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RESEARCH ARTICLE

IMPLEMENTATION OF SCIENCE MODULES BASED ON GUIDED DISCOVERY LEARNING (GDL) ON ENVIRONMENTAL POLLUTION MATERIALS TO IMPROVE JUNIOR HIGH SCHOOL STUDENTS LEARNING ACHIEVEMENT.

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Abstract

This study aimed to determine the effectiveness of science module products based on guided discovery learning (GDL) on environmental pollution topic to improve junior high school students' learning achievement. The trial of the product was done at Junior High School 2 Suboh, Situbondo, Indonesia, in class VII in the second semester consisting of 35 students. The study was conducted three times, where the material for the first meeting being discussed was water pollution, the second meeting was air pollution and the last meeting was soil pollution. The research instruments were observation sheets and test sheets. The research design was one group pre test-post test design and the research data was tested by the normalized gain (gain score). Based on the results of the study, it was concluded that the implementation of science modules based on guided discovery learning (GDL) for students' learning achievement had significant increase from the range $0.3 \leq [g] \leq 0.7$ coming from medium criteria to high criteria in the range $[g] \geq 0,7$ based on normalized gain (gain score). Therefore, the module based on guided discovery learning (GDL) on environmental pollution material effectively improves the junior high school students' learning achievement.

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Introduction:-

Natural Science is the science that underlies the development of science and technology and its benefits to society. Science has characteristics that cover the domain of attitudes, processes, products, and applications. The science learning applied by teachers in the class today tends to be implemented in a classical way which only relies on textbooks with teaching methods that emphasize the process of memorizing concepts, theories, and laws. This situation is exacerbated by test/test oriented learning which is only focused in terms of product aspects. As the result, IPA as a process, attitude, and application are not covered in this kind of learning. This is thought to be the cause of the low results of education in Indonesia.

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The implementation of 2013 curriculum at schools requires the attainment of complete student competence either knowledge, skills or attitudes. Science learning in junior high school should be given in an integrated manner because through integrated science learning students can get direct experience so that they can add strength to receive, store, and apply the concepts they have learned. According to Permendiknas No. 22 of 2006, the scope of science is taught in one science subject. The logical consequence is that science learning must be packaged into a unified whole. The science learning at the junior high school level in the 2013 curriculum in an integrated manner, natural phenomena is learned as a unified whole, which links the understanding of science subjects from an integrated review of physics, biology, and chemistry. The existing problems so far in science learning are separated in biology, physics, chemics material. In fact, the learning resources that have existed so far have not integrated yet. The availability of integrated science teaching materials which comprehensively presents a combination of various fields of natural science studies as a whole as one interconnected entity is absolutely necessary. In the field, the integrated science reference books have been circulating, but the integration is not connected yet but still fragmented.

Based on the results of preliminary observations in Junior High School 1 Suboh, Situbondo, Indonesia, which has implemented the 2013 curriculum, the IPA book used is the 2013 curriculum student science book. Nonetheless, the Junior High School 1 Suboh, Situbondo, Indonesia, science teacher stated that science learning still uses teaching materials in the form of books and worksheets. The teaching and learning activities that took place in the school still used a lecturing method even though it was varied by the question and answer method. Most of the students' learning time in class spend only to listen to the teacher's explanation and to write the material. In teaching and learning activities, they rarely used discussion methods or demonstration methods. This resulted in students becoming passive and the science skills are not developing. The students' books are less variation, there are still many materials that have not been linked, the material observed does not display images that are familiar to students, has not shown more students' learning activities, has not yet displayed the basis and has not trained students to learn independently. So, it is necessary to modify the teaching materials for students to be interesting teaching materials, featuring more student learning activities, based on, displaying appropriate tools in the students' environment and training self-learning students.

The content of 2013 curriculum reveals that a curriculum must be responsive to the development of science and technology and be able to build the curiosity and ability of students to be optimized properly (Kemendikbud, 2013). In line with the science learning objectives described in the Content Standards (BSNP, 2007), it is emphasized on direct experience to develop the students' competencies being able to understand the natural environment through a process of finding out and acting. One of the science topics class VII in semester 2 at the junior high school level whose material is very close to the experience of students in everyday life is pollution of the environment around us. Science subjects, especially in the matter of environmental pollution, are a concept that is often found in daily life, and a global problem that requires immediate resolution and handling (Widiyanto et al., 2015). Skills in finding out and acting are called inquiry skills or discovery skills. In line with these demands, teachers are expected to develop learning that facilitates students to find concepts through learning resources that characterize the discovery learning.

Purwanto (2012) states that there are several constraints to the application of discovery in learning including the preparation needed to be more mature, long time and teaching materials that facilitate discovery based learning is still limited. Teachers can overcome these problems by learning in the outside school hours and appropriate teaching materials. One form of teaching material that is right in supporting the independent learning process is a module. The module developed is a module based on guided discovery learning on environmental pollution material. Guided discovery learning is a learning model where students think for themselves so they can "find" the desired general principle with guidance and instructions from the teacher in the form of directing questions (Ali, 2004). Guided discovery learning modules are modules that include material and assignments that facilitate students to find a concept based on a problem. With the existence of this module, because it is used independently by students with concepts that can be found or built on their own by students, it is expected that the concept can last for a long period of time in students' memory and have a positive impact on their learning achievement.

