EDUMASPUL
JURNAL PENDIDIKAN
Vol. 6 – No. 2, year (2022), page 2616-2622
| ISSN 2548-8201 (Print) | 2580-0469) (Online) |

The Effect of Inquiry Training Instructional Models Using Phet Media and Motivation toward Students Science Process Skill Junior High School Labuhan Deli Satu Atap Academic in 2022/2023

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Receive: 17/08/2022	***Accepted: 17/09/2022***	***Published: 01/10/2022***

Abstrak

Penelitian ini bertujuan : (1) untuk mengetahui perbedaan keterampilan proses sains siswa dengan penerapan model pembelajaran *Inquiry Training* menggunakan *media PhET* dengan pembelajaran konvensional, (2) untuk mengetahui perbedaan keterampilan proses sains siswa yang memiliki motivasi tinggi dan motivasi yang rendah, (3) untuk mengetahui interaksi antara model pembelajaran *inquiry training* menggunakan media PhET dan model pembelajaran konvensional dengan tingkat motivasi dalam mempengaruhi keterampilan proses sains siswa. Sampel diambil dengan menggunakan *cluster random class* dimana setiap kelas memiliki kesempatan yang sama untuk menjadi sampel penelitian. Pada kelas pertama diterapkan model pembelajaran *inquiry training* dan kelas kedua sebagai kelas kontrol diterapkan model pembelajaran konvensional. Variabel dalam penelitian ini yaitu : (1) variabel bebas yaitu model pembelajaran *inquiry training*, (2) variabel moderator yaitu motivasi siswa dan (3) variabel terikat yaitu keterampilan proses sains siswa. Instrumen yang digunakan dalam penelitian ini adalah instrumen untuk mengetahui motivasi siswa yang terdiri dari 25 pertanyaan dan instrumen keterampilan proses sains yang terdiri dari 10 pertanyaan.yang dinyatakan valid dan reliabel. Hasil penelitian menunjukkan bahwa : (1) keterampilan proses sains siswa yang diberikan model pembelajaran *inquiry training* lebih baik dibandingkan model pembelajaran konvensional; (2) keterampilan proses sains siswa yang memiliki motivasi tinggi lebih baik dibandingkan siswa yang memiliki motivasi rendah; (3) terdapat interaksi antara model pembelajaran *inquiry training* dan motivasi terhadap keterampilan proses sains siswa.

***Kata Kunci**: Inquiry Training, Motivasi, Keterampilan Proses Sains*

Abstract

This research aims : (1) to determine differences in students' science process skills who applied inquiry training instructional models using PhET media better than conventional models, (2) to determine differences between students science process skills who have high motivation better than students who have low motivation, (3) to determine the interaction between inquiry training instructional models using PhET media and conventional instructional models with a level of motivation in influencing students science process skill. The sample was taken using a cluster random class in which each class has an equal opportunity to be a sample. The first class applied inquiry training instructional models and the second class as a class of control applied conventional instructional models. The variables in this study are: (1) The independent variable is the inquiry training instructional models, (2) a moderator variable is the motivation of students, and (3) The dependent variable is the students' science process skills. The instrument used in this study is an instrument to know the motivation of students consisting of 25 questions and an instrument science process skills that consists of 10 questions that are declared valid and reliable. Results of the research showed that: (1) The students' science process skills who gave inquiry training instructional model is better than the conventional instructional model; (2) the science process skills of students who have high motivation were better than students who have low motivation; (3) there is the interaction between the learning model inquiry training and motivation toward science process skills of students.

Keywords: Inquiry Training, Motivation, Science Process Skills

Introduction

Education is one of the basic human needs and cannot be separated from everyday life. Education is something that has a very important role to improve and produce quality human resources. Education is not just obtained in a short time but requires a learning process to produce results that are under the process being passed, therefore education should be managed properly both in quality and quantity. According to Nana

Syaodih Sukmadinata in Toenas, (2012: 258) that education functions to assist students in developing all their potential skills and personal characteristics in a positive direction both for themselves and for their environment. A well-planned and well-planned learning process will facilitate and help students to develop the potential that exists in students so that the goals of learning can be achieved. One form of effort to improve the quality of education is to carry out learning process activities in schools because schools as formal educational institutions systematically plan an educational environment to carry out various learning activities.

