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RESEARCH ARTICLE

THE EFFECTS OF INSTRUCTIONAL STRATEGIES AND SCIENCE PROCESS SKILL ON BIOLOGY TOWARD STUDENTS ACHIEVEMENT IN MTS MU'ALLIMAT NW PANCOR.

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Abstract

This study was aiming at knowing the effects of Project Based Learning Strategy and Process Skill of Science on students' learning outcomes of the seventh graders of Mts Mu'allimat NW Pancor. Research method used in this study was quasi experiment with treatment by level 2x2. The population was the students of Madrasah Tsanawiyah, while the targeted population was all students of seventh grade in year 2016/2017 which consists of 6 classes. Four classes were selected randomly and each class consists of 30 students, which were administrated by Project Based Learning and Direct Learning. The data was analyzed using two ways ANOVA with a treatment by level 2 x 2. Result of this study showed that: (1) Biology learning outcomes of the students who were treated using Project Based Learning strategy was higher than those who were treated using Direct Learning Strategy; (2) there was an interaction effect between learning strategies and science process skill on the students' learning outcomes of science; (3) For students who have high process skill on science, when they were treated using Project Based Learning the outcome was higher than those who were treated using Direct learning Strategy; (4) Biology Learning Outcomes of the students who were treated with Project Based Learning strategy was not lower than those who were treated by using Direct Learning strategy for students who have low science process skill.

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Introduction:-

Learning biology is still dominated by a behavioristic paradigm that considers knowledge as memorized facts and teachers as the main source of knowledge. In this paradigm, teacher does not attract the students to engage in the whole process of learning, studying collaboratively, group inquiry, not involving students in the planning of learning, not assessing the project, and not presenting the results of class discussions. Students' understanding towards a subject will be achieved, if the students themselves are actively engage during learning process. To change such situation, the change of paradigm especially the school paradigm is needed to shift the learning. A new paradigm of learning that needs to be developed by an educator in the field of science is an educational learning that puts emphasis on the importance aspect of learning process.

When the students taught using memorizing technique, students might have less opportunity to learn the material directly in a meaningful learning through process skills and scientific attitudes. An engaged learning with a meaningful task is still perceived as a complex problem for teachers today although the learning activities can be conducted individually, competitively or cooperatively. Ausubel says:

Distinguised two types of learning, 1) rote Learnin, in which " learned materrials are discrete and relatively isolated entities which are only relatable to cognitive structure in an arbitrary, verbatim fashion not permitting the establishment of [sinificant] relationships" and 2) meaningful learning, which "takes place if the learning task can be related in a nonarbitrary, substantive fashion to what the learner already knows, and if the learner adopts a corresponding learning set to do so". (Reigeluth, 1999: 53)

Learning by memorizing techniques does not help students to acquire knowledge. While, learning can build an understanding of cognitive structure, learning process also must be meaningful for students to solve life problems. (Vygostsky in Yau Tung, 2015: 246) says that teachers should develop opportunities for pupils to interact with teachers, fellow students, and the environment to construct knowledge. This means that teachers have a big role in building students' understanding by putting more emphasis on student activeness and providing a meaningful learning.

The observation result shows that the development of science process skill both in learning process and evaluation of learning result is rarely promoted, consequently the students become unable to develop their skill in finding and connecting concept, especially on environmental pollution material. The observation results also show that most students encounter unpleasant experiences during biology learning, resulting a low student achievement index. This is caused by many factors such as students who are good in concept, the teacher does not involve students in the real life learning such as conducting experiments, not fully taught the students with appropriate strategies or approaches and varied, and the school environment or facilities and infrastructure are still inadequate, as well as low school discipline.

Biology learning is generally not easy for students to understand a complex concept and abstract, but if they are provided with the real situations and conditions they will understand the material easily. The learning process is expected to give real life situations so it can provide a more meaningful learning experience

Based on the facts and conditions, one alternative to increase the student involvement in learning is by applying project-based learning. This emphasizes the interrelationship between concepts with daily life experience of students so they can relate the concept they already have with the new knowledge they will learn.

Based on the background of the problem the researcher formulated research problems as follows: (1) Are there any differences in in terms of learning outcome between students who are taught with Project based Learning Strategy to students who are taught using Direct learning strategy? (2) Is there any influence of interaction between learning strategy and (3) Are there differences in biology learning outcomes between students who are taught with a project-based learning strategy with students who are taught direct learning strategies, for students who have high science process skills, (4) Are there differences in biological learning outcomes between students who are taught by a project-based learning strategy with students who are taught by Direct learning strategies, for students who have low science process skills.