Research conducted by Abdisa (2012) regarding the effect of guided discovery learning in physics learning concluded that there is a difference between guided discovery learning, demonstration and expository learning in rotational material in lectures. On the basis of the significance obtained from the three levels of achievement are high, medium and low. The results of the study from Apriani (2012) state that 7E Learning Cycle has an effect of 23.15% on students' learning achievement and generic skills. The research above underlies the research on the

implementation of the science module based on guided discovery learning on environmental pollution material to improve the learning achievement of junior high school students.

The selection of guided discovery learning models is in line with Allen et al (2002), in learning to use the principles of solving problems. The distinctive feature of the guided discovery learning model is that students are briefly guided to find answers to learning problems so that students' learning achievement increase (Suyitno, 2004). Fathur Rohim et al (2012), a guided discovery model is more effective in learning science because it helps students to meet with two important criteria in active learning, namely understanding new information and integrating new information until the right knowledge is found, can improve students' learning achievement. Unal and Ergin et al (2006) state that students who get guided discovery learning have better science skills, their learning achievement increase compared to conventional learning. Martins and Oyebanji et al (2000) and Bajah and Asim et al (2002) report that guided discovery learning is more effective than conventional learning and improves students' learning achievement. The purpose of this study was to determine the effectiveness of the science module based on guided discovery learning (GDL) on environmental pollution material to improve the learning achievement of junior high school students.

Research Method:-

The research was conducted at Junior High School 2 Suboh, Situbondo, Indonesia, in class VII in the second semester II with a total of 35 students. This research was conducted for 4 months, starting from October 2018 to January 2019. The data collection methods were observation, tests and documentation. The research design was one group pre test-post test design by using one experimental class. The study was conducted three times, where the first material in the first meeting was water pollution, the second meeting was air pollution and the last meeting was soil pollution. The instrument used to collect data is learning achievement test, consisting of pre test and post test. The data analysis techniques for the effectiveness of the science module based on guided discovery learning on learning achievement were analyzed by using the gain score formula. According to Hake (1998), the normalized gain score formula is as follows:

$$\langle g \rangle = \frac{\langle S_f \rangle - \langle S_i \rangle}{\langle S_m \rangle - \langle S_i \rangle}$$

Note:

- $\langle g \rangle$ = normalized gain score
- $\langle S_m \rangle$ = Students' maximum score
- $\langle S_f \rangle$ = post-test score
- $\langle S_i \rangle$ = pre-test score

with the gain score category:

- $[g] < 0,3$: Low
- $0,3 \leq [g] < 0,7$: Medium
- $[g] \geq 0,7$: High

Results And Discussion:-

Data obtained in the trial phase in the field included data on learning achievement starting from pre test to determine the similarity of initial abilities. After the pre test, the learning was carried out based on the syllabus and lesson plans. The number of meetings was 3 times face to face meetings or in 8 lesson hours. After the learning, it ended with post test. The pretest and posttest values were then calculated for the increase in learning achievement to determine the effectiveness of science learning module based on guided discovery learning. The formula used was the normalized N-gain formula. Description of learning achievement data using modules based on guided discovery learning obtained from the pre test and post test values are presented in Table 1.

Table 1:-Learning achievement score after N-gain analysis

Gain Score	Criteria	Percentage of Student Number (%)		
		1 st Learning Activity	2 nd Learning Activity	3 rd Learning Activity
$[g] < 0,3$	Low	-	-	-
$0,3 \leq [g] < 0,7$	Medium	43	37	20
$[g] \geq 0,7$	High	57	63	80

Based on the results of the N-gain analysis, the average of learning achievement in learning activities 1 for 35 students increased by 0.70 where 43% students referred into the medium criteria and 57% students were in the high criteria. In learning activities 2, the average of learning achievement increased by 0.72 where 37% students were in the medium criteria and 63% students were in the high criteria. Meanwhile in learning activities 3, the average of learning achievement increased by 0.80 where 20% students were in the medium criteria and 80% students were in the high criteria. According to the criteria of Hake (1998) that the increase in learning achievement in the form of pretest and posttest based on the results of N-gain analysis which is in learning activities 1, 2 and 3 is $[g] \geq 0.7$ in the "high" category. This reveals that the use of science module based on guided discovery learning can effectively improve the learning achievement of junior high school students.

Modules based on guided discovery learning effectively improve students' learning achievement because modules based on guided discovery learning are arranged systematically based on aspects of objectives, material, activities and evaluation questions. According to Shulman and Keisler (in Mayer et al. 2004), guided discovery learning is generally more effective than pure discovery. Some students do not learn rules or principles with pure discovery. This is consistent with the research of Lie and Osman (2012) which shows that students given modules have a high post test value compared to students who do not use the module in learning.

