based Learning active learning strategies which in practice require students

to be actively involved during the teaching and learning process reducing the burden of interpreting and creating meaning from learning stimuli. The number of variables contained in the complex material will affect how to describe the meaning of learning. Eventually learning will be focused and directed so that productive and effective learning processes and outcomes are achieved. Meanwhile, students who have low learning independence who use the 7E Learning Cycle Model will have difficulty learning independently in the learning process. This is because of the 7E Learning Cycle Model. each of the stages is continually guided so students are not independent in the learning process. For students who have low learning independence it will be difficult to decipher the number of variables found in complex media. students with low learning independence have the characteristic of being unable to optimize existing knowledge and understanding as a whole. All information received will be partially digested and even just missed.

Thus, it can be concluded that students' high-level thinking skills that are treated with the media of the 7E Learning Cycle Model who have low learning Independence are lower than those using the Problem Based Learning Model which has low Learning Independence.

Conclusion:-

Based on the results of the analysis and discussion described in this study, the following findings can be obtained:

First, differences in high-level Thinking Skills between children who take learning using the 7E Learning Cycle Model and children who take learning using Problem Based Learning Models. Empirical evidence through this study shows that the high-level Thinking Skills score of elementary school students on learners who use the 7E Learning Cycle Model is higher than that of learners who learn to use the Problem Based Learning Model media. Thus efforts to improve the high-level Thinking Skills of elementary school students by paying attention to the learner's independence of learning, can be pursued by using the 7E Learning Cycle Model as a science learning process in primary schools.

Second, the effect of the interaction between the Learning Model and Learning Independence on higher-order Thinking Skills. Based on a statistical analysis of high-level thinking skills in elementary school students that are influenced by two independent variables in this study, namely, Learning Model and Learning independence cause the effect of interaction.

Third, improvement of high-level thinking skills of elementary school students who have high learning independence through the 7E Learning Cycle Model. Empirical evidence through this research shows that for students who have high learning independence, high-level thinking skills of students who learn to use the Learning Cycle 7E Model integrated into science learning in elementary schools are proven to be higher than students who learn to use the Problem Based Learning Model . Thus efforts to improve the high-level thinking skills of elementary school students by taking into account the learner's independence of learning, can be pursued by using the 7E Learning Cycle Model as a learning process that is integrated in the science learning process in primary schools.

Fourth, improvement of high-level thinking skills of elementary school students who have low learning independence through the Problem Based Learning Model. Empirical evidence through this research shows that for elementary school students who have low learning independence, to the high-level thinking skills of students who learn to use the Problem Based Learning Model integrated into science learning in primary schools is proven to be higher than students who learn with the Model Larning Cycle 7E. Thus the effort to improve the high-level thinking skills of elementary school students by taking into account the low independence of learners can be achieved by using the Problem Based Learning Model as a learning process that is integrated in the learning process of Natural Sciences in elementary schools.

Acknowledgements:-

The researcher wants to express his gratitude and maximum appreciation to the parties concerned, namely as follows: Prof. Dr. Ilza Mayuni, M.A. as Acting Director of PPs UNJ, who has given the opportunity to researchers to carry out research, so that it can be completed on time. Erry Utomo, M.Ed, Ph.D, as the Coordinator of the Postgraduate Study Program in Basic Education, Postgraduate Program, State University of Jakarta. All Lecturers, Staff, and PPs UNJ employees who have helped a lot in the lectures and research conducted. Jaenul Aripin S.Pd and

Iyung S.Pd beloved, as parents who always devote love and prayers are sincere and full of patience and never tired of accompanying every step of the author in reaching goals.