To achieve the goal in each activity, it always followed by measurement and assessment. Similarly, in learning process each activity needs to be measured to know the results, how far the learning objectives set has been achieved. To know whether the learning outcomes achieved, it can be known through an evaluation. Referring to Sunal in Susanto which states that evaluation is the process of using information to make consideration of how effectively a program has met the needs of students (Akhmad Susanto, 2013; 5). Thus it can be interpreted that the evaluation is a tool used to determine the extent of the influence of the learning process that has been implemented to meet the students needs. Popham in Schunk says Assessment involves 'a formal effort to determine students' status with respect to educational variables of interest. (Schunk, 2012: 14) This means that assessment involves the process of gathering information related to important variables in decision making by a teacher to improve the learning outcomes side. Bloom's cognitive domains of learning: cognitive domains, affective domains, and psychomotor domain (Gagne, 2005: that is, Bloom classifies learning outcomes into three domains, ie cognitive, affective and psychomotor domains.) (Reigeluth, 2013: 15)

Intructional outcomes are the various effects that provide a measure of the velue of alternative methods under different condition. Outcome may be actual or desired. Actual outcomes are the3 real-life results for using specific methods under specific condition, Whereas desired outcome are goals, Which often Influence what methodes should be selected

This means that learning outcomes is the effect of a learning strategy during a learning process. Thus, the more appropriate method or learning strategy used, the better learning outcomes will be achieved. Learning outcomes can also interpret as the students' ability to obtain information after learning activities (Susanto, 2013: 60). It means that learning outcomes are skills and attitudes that students get after receiving the treatment given by teachers using various learning strategies to construct knowledge in everyday life. The development of science is not only characterized by a collection of facts, but also marked by the existence of "*scientific methods*" manifested through a series of "*scientific work* "(*scientific attitudes*), values and scientific attitudes". The nature of IPA (science) includes four element:

product: facts, principles, theory and law: (2) process: problem solving procedure through scientific method including observation, hypothesis preparation, experimental design, experiment, hypothesis testing through experiment; evaluation, measurement and conclusion; (3) application: application of scientific method or work and concept of IPA(sciences) in the daily life; (4) attitude: curiosity towards objects, natural phenomena, humans, and causality relationships that create new problems and could be solved through correct procedures; science is open ended. (Depdiknas, 2007: 8)

Gagne viewed learning as "a set of events embedded in purposeful activities that facilitate learning. (Gagne, 2005: 1) This means that learning is a series of activities that are intentionally created to promote a learning process. Project-Based Learning is a learning model that provides an opportunity for teachers to manage learning within the class through a project work. (Wena, 2009: 144) it means that learning process is regulated to invite students doing complex tasks that are challenging questions or problems taken from the topic discussed. Project Based learning give students more opportunity than the educators, where students are brought closer to or introduced to the real working atmosphere that they actually encounter around their real environment. Meanwhile, according to Larmer *"Project-based learning is an instructional strategy that can enable you and your students to go beyond the content coverage and develop the deep understandings and success skills needed to thrive in today's complex world". (Larmer, 2015: 22-23).* Project-based learning is a learning approach that enable teachers and students to improve understanding and develop skills required to cope with the current knowledge. (Capraro, 2013: 50) says:

Project-Based Learning (PBL) is defined as a model for classroom activity that shifts away from the classroom practices of short, isolated teacher-centered lessons and instead emphasizes learning activities that are long-term, interdisciplinary, student-centered, and integrated with real-world issues and practices

Project-based learning is defined as a change from teacher-centered learning to student-centered learning that can be integrated into a real life. Project-based learning has the greatest potential to make learning more engaging, meaningful to learners and encourage students to construct their personal knowledge and skills. According to (Howe and Jones,: 1000 argues that "*Direct instruction is the use of traditional method of lecture, demonstration, seat work, recitation, and feedback*." Similarly, (Arends, 2007: 99) stated that teachers could demonstrate and give examples towards some skills taught and give students time to practice those skills and receive feedback. It means that in

direct learning the teacher should deliver the material or knowledge to the students, by providing models or examples, give the students to practice applying what they have already studied and provided feedback. (Joyce and Weil, 2009: 369) states:

The term of direct intructionhas been used by researchers to refer to a pattern of teaching that consists of the teacher's explaining a new concept or skill to students, having them test their understanding by practicing under theacher direction (that is, controlled practice), and encouraging them to continue to practice under teacher guidance (guided practice).