Science (Science) education is one aspect of education that is used as a tool to achieve educational goals. Science education does not only consist of facts, concepts, and theories that can be memorized but also consists of active activities or processes of using scientific minds and attitudes in studying natural phenomena that have not been explained thus, the demand to continuously update scientific knowledge becomes a must. Science is a product because it consists of a collection of knowledge in the form of facts, concepts, principles, and laws about natural phenomena. Science as a process, because it is a series of structured and systematic activities carried out to discover concepts, principles and laws about natural phenomena including the ability to think to compile and discover new concepts. Science education, especially physics as part of education in general, has a role in improving the quality of education, especially in producing quality Indonesian people.

An important target of modern education, especially physics education, is to educate individuals to be able to overcome the problems found in everyday life. A good education does not only prepare students for a profession, but it is far more important to prepare the ability to solve the problems they face. Physics as a part of science is included in the curriculum in Indonesia from elementary to secondary levels. Physics learning aims to master the knowledge, concepts and principles of physics, and have scientific knowledge, skills and attitudes. Physics as a constituent of science is a vehicle or means to train students to be able to master the knowledge, concepts and principles of physics and have motivation towards science process skills. The teacher as one of the executors of education in schools is very necessary, it is not uncommon to find teachers who lack enthusiasm in carrying out their duties, which results in less success in the goals to be achieved. This is caused by various factors. One of them is the teacher's lack of work motivation (Hamzah B. Uno, 2006:63). Motivation according to understandingCognitivism is a factor that comes from human beings related to choices, decisions, interests, and goals related to the advantages and disadvantages that will be experienced by individuals. Motivation according to the perspective of cognitivism is intrinsic and is very closely related to the individual's ability to solve the problems they face which involve understanding and understanding of problematic issues. (Martini Jamaris, 2013:171). Motivation is an energy within humans that encourages them to carry out certain activities with specific goals, motivation is anything that can motivate students or individuals to learn. Without learning motivation, a student will not learn and ultimately will not achieve success in learning. Teachers must be able to motivate students, to improve learning outcomes and will make a good contribution. Giving high motivation to children compared to giving low motivation to children must greatly affect student learning outcomes. Whereas (Hamzah B. Uno, 2006: 3) states that "Motivation can be interpreted as an urge contained in a person to carry out certain activities to achieve certain goals. High motivation will make learning more enthusiastic, appearance, meaning and perseverance. The spirit of competence must always be grown in students so that an obsession arises to be good.

The process skills approach in science learning assumes that science is formed and develops through a scientific process which must also be developed in students as a meaningful experience that can be used as a provision for further self-development (Memes, 2009: 1-5). The process skills approach emphasizes how students learn and manage their acquisition, so it is easy to understand. By developing skills in the acquisition process, children will be able to find and develop their motivations and the values demanded. These skills become cogs for discovering and developing attitudes and values. Sabella, et al. (2007: 44) state that one of the causes of weak mastery of physics is because students only learn surface patterns, further Kristianingsi, et al (2010: 44) state that as a result of the teacher during the lesson gives more lectures or delivers products only, the students are less trained to develop their thinking power in developing the application of concepts that have been learned in real life. Having a scientific attitude as an affective component, scientific knowledge/insight as a cognitive component and

science process skills as a psychomotor component. District, (2007: 44) defines process skills as ways that people take to gain knowledge about this nature including processes including planning, compiling models, drawing conclusions and others. then students are less trained to develop their thinking power in developing the application of concepts that have been learned in real life. Having a scientific attitude as an affective component, scientific knowledge/insight as a cognitive component and science process skills as a psychomotor component. District, (2007: 44) defines process skills as ways that people take to gain knowledge about this nature including processes including planning, compiling models, drawing conclusions and others. then students are less trained to develop their thinking power in developing the application of concepts that have been learned in real life. Having a scientific attitude as an affective component, scientific knowledge/insight as a cognitive component and science process skills as a psychomotor component. District, (2007: 44) defines process skills as ways that people take to gain knowledge about this nature including processes including planning, compiling models, drawing conclusions and others.