References:-

- Wayan Widana. (2017). Higher order thinking skills assessment(HOTS).JISAE, 3(1), 32–44.
- Pinho-lobes, M., & Macedo, J. (2014). Project-Based Learning to Promote High Order Thinking and Problem Solving Skills in Geotechnical Courses. *International Journal of Engineering Pedagogy*, 4(5), 20–28.
- Günay, A., Didem, İ., & Özcan, E. (2016). Concept Cartoons Supported Problem Based Learning Method in Middle School Science Classrooms. *Journal of Education and Learning*, 5(2), 272–284. <https://doi.org/10.5539/jel.v5n2p272>
- Rina Dwi Jayanti, Romlah, A. S. (2016). The Effectiveness of Physics Learning Problem Based Learning (PBL) Model Through POE Method Against Students' High Level Thinking Ability. *National Seminar on Education of Physics Education, Faculty of Tarbiyah and Teacher Training IAIN Raden Intan Lampung*, (26 May), 208–214. <https://doi.org/10.13140/RG.2.2.20606.18247>
- Heong, Y. M., Othman, W. B., Yunus, J. Bin, Kiong, T. T., Hassan, R. Bin, Mohaffyza, M., & Mohamad, B. (2011). The Level of Marzano HOTS among Technical Education Students. *International Journal of Social Science and Humanity*, 1(2), 121–125.
- (<https://puspendik.kemdikbud.go.id>)
- Osman, K., Hiong, L. C., & Vebrianto, R. (2013). 21st Century Biology: An Interdisciplinary Approach of Biology, Technology, Engineering and Mathematics Education. *Procedia - Social and Behavioral Sciences*, 102(Ifee 2012), 188–194. <https://doi.org/10.1016/j.sbspro.2013.10.732>
- Yusmanto, H., Soetjipto, B. E., & Djatmika, E. T. (2017). The Application of Carousel Feedback and Round Table Cooperative Learning Models to Improve Student's Higher Order Thinking Skills (HOTS) and Social Studies Learning Outcomes. *International Education Studies*, 10(10), 39–49. <https://doi.org/10.5539/ies.v10n10p39>
- Pinho-lobes, M., & Macedo, J. (2014). Project-Based Learning to Promote High Order Thinking and Problem Solving Skills in Geotechnical Courses. *International Journal of Engineering Pedagogy*, 4(5), 20–28.
- Malik, A., Ertikanto, C., & Suyatna, A. (2015). Descriptions of HOTS Assessment Needs in Physics Learning with Guided Inquiry Method. *Proceedings of the National Physics Seminar*, IV, 1–4.
- Noma, L. D., Prayitno, B. A., & Suwarno, S. (2016). Problem Based Learning to Improve HOTS of High School Students. *Bioedukasi: Jurnal Pendidikan Biologi*, 9(2), 62–66. <https://doi.org/10.20961/bioedukasi-uns.v9i2.4222>
- Yusmanto, H., Soetjipto, B. E., & Djatmika, E. T. (2017). The Application of Carousel Feedback and Round Table Cooperative Learning Models to Improve Student's Higher Order Thinking Skills (HOTS) and Social Studies Learning Outcomes. *International Education Studies*, 10(10), 39–49. <https://doi.org/10.5539/ies.v10n10p39>
- Ellis, J. M. (2018). The Effects of Adolescent Self-Regulated Learning on Engagement in a College Access Program : An Exploratory Study, 4(1), 1–17. <https://doi.org/10.1177/2332858418756051>
- Lee, I. (1998). Supporting greater autonomy in language learning Icy Lee. *ELT Journal Volume*, 52(October), 282–290.
- Zheng, L., Li, X., & Chen, F. (2016). Effects of a mobile self-regulated learning approach on students' learning achievements and self-regulated learning skills. *Innovations in Education and Teaching International*, 3297(November), 1–9. <https://doi.org/10.1080/14703297.2016.1259080>
- Lehmann, Hähnlein, I. (2013). Computers in Human Behavior Cognitive , metacognitive and motivational perspectives on prefection in self-regulated online learning. *COMPUTERS IN HUMAN BEHAVIOR*. <https://doi.org/10.1016/j.chb.2013.07.051>.
- Zimmerman, B. J., & Martinez-pons, M. (1990). Student Differences in Self-Regulated Learning : Relating Grade , Sex , and Giftedness to Self-Efficacy and Strategy Use, 82(1), 51–59.
- Pintrich, P. R. (2004). A Conceptual Framework for Assessing Motivation and Self-Regulated Learning in College Students, 16(4), 385–386.
- Sani,Ridwan Abdullah.Learning Innovation, .Jakarta:Bumi Aksara.2016Goldston, M. J., Day, J. B., Sundberg, C., & Dantzler, J. (2010). Psychometric Analysis of A 5E Learning Cycle Lesson Plan Assessment Instrument. *International Journal of Science and Mathematics Education*, 8(4), 633–648. <https://doi.org/10.1007/s10763-009-9178-7> (Goldston et al., 2010)