Direct learning is learning begins with a teacher's explanation towards concepts or skills. Next the teacher is demanded to make learning design so that learning objectives can be achieved through learning experiences. It shows that the direct learning environment as a place where learning becomes the main focus and students engage in academic tasks that can increase student participation in learning during the activities to achieve the optimal learning outcomes. Direct learning demands and helps students to improve their learning outcomes.

The rapid development of science today produces many concepts that must be learned by studetns through learning, while teachers are no longer possible to teach many concepts to students. Scientific process skills should be developed in students as a meaningful experience because in science learning, scientific skills and scientific attitude have an important role in finding the concept of science. Students can build new ideas when they are experiencing a real symptom. Building a new idea is not only depending on the characteristics of the object, but also on how the student understands an object or processes the imformation.

Ango (2002: 26-27) stated "*Process skills of science are basic and critical components of the process of conducting study of science under the guidance of a teacher"*. Means that the skill process of science is a basic and important component of the learning under the guidance of teachers during the learning process. (Howe and Jones, 1993: 130) suggests the basic science components process:

Observing. Using one or more of the five senses to notice characteristics of objects or events, (2) Communicating.Conveying information through language, pictures or other means of representation, (3) Classifying. Putting things into categories according to certain charactristics, (4) Measuring. Making quantitative observations by comparing things to one another or to a unit of measure, (5) Relating objects in space and time. Using the relationships of space and time in describing and comparing shapes, locations, motions, and patterns.

Meanwhile, (Dimiyati, 2009: 139) stated that the interaction between development process skills with facts, concepts, and science principles will eventually develop the attitude and value of scientists in students.
According to (Rustaman, 2007: 19-22) The types of science process skills are:
(1) Observation skill (2) skill to observe (interpretation), (3) classification skills, (4) predicting skills, (5) communication skills, (6) skills to formulate hypotheses , 7) skill of planning experiment, 8) applying concept skill, 9) skill of formulating question,

Scientific process skills are an intellectual skill used to understand any phenomenon, where these skills are required to acquire, develop and apply concepts, law principles and science theories science.

Method:-

The research method used in this research is quasi experimental method. Both groups are treated differently from project-based learning strategy as exsperimen group while direct learning strategy as control group. Variable in this research is learning strategy that is; Project-based learning and direct learning as independent variables, Process skills as attribute variables and biological learning outcomes as a dependent variable. The research design used in this study is design treatment by level 2 x 2. Target population in this study is all students Mts Mu'allimat NW Pancor with the number of 560 people, while the affordable population in this study are all students of class VII which amounted to 170 people. The sampling technique was done by random sampling. By selecting four classes of six classes of students of class VII, to specify the individual to be given the first treatment and the second treatment (control); Of the four classes of 120 students, two classes of 60 students were selected as experimental groups and treated with a project-based learning strategy and two classes of 60 people as control groups and treated with direct learning strategies.

All students from the experimental group and the control group were given a test instrument to identify students with high science process skills and low science process skills. Furthermore, it is determined that the group of students who have high science process skills and students who have low science skills. Determination of the group of students is done by taking 33% or 1/3 upper limit score of 60 students to determine the group of students with high science process skills and 33% or 1/3 lower limit score of 60 students to determine the group of students with the skills of the process of science low.

Data analysis used in this research include descriptive analysis and differential analysis. Descriptive analysis is proposed to get a clear picture of the data that has been collected in the study. Descriptive analysis presented includes average, standard deviation, and variance. To illustrate the data that has been collected, the data are presented in the frequency distribution and histogram lists for the two data sets. Prior to hypothesis testing, it is necessary to test the requirements of data analysis include data normality test and test of data homogeneity. Normality test is used to determine whether the study sample is taken from normal population or not. Normality test is done by using Lilliefors Test for all sample groups with significance level of 5% (Kadir, 2010: 107) Conclusion determined by criterion if $L_0 > L_{able}$, H_0 is rejected and if $L_0 < L_{able}$, H_0 is accepted for significance 5% .. Homogeneity test done by using Bartlett Test with Testing criteria is H_0 accepted if count <tabelpada 5% significance level. To test the hypothesis in this research, it is used Two Ways Anava test (Gall, 2007; 318) with treatment design by level 2 x 2 and tested further by using t-*Dunne* test (Kadir, 2010: 221)

Results and Discussion:-

In accordance to the research design used in this study *treatment by level* 2 x 2, there are eight groups of data that will be described as follows. In accordance with the design in this study is the design *treatment by level* 2 x 2, then the hypothesis that has been formulated in this study is tested by using two ways Anava. The results of calculations with anava presented as in the table below.