In essence, science process skills have eight aspects, namely observing, classifying, measuring, interpreting, predicting, implementing, planning, researching and communicating.

Based on the results of a preliminary study that was conducted at SMP Negeri 3 Labuhan Deli One Roof through a questionnaire on July 18 2015, there were several factors regarding the low student learning outcomes, the first being the low interest in student learning in science. This is evidenced by the initial test data for 60 students to enter 2022/2023. The second factor is the absence of media that supports learning, as evidenced by the incomplete handbooks owned by students and other media, such as PhET media, they are not familiar with, so students only receive the material. entirely from the teacher and when teaching and learning activities take place, this occurs due to the low economic condition of students. The third factor is that only a small number understand the concept. Most students are unable to relate what they learn to how that knowledge will be used or utilized. This can also be seen in the students who are only able to work on practice questions that are following the example questions. Students working on practice questions only copy from example questions whose questions are similar in the form indicating that students have problems understanding concepts so they are unable to solve practice questions according to the concept. However, if the questions are changed, for example by changing what is known to what is being asked, they will be confused as if the problem has never been discussed. The fourth factor has not paid attention to the aspects of students' science process skills; there has never been physics learning that pays attention to students' science process skills. The physics practicum that has been carried out so far has not paid attention to aspects of science process skills, this problem is also caused by students not being able to do experiments in the laboratory as evidenced by the incompleteness of the equipment in the laboratory so that students are less able to observe phenomena that occur during practicum, less able to communicate with one's friends groups, less serious, unable to make correct conclusions and tend to ask the teacher every time they are going to experiment. The fact that students at SMP Negeri 3 Labuhan Deli One Roof conclude that they still do not have good science process skills. This problem is also caused by students not optimally conducting experiments in the laboratory as evidenced by the incomplete equipment in the laboratory so students are less able to observe phenomena that occur during practicum, less able to communicate with group mates, less serious, unable to make correct conclusions and tend to ask questions Each teacher will experiment. The fact that students at SMP Negeri 3 Labuhan Deli One Roof conclude that they still do not have good science process skills. This problem is also caused by students not optimally conducting experiments in the laboratory as evidenced by the incomplete equipment in the laboratory so students are less able to observe phenomena that occur during practicum, less able to communicate with group mates, less serious, unable to make correct conclusions and tend to ask questions Each teacher will experiment. The fact that students at SMP Negeri 3 Labuhan Deli One Roof conclude that they still do not have good science process skills.

The assessment of physics learning has not paid attention to the motivational ability of students' science process skills. This was proven after consulting with Mr. Muhammad Idris a science teacher at SMP Negeri 3 Labuhan Deli One Roof. The assessment carried out so far is still on the cognitive element. The value listed in the report card still comes from the element of students' knowledge of science material. Student motivation should also receive an assessment.

One model that is suitable for learning physics is where students are allowed to discover directly, increase their understanding of science, increase productivity in learning and think creatively which creates a stimulus in students with great curiosity and allows these students to be able to find material on their own. what he must understand is the inquiry training model. The inquiry training learning model is designed to help students develop discipline and develop the intellectual skills needed to ask questions and find answers based on curiosity (Joyce, 2009: 188). The Inquiry Training Model has a direct impact on increasing students' motivational abilities and science process skills so it is very appropriate to be applied in science learning. The inquiry training model is a learning model that trains students to learn from facts to theory. This learning model has the following steps: (1) Conformation with the problem in this case the teacher explains the inquiry procedure and presents odd events to students (2) data collection and verification, namely testing the nature of objects and conditions (3) data collection-experiment, that is, students carry out experiments, isolate relevant variables, test hypotheses with causal relationships (4) organize and formulate explanations, after conducting experiments and obtaining data,

Based on the description above, states that students' science process skills are still low. In improving science process skills, an inquiry learning model is needed. Based on Bruce & Weil in M. Hosman, (2014: 346) explains that the inquiry learning model is to assist students in developing discipline, intellectual students, who need to search for data, process data, and use logical thinking about the data. Besides that, it states that inquiry exercises can develop scientific knowledge, and produce creative skill abilities, and skills in obtaining and analyzing data.