20. Spencer, B. H., & Guillaume, A. M. (2006). Integrating Curriculum Through the Learning Cycle: Content-Based Reading and Vocabulary Instruction. *The Reading Teacher*, 60(3), 206–219. <https://doi.org/10.1598/RT.60.3.1>
21. Pinho-lobes, M., & Macedo, J. (2014). Project-Based Learning to Promote High Order Thinking and Problem Solving Skills in Geotechnical Courses. *International Journal of Engineering Pedagogy*, 4(5), 20–28.
22. Withers, M. (2016). The college science learning cycle: An instructional model for reformed teaching. *CBE Life Sciences Education*, 15(4), 1–12. <https://doi.org/10.1187/cbe.15-04-0101>
23. Waskitarini Darmiyanti, Yuli Rahmawati, Fera Kurniadewi, dan A. R. (2017). Analysis of students' mental models in applying the learning cycle 8e learning model to the salt hydrolysis material. *Journal of Chemistry Education Research*, 1 (learning cycle learning model 8e), 38–51. (Imaniyah, Siswoyo, & Bakri, 2015)
24. Danar, S., Sari, C., Mulyani, B., & Utami, B. (2013). The application of the learning cycle 5e (learning cycle 5e) with portfolio assessment to improve the quality of the process and learning outcomes on the solubility material and the solubility results of students in grade xi ipa 2 sma Negeri 1 kartasura school year 2011 / 2012, 2(1), 1–6.
25. M. Demirel M. Dagyar. (2016). Effects of Problem-Based Learning on Attitude : A Meta- analysis Study. *Eurasia Journal of Mathematics, Science & Technology Education*, 12(8), 2115–2137. <https://doi.org/10.12973/eurasia.2016.1293a>
26. Jailani, J., Sugiman, S., & Apino, E. (2017). Implementing the Problem-Based Learning in Order to Improve the Students ' HOTS and Characters. *Jurnal Riset Pendidikan Matematika*, 4(2), 247–259.
27. Ulger, K. (2018). The Effect of Problem-Based Learning on the Creative Thinking and Critical Thinking Disposition of Students in Visual Arts Education The Interdisciplinary Journal of Problem-based Learning Article The Effect of Problem-Based Learning on the Creative Think. *Interdisciplinary Journal of Problem-Based Learning Volume*, 12(1), 3–6.
28. Mustafa, S., & Sari, V. (2019). The Implementation of Mathematical Problem-Based Learning Model as an Effort to Understand the High School Students ' Mathematical Thinking Ability. *International Education Studies*, 12, 117–123. <https://doi.org/10.5539/ies.v12n2p117>
29. Duman, B., & Özçelik, C. (2018). The Effect of the Creative Drama-supported Problem-based Learning Approach on the Self-efficacy Ability in Geometry. *Universal Journal of Educational Research*, 6(12), 2918–2924. <https://doi.org/10.13189/ujer.2018.061227>
30. Ceker, E. & Ozdamli, F. (2016). Features and characteristics of Problem Based Learning. *Cypriot Journal of Educational Sciences*, 11(4), 195–202.
31. Günay, A., Didem, İ., & Özcan, E. (2016). Concept Cartoons Supported Problem Based Learning Method in Middle School Science Classrooms. *Journal of Education and Learning*, 5(2), 272–284. <https://doi.org/10.5539/jel.v5n2p272>
32. Rerung, N., Sinon, I. L. S., & Widyaningsih, S. W. (2017). Application of the problem based learning (PBL) learning model to improve learning outcomes. *Scientific Journal of Physical Education Al-Biruni*, 06 (April), 47–55. <https://doi.org/10.24042/jipf>.
33. Ulger, K. (2018). The Effect of Problem-Based Learning on the Creative Thinking and Critical Thinking Disposition of Students in Visual Arts Education The Interdisciplinary Journal of Problem-based Learning Article The Effect of Problem-Based Learning on the Creative Think. *Interdisciplinary Journal of Problem-Based Learning Volume*, 12(1), 3–6.