Learning by using guided discovery model gives students the opportunity to experience directly in finding knowledge independently. The knowledge gained independently strengthens the students' knowledge. This has a big influence on the students' achievement. This is in line with the opinion of Purwatiningsi (2013), which states that guided discovery model learning provides better learning achievement, because students get their knowledge directly. The knowledge obtained directly will settle in his mind. Patel (2014) also stated that guided discovery learning will increase the students' motivation to create many achievements. Matthew (2013) stated that the results of students who were taught by using guided discovery learning were better and significant than students who used conventional learning.

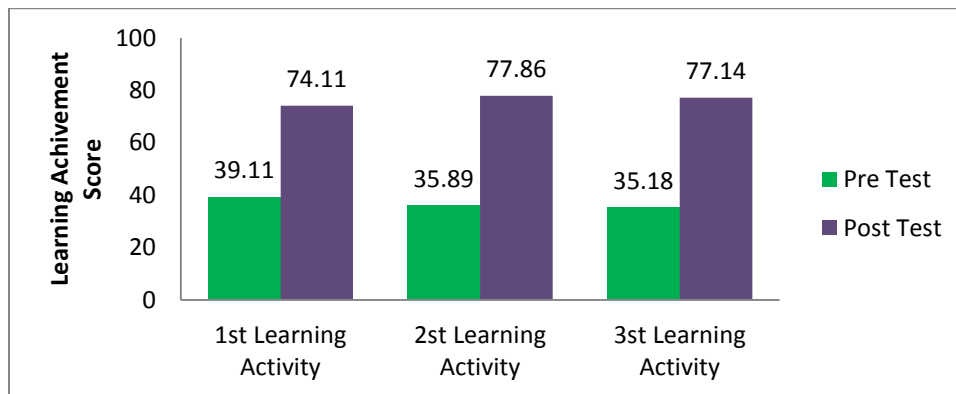


Figure 1:-Diagram of learning achievement increase

Based on diagram 1 that the learning achievement where the pre test in learning activities 1 on water pollution material with an average value of 39.11 increased at the post test with an average value of 74.11. The results of the pre test learning in learning activities 2 on air pollution material with an average value of 35.89 increased at the post test with an average value of 77.86. While the pre test in the learning activities 3 on soil contamination material with an average value of 35.18 increased at the post test with an average value of 77.14. Therefore, learning using modules based on guided discovery learning has a good impact on students' learning achievement. This can be seen from the value of the average students' learning achievement at the post test which was higher than the value of the pre test.

Learning achievement changes in behavior as a whole, not just one aspect of human potential (Suprijono, 2009). According to Purwanto (2013), learning, in essence, are changed in behavior due to learning. Behavior change is caused because he achieves mastery over a number of materials given in the teaching and learning process. The achievement is based on predetermined teaching goals. This is in accordance with Sudjana's theory (2013) argues that each teaching and learning process is measured by how far the learning achievement achieved by students, besides being measured in terms of the process. The increase in learning achievement is caused by the guided

discovery learning module containing observational activities that guide students to analyze, identify problems and patterns of interaction that are generated, describe problems, use data, evaluate answers, solve problems based on facts found so as to obtain conceptual understanding. The results of this study indicate that learning using modules based on guided discovery learning is effective in improving students' learning achievement.

According to Akinyemi & Folashade (2010), the application of guided discovery learning afterward will guide students in finding concepts independently, thus students can develop positive attitudes in learning and can improve learning achievement with thinking activities and with teacher guidance. Through Guided gradually it will give students experience afterward to carry out activities based on guided discovery learning syntax. Knowledge gained through this method is very personal and effective because it strengthens understanding, memory, and transfer (Teacher's book, 2013). This is supported by the research of Balim (2009) the results that there are significant differences that support the experimental group compared to the conventional group by obtaining results at a better cognitive level. In connection with the cognitive level of students, guided discovery learning is a cognitive learning method that requires the teacher to be more creative in creating situations that can make active learning learners find their own knowledge.

Bruner (1996) suggests that students learn through their active involvement with concepts and principles that can add experience and lead to experimental activities. This is supported by the research of Russell and Straits (2001) which shows that the results of discovery learning can improve students' learning achievement, raise the level of higher thinking skills which lead to better understanding of students' material. In line with Janine Swaak (2004) which says that discovery learning produces substantial benefits.

Conclusion:-

The implementation of science modules based on guided discovery learning on environmental pollution material based on N-gain analysis revealed that the average score of learning achievement in learning activities 1 is 0.70, 0.72 in learning activities 2, and 0.80 in learning activities 3. learning activities 1, 2 and 3 are in the range of $[g] \geq 0.7$ included in the high criteria. The average score of students' learning achievement after using the module is higher than the average score of students before using the module. The highest score of students' learning achievement is the result of the posttest score in learning activities 2 with an average value of 77.86. This means that the use of science modules based on guided discovery learning on environmental pollution material effectively improves the learning achievement of junior high school students.

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