In addition, at Labuhan Deli One Roof Public Middle School 3, the learning process at the elementary level is currently not showing good quality. Most of the physics learning process applied in schools only emphasizes the process of memorizing concepts, principles, or formulas. The process of learning physics so far has not optimally provided opportunities for students to be actively involved in the process of the scientific method of physics and has not been oriented towards cultivating students' scientific attitudes. Physics learning is still teacher-centered and has not shifted to a student-centered learning orientation. This results in learning only focusing on memorizing concepts, so students find it difficult to understand physics concepts.

In this study, the authors intend to apply the Inquiry training learning model by using PhET Simulation Media which comes from the plural form of medium which comes from Latin and means intermediary or conductor. Because in activities the presence of the media has a significant meaning in efforts to increase student motivation. Simulation is similar to practice but not in actual reality, but rather as if it describes the actual situation in a limited sense. (Hamalik in Arsyad, 2008: 15) suggests that the use of media in learning can generate new desires and interests, generate motivation and stimulate learning activities and even bring psychological influences on students. The reason the authors chose the Inquiry training model is because this model has the characteristics of focusing more on observational learning, measurement, curriculum experiments, and mental processes (inductive reasoning, formulating hypotheses, deductive reasoning, activities, exploration, synthesis and evaluation). Besides that, the inquiry training learning model also has several stages, namely: (1). Involve students directly in a problem, (2). Students collect information to verify problems (3). Students carry out investigations to explore concepts and directly test the hypotheses they have made (4). Students organize and formulate the data they have obtained during the investigation process into an explanation (5). Students analyze the problem-solving strategies that have been done and develop them to be more effective. According to several studies showing the use of the inquiry training learning model can improve learning outcomes cognitively, psychomotor and affective. (2014: 5) said that the inquiry learning model can increase student motivation and understanding of students' physics concepts, Sukarman, et al. (2013: 154) said that inquiry learning can improve students' cognitive learning outcomes and student achievement motivation, followed by Tella (2007: 154) states that students who have high and low motivation will also have different learning achievements. Motivated students tend to have better learning achievements.

Method

This research will be carried out from October to November 2022 in Semester I Class VIII of SMP Negeri 3 Labuhan Deli One Roof for the 2022/2023 Academic Year. The research time interval will start with a preliminary survey, preparation of research proposals, instrument

trials, data collection, data analysis, and finally writing a research report.

This type of research is quasi-experimental (quasi-experimental), which aims to see the effect of the independent variable on the dependent variable and to find out whether there is an effect or something imposed on the student subject.

The research design used is a design that uses a pretest and posttest. This design is the most effective in terms of showing causal relationships. This research involved two classes, namely the control class and the experimental class which was given different treatments. The experimental class was treated with the Inquiry Training learning model using FhET media, and the control class was given the conventional learning treatment.

Results and Discussion

There are differences in student physics KPS results with IT and DI learning models

Learning model *inquiry training* brings students directly into scientific activities through exercises that involve scientific processes within a certain time. this model has resulted in an increased understanding of knowledge, more creative thinking, and acquired skills to acquire and analyze information, construct concepts, and then produce tests and explanations or theories. Students will be actively involved in exploration, asking questions, solving problems, inductive reasoning, symbolizing, and engaging in discovery.

Learning model *inquiry training is* designed to bring students directly into the scientific process through exercises that can condense the scientific process into a short period. The effect is that of the learning model *inquiry training* will increase scientific understanding, productivity in creative thinking, and skills in acquiring and analyzing information, but the exercise is as efficient as the repetition and teaching method coupled with laboratory experiences.

Learning model *inquiry training* is an effort to develop independent learners, the method requires students' active participation in scientific research. Students have curiosity and a great desire to grow and develop. Learning model *inquiry training* capitalizes on the exploration of students' natural passions, giving students specific directions so that students can explore new fields effectively.