Tabel 1:-Summary of two ways Anava Learning Outcomes of Biology Students

Source of varians	JK	db	RJK	$F_{counting}$	F_{table}
					α=0.05
Between A	189,11	1	189,11	19,379	3,97
Between B	214,51	1	214,51	21,982	3,97
Interaction AxB	391,61	1	391,61	40,130	3,97
Inside	741,65	76	9,76		
Total	1536,89	79			

Based on the analysis result, it can be concluded as followed:

The differences outcomes in teaching Biology using Project Based Learning strategies and Direct Learning Strategies:-

Based on the calculation of two ways anova obtained $F_{counting} = 19.379$ and F_t (0.05; 1/76) = 3.97. Because $F_{counting} > F_{table}$ then H_0 is rejected. So it can be concluded that the results of learning Biology of students who are taught using Project-Based learning is higher than the results of learning Biology with Direct learning strategy.

The influence of interaction between learning strategy and science process skill to the result of Biology learning:-

Based on calculation result of two ways anava obtained $F_{counting} = 40,130$ and Ft (0,05; 1/76) = 3,97. Because $F_{counting} > F_{table}$ then H0 is rejected. So it can be concluded that there is influence of interaction between learning strategy and science process skill result in learning Biology. Based on testing on the second hypothesis, there is an interaction between learning strategy and science process skill to Biology learning result hence need to do further test by using t-Dunnet test. Here is presented summary of calculation for further test.

Table 2:- Summary Result of Further Test Using t-*Dunnet*

Group	$t_{counting}$	t_{table}	H1	Decision
A1B1 - A2B1	7,591	1,725	A1B1 > A2B1	Ho is rejected
A1B2 - A2B2	-1,64	-1,725	A1B2 < A2B2	Ho is accepted

Based on the test result, it can be concluded that :

The differences in learning outcomes towards Biology students who are taught by using Project Based Learning Strategy and students who are taught with Direct learning strategies for the students who have high science process skills:-

Based on the results of further test calculation as in the table 4.14 obtained t counting = 7,591 and t (0.05; 20) = 1.725. Because $t_{counting}$ = 7,591> t_{table} = 1.725 then H_0 is rejected. So it can be concluded that the Biology learning outcomes that follow the Project Based Learning Strategy is higher than the Biology learning result following the Direct Learning Strategy, for students who have high science process skills. Based on table 2, for students who have high scientific process skills, the average of Biology learning outcomes that are taught with Project Based Learning Strategy is 33.55 and which is taught by Direct Learning Strategy of 26.05. Thus, the learning outcomes of Biology that are taught by Project Based learning is higher than that of Biology learning which is spent by Direct Learning for students with high science process skills.

The differences of learning outcomes in students Biology who are taught by Project Based Learning Strategy and students who are taught with Direct Learning strategy for students who have low science process skills:-

Results of analysis as shown in Table 4:14 obtained $t_{counting}$ = -1.64 and t (0.05; 20) = -1.725. Because $t_{counting} > t_{table}$ then H_o is accepted. Thus it can be concluded that the learning outcomes of Biology that are taught using Project Based learning is not lower than the result which is taught using Direct Learning for students who have low science process skills.

Based on the data obtained, the average outcomes in leaning Biology with Project Based was obtained 25.85 while, Direct Learning Strategy was 27.20, for students with low science process skills. Although the results with Project-Based learning are smaller than Direct learning strategy for students with low science process skills, the differences are not statistically significant.

Based on the analysis results the researcher will discuss the results of hypothesis testing based on theory and / or relevant research results to describe whether the research results obtained to support the theory or not to a relevant research.

Firstly, the first hypothesis testing shows that the learning outcomes of students who are taught using Project Based learning is higher than the those who is taught using Direct learning strategy. (Gaer in Wena, 2014: 145) explains that Project-Based Learning is potentially large enough to make learning experience more interesting and meaningful. It means that in the project-based learning strategy students are given the opportunity to utilize their surrounding environment as a learning experience to facilitate their understanding and learning becomes more interesting and meaningful. (Capraro, 2013: 50) said that project-based learning is defined as a change from teacher-centered learning to a student-centered learning that can be integrated into a real life situation. Based on the above theory, a form learning that enables the students to be more actively collaborative in learning activities is Based on Project-Based Learning because students are given the opportunity to gain an integrated learning experience practically therefore; learning process becomes the students centered learning.

