ANALYSIS OF STUDENT'S MISCONCEPTIONS ON PARABOLIC MOTION MATERIAL AND STRAIGHT MOTION USING FIVE TIER MULTIPLE CHOICE AT BUNGO DISTRICT

THESIS

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By

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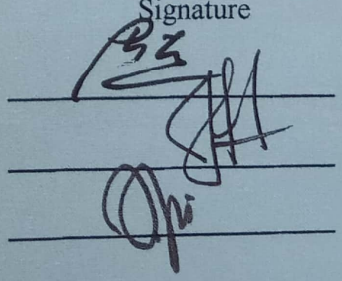

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STATEMENT LETTER

I Hereby declare:

1. My paper, the final project in the form of a thesis entitled " Analysis of Student's Misconceptions on Parabolic Motion Using Five Tier Multiple Choice at Bungo District" , is my own work.
2. This paper is purely my own ideas, formulations and research, without the help of other parties, except from the supervisor.
3. In writing this paper, there are no works or opinions that have been written of published by others, unless clearly stated in writing in the literature.
4. I make this statement in fact and if there re any deviations in this statement, I am willing to accept academic sanctions in the form of revovcation of the degree. I have obtained because of this writing, as well as other sanctions in accordance with applicable norms and regulation.

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ABSTRAK

Witya Kusuma, 2024: Analisis Miskonsepsi Pesrta Didik pada Materi Gerak Lurus dan Gerak Parabola Menggunakan *Five-Tier Multiple Choice* di SMA Kabupaten Bungo

Siswa seringkali mengalami miskonsepsi ketika mempelajari fisika, tidak terkecuali pada materi gerak lurus dan gerak parabola. Miskonsepsi ini dapat diidentifikasi dengan menggunakan tes diagnostik, tetapi tes diagnostik belum tersedia di sekolah. Untuk menyelesaikan masalah ini, diperlukan sebuah instrumen tes yang dapat mengidentifikasi miskonsepsi siswa pada materi gerak lurus dan gerak parabola.Penelitian ini bertujuan untuk menganalisis miskonsepsi peserta didik pada materi gerak lurus dan gerak parabola. Instrumen yang digunakan dalam mengidentifikasi miskonsepsi dan penyebabnya adalah *Five-Tier Multiple Choice* yang terdiri dari 17 butir soal pilihan ganda enam tingkat pada materi gerak lurus dan 18 butir soal pilihan ganda enam tingkat pada materi gerak parabola.

Jenis penelitian yang digunakan adalah penelitian deskriptif dengan pendekatan kuantitatif.Populasi dalam penelitian ini adalah siswa kelas XI MIPA SMA Negeri di Kabupaten Bungo. Sampel dalam penelitian ini adalah lima sekolah di Kabupaten Bungo dengan jumlah responden yaitu 127 peserta didik.

Secara keseluruhan, hasil penelitian di SMA Kabupaten Bungo didapatkan miskonsepsi tergolong rendah pada materi gerak lurus sebesar 22,93% dan miskonsepsi tergolong sedang pada materi gerak parabola sebesar 39,15%. Miskonsepsi tertinggi pada materi gerak lurus yaitu terdapat di SMA E yaitu 35,29% dan paling rendah terdapat pada SMA A yaitu 15,03%. Pada materi gerak parabola miskonsepsi tertinggi terjadi di SMA C yaitu 60,05% dan miskonsepsi paling rendah terjadi di SMA B 28,93%.

Kata Kunci: *Five-tier multiple choice*, Miskonsepsi.

ABSTRACT

Witya Kusuma, 2024 : Analysis of Student Misconceptions on Material Using Straight Motion and Parabolic Motion Five-Tier Multiple Choice at Bungo District High School

Students often experience misconceptions when studying physics, including rectilinear motion and parabolic motion. These misconceptions can be identified using diagnostic tests, but diagnostic tests are not yet available in schools. To solve this problem, a test instrument is needed that can identify students' misconceptions in the material about straight motion and parabolic motion. This research aims to analyze students' misconceptions in the material about straight motion and parabolic motion. The instruments used to identify misconceptions and their causes are Five-Tier Multiple Choice which consists of 17 five-level multiple choice questions on rectilinear motion material and 18 five-level multiple choice questions on parabolic motion material.