Learning model *inquiry training* is a way of learning in which students are asked to solve problems, plan experiments, conduct experiments, collect and analyze data, and draw conclusions. In i*nquiry training*, students are invited to discover physics concepts from experiences or events experienced by students in their daily lives. From studying these events, physics concepts are developed in students' minds. Students do not need to memorize a lot of formulas to answer problems or problems they face, but it is enough with simple concepts that are built into inquiry activities so that they can solve these problems.

Learning model *inquiry training* designed to be able to improve students' KPS. The procedure is designed to facilitate teacher and student efforts that are closely related to the elements of the subject matter and description of the material to produce independent students. Students can construct their knowledge based on 5 steps in inquiry, namely: (1) asking questions or problems, (2) formulating hypotheses, (3) collecting data, (4) analyzing data and (5) making conclusions.

Learning activities such as asking questions or problems, formulating hypotheses, collecting and analyzing data and concluding are carried out by students. In the learning process, there is openness between students and between students and teachers with a question-and-answer process going on. Students are active in conducting experiments such as investigating the characteristics of rectilinear motion. Students are presented with rectilinear motion problems and can identify the importance of paying attention to what measuring instruments are appropriate for measuring a measuring object, understand the characteristics of rectilinear motion, identify errors in conducting experiments and formulate temporary answers to the problems presented. The process of experimentation and data collection was carried out by students with enthusiasm,

The data obtained is analyzed by conducting a question and answer in groups, not infrequently students also ask the teacher about the results they conclude. Learning with models *inquiry training* invites students to actively seek their knowledge. Students are trained to discover physical phenomena from processes designed by the teacher. The teacher's role as a motivator is seen when the teacher invites students to identify and formulate problems. As a facilitator the teacher gives space to students to conduct experiments and collect data, the teacher gives space to students to do questions and answers and allows students to present the results of their discussions. In each experiment, students acquire skills in designing or designing and using experimental tools. A series of psychomotor activities is carried out by students with enthusiasm and the ability to build cognitive

structures in long-term memory. KPS results are also getting better.

The constructivist view of the most important principle in educational psychology is that teachers don't just impart knowledge to students, it is thought appropriate to corroborate the findings in this study. The teacher acts as a learning facilitator and designs learning where students do the learning.

There are learning theories that underlie the inquiry training learning model and one of them is the constructivism learning theory. There are two very important concepts in constructivism theory, namely Zone Proximal Development (ZPD) and Scaffolding. ZPD is the distance between the actual level of development which is defined as the ability to solve problems independently and the level of potential development where the ability to solve problems is under the guidance of adults or through collaboration with peers who have higher abilities. The teacher's role is to guide students in formulating problems and designing an experiment. Then do Scaffolding which is the provision of many assistance to students during the early stages of learning, then reducing assistance and allowing the student to take on increasing responsibilities once he or she can do so. The teacher makes observations of student activities such as data collection, data analysis, and concluding learning. The decision-making process is fully given to students, the teacher is only a motivator so that the enthusiasm of students in carrying out learning is maintained and becomes an inspiration so that creative ideas emerge in drawing student conclusions.

Unlike the case with models conventional method prioritizes the training process for students. Knowledge is taught by training students, and the tendency of students is required to memorize the knowledge given by the teacher. A series of activities carried out instructional without allowing students to seek their knowledge.

This series of instructional activities was conditioned on a silent class situation, without student activity, without question and answer activities and students only paid attention to the teacher's explanation. Passive student activity has an impact on the weak absorption of knowledge by students. The knowledge gained does not last long in students' memory, so students' KPS results are also low.

KPS results of students taught with the model *inquiry pieces of training* show good results. Students can answer the KPS test in all cognitive domains well. It is different when compared to the KPS results of students taught by conventional learning models who obtain lower KPS results.