Arends (2007: 99) argue that direct learning requires teachers to demonstrate and model examples of the skills taught and give students time to practice the skills and receive feedback. It can be interpreted that in the direct learning the role of teachers is more dominant therfore a teacher is required to be more attractive for students. So, the result of biology study with Project Based learning is higher than Direct learning.

Secondly, the result of the second hypothesis testing shows that there is an interaction effect between learning strategy and science process skill to Biology learning result. Scientific process skills should be developed as a meaningful experience for the students. Because in scientific learning, scientific skills and scientific attitude have an important role in finding the concept of science. Students can build new ideas when they are experiencing a symptom. Building a new idea is not only depending on the characteristics of the object, but also on how the student understands an object or processes the imformation. Scientific process skills can be developed through scientific inquiry activities that can provide an opportunity for a person to practice their intellectual skills and stimulate his curiosity in obtaining and processing the information to encourage students' become more productive. Teachers also have an important role in helping students to develop science processing skills through the implementation of strategies, learning that helps students to learn more actively.

Learning is an activity undertaken by students to make behavior change through experience. Learning can also regarded as a process of assimilating and connecting the actual knowledge they already have with the new knowledge they are learning so that they have the opportunity to construct their own knowledge and understanding through that experience. In developing these thoughts students need the skills so they can easily find new knowledge. Learning strategy and science process skill are factors that influence student's learning outcomes. So there is an intraction between learning strategies and science process skills to biological learning outcomes.

Thirdly, the third hypothesis testing shows that the learning outcomes for students who are taught using Project Based learning strategy is higher than those who are taught using Direct learning strategy, especially for students who have high science process skill.

Based on the opinion (Reigeluth, 2013: 15) that learning outcomes is the influence of a learning strategy that has been learned in the learning process, the more learning strategy used, the better result achieved. It means that the learning process implemented with the right strategy or in line with the context can support the achievement learning outcomes. (Putra, 2003: 57) argues that in science process skills students are trained to be skillful in obtaining and processing information through thinking activities by following scientific procedures such as skillful observation, measurement, classification, conclusions and communication of findings. This means that the process of science skills is a skill to acquire, develop and apply concepts, principles and theories in a real life to find a new knowledge. Students' science process skills need to be developed through the educational process. Scientific process skills determine the students ability to achieve their success in the learning process. It means that the learning outcomes with Project-Based learning strategy is higher than student outcomes with direct learning strategies for students who have high scientific process skills

Fourthly, in the fourth hypothesis testing Ho was accepted. This indicates that for students who have low science process skills, students' learning outcomes with a Project Based learning strategy are not lower than the result, which is taught with Direct learning strategy. As explained in Chapter II that Project Based Learning is a student-centered, innovative learning, while direct learning is essentially teacher-centered learning so that teachers must be active in learning. Thus, the learning result with Project-Based learning is lower than the results of learning that with direct learning. According to researcher, Ho was accepted since some intended indicator is not completely achieved in learning. In addition, the sample size is also possible to be the reason for Ho to be accepted in this study therefore; a larger sample size is needed. Researchers realize that there were some limitations that can affect the condition of research conducted, to complete this research is relatively too short, in addition researchers only examine the results of learning based on learning strategies and skills within the scientific process, limited subjects which was only 120 people, therefore a larger subjects subject needs so it can be generalized widely.

Conclusion and Suggestion:-

Based on the results of research and discussion described, the conclusion can be drawn as follows: (1) Learning outcomes for students who are taught using a Project Based Learning is higher than those who were taught with Direct learning strategy. (2) There was influence between learning strategies and science process skills on Biology students outcomes. (3) Learning result that is taught using Project Based Learning strategy is higher than which is taught by Direct learning strategy, for students who have high science process skill, (4) Learning result of student with Project-based learning is not lower than those who with Direct learning strategy, especially for students with low science process skills.

Based on the conclusion, it is recommended as follows: (1) Project Based Learning Strategy has different characteristics with Direct Learning. Project-Based Learning Strategies make student become more active than Direct learning, either individually or in groups. Therefore, it is expected that the teachers should apply the project based learning, (2) the teachers are expected to choose the right strategy and able to develop the students' science process skill to improve student learning outcomes, (3) teachers are required to encourage and facilitate each activity to develop students' science process skills, (4) Teachers need to pay more attention to the skills of science processes owned by students so that learning becomes meaningful.

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