So it can be concluded that there are differences in KPS results between students who are taught by the model *inquiry training* and conventional where KPS results of students taught by models *inquiry training are* better than the KPS results of students taught by conventional models. This conclusion is in line with the results of previous studies. Ulina Marito and Master Sihotang(2014) states that an increase in student activity, affective and psychomotor is offset by an increase in learning outcomes when using the inquiry training learning model. Likewise, relevant research conducted by Trisno, Yusuf Kendek and Marungkit Pasaribu (2012) result is there is a significant difference in learning outcomes between students who take the inquiry training learning model and students who take conventional learning. The same results were also stated in the research conducted by Retno Putri Sari (2014), that there was a significant increase by implementing the inquiry training model learning on increasing learning motivation and understanding of concepts.

In general, the difference that underlies the results of this study with previous research is that in this study PhET media was used and it was concluded that to apply the inquiry training learning model, teachers must consider the level of learning motivation possessed by students.

There are differences in KPS students who have high learning motivation and low learning motivation.

For students who have high learning motivation will havethe ability to capture meanings such as being able to understand or understand what is being taught, knowing what is being communicated, giving explanations or giving more detailed descriptions using your own words, being able to restate a concept, being able to classify an object and being able to express a material presented in a more understandable form.

At this stage, in presenting or describing mental abstractions, students do not rely on concrete operations. Students are faced with real situations where they have to experiment with objects by paying attention to the rules in the experimental stage. The probability of an error in the measurement results is limited to the accuracy of the instrument, with good learning motivation students will be more careful in reading the measurement results in their experiments.

Students can acquire logical, rational and abstract strategies. Those at this stage can consider various views simultaneously and view their actions objectively. Students with logical thinking can have the right opinion in discovering physical phenomena related to motion matter. Student work while doing student worksheets is also more focused. Students are also able to abstract experimental results in reading results with measurement uncertainty. So that it can be said that students with high learning motivation get good KPS.

In contrast, if students have low learning motivation, students tend to be monotonous in doing experiments. Students are not able to work independently, and dependence on instructions from the teacher makes students slow in doing their learning. The difficulty in abstracting student experimental results is because students find it difficult to use logic in discovering a physical phenomenon related to vibration and wave material. So that it can be said that students with low learning motivation get poor KPS.

So it can be concluded that there is a difference KPS between students who have high learning motivation and low learning motivation, where students who have high learning motivation get better KPS results than students who have low learning motivation.

Interaction Between Inquiry Training Learning Model and Learning Motivation Against Students' KPS

Students who have high learning motivation tend to have the ability to capture meanings such as being able to understand or understand what is being taught, knowing what is being communicated, giving explanations or giving more detailed descriptions using your own words, being able to restate a concept, being able to classify an object and being able to express a material presented in a more understandable form. Students who have high learning motivation are taught with an inquiry training model that is more appropriate for reducing learning outcomes that were previously contained in their knowledge. Students can coordinate with friends in their groups. Students can combine the use of measuring instruments used in motion experiments that support their learning, to obtain high KPS results. However, if given conventional learning it will have a negative effect. Students tend to be passive, and unable to coordinate their learning.

Whereas students who have low learning motivation are less able to interact when taught with the inquiry training model. The inquiry training model seeks to be able to construct one's experience of the world of objects by looking at it through a logical framework that transforms, organizes and interprets the experience. Students who have low learning motivation will experience many obstacles so if given the inquiry training model it will be inappropriate and harm students' KPS results. Thus students who have low learning motivation will be better if taught conventionally.

So it can be concluded that the learning model *inquiry training* and learning motivation affects students' KPS results, but it is different from the conventional learning model where learning motivation does not play a role in influencing students' KPS results.

Conclusion

Based on the results of the research and discussion, several conclusions can be obtained as follows:

1. There are differences in student learning outcomes that are taught with the inquiry training learning model and conventional learning models. The learning outcomes of students who are taught with the inquiry training learning model are better than the learning outcomes of students who are taught with conventional learning models.
2. There are differences in the learning outcomes of students who have a high level of motivation and a low level of motivation. The learning outcomes of students who have a high level of motivation are better than the learning outcomes of students who have a low level of motivation.
3. There is an interaction between the inquiry training learning model and motivation on students' science process skills where what is taught by the inquiry training model is also influenced by the level of motivation, while what is taught by the conventional model is not influenced by the level of motivation.

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