The type of research used is descriptive research with a quantitative approach.The population in this research is class XI MIPA SMA Negeri students in Bungo Regency. The samples in this study were five schools in Bungo Regency with a total of 127 students as respondents.

Overall, the results of the research at Bungo Regency High School showed that misconceptions were relatively low in the rectilinear motion material at 22.93% and moderate misconceptions in the parabolic motion material were 39.15%. The highest misconception in straight motion material is found in SMAE, namely 35.29% and the lowest is in SMA A, namely 15.03%. In the parabolic motion material, the highest misconception occurred in SMA C, namely 60.05%, and the lowest misconception occurred in SMA B, 28.93%.

Keywords: Five-tier multiple choice, Misconceptions.

FOREWORD

Thank you for the presence of Allah SWT who has given His mercy and grace which is always poured out on all His servants. Shalawat and greetings are sent to the role model of the Islamic community, namely the Prophet Muhammad SAW. Alhamdulillah, with His blessings and guidance, the author has been able to complete the thesis entitled **"Analysis of Student Misconceptions on Material Using Straight Motion and Parabolic Motion *F*ive-*Tier MultipleChoice* at Bungo District High School".**

In completing the writing of this thesis, the author realized that this thesis could not be completed without the support, guidance, motivation and facilities that have been provided. Therefore, with all humility the author would like to express his sincere thanks to:

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May all the guidance, assistance and attention that has been given to the author become good deeds and be rewarded with double rewards by Allah SWT. The author realizes that this thesis has shortcomings and weaknesses. On this basis the author hopes for suggestions in improving this thesis. Hopefully this thesis is useful for all readers.

Padang, 1 March 2024

Writer

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CHAPTHER I

INTRODUCTION

A. Background of the Problem

Physics is a science that studies natural phenomena and the symptoms that occur around them through a series of scientific processes and the results are recognized as scientific products consisting of concepts, principles and theories. Physics is very synonymous with natural phenomena, so when studying physics you must be able to understand the ideas of physical material. Each concept cannot stand alone, but there is a relationship between one concept and other concepts. Physics is important to teach and apply in schools because it provides students with knowledge and provides a platform for the growth of scientific work abilities/skills in order to solve problems that exist in everyday life (Giancoli, 2001).

Physics learning can develop students' thinking abilities to solve everyday problems (Hamalik, 2006). Therefore, learning physics is learning about everyday natural phenomena and symptoms which can be studied through activities based on a scientific attitude, such as experiencing, observing and experimenting, in order to improve competence in the science process. In learning, students can use existing concepts to deal with new phenomena with small changes (adjustments) or even students have to replace and change the main concepts

which they already have because they do not match the new problems (Suparno, 2013). However, in general students have little ability to connect concepts learned from books and their environment (Taufiq, 2012). Physics subjects can be categorized as subjects that are less liked by students. Students consider physics to be a difficult subject during school and even more difficult when they reach college (Guido, 2018). So there are many misconceptions among students.

According to (Mosik & Maulana, 2010) before studying physics, students do not come to class with an empty head. Students' cognitive structures have been formed as preconceptions about events and understanding of physics concepts. The result of mixing these concepts creates interpretations wrong (Tayubi, 2018). Apart from that, as technology develops, students also gain an understanding of concepts by accessing the internet via their smartphones. Students also gain understanding of a concept through learning in the classroom. Students are expected to build a concept after learning by formulating the principles they obtain from learning with their initial assumptions. After that, students will summarize these concepts into an understanding. Students' interpretation of a concept that is different from that of physical scientists is called a misconception (Fajriyyah et al., 2020). Misconceptions occur in various scientific fields, one of which is physics. There are many misconception what students experience in studying physics is because a lot of the material is abstract so students find it difficult to understand the correct concepts. Misconceptions are errors in understanding the concepts of learning material which can cause a mismatch

between the concepts a person has and scientific concepts or concepts held by scientists (Artiawati et al., 2016).

Students' incorrect understanding of concepts has a big influence on learning. Misconceptions will consistently affect the effectiveness of students' future learning processes (Tri Wahyuningsih, 2012). The impact that misconceptions have on students will hinder the learning process (Hermita, 2017), because students will be more confident in the concepts they have and reject the concepts of experts.

Misconceptions will result in low student learning outcomes if they are not followed up properly. The influence of these misconceptions has often been stated in various studies in Indonesia. Among them, Mosik & Maulana, (2010) in their research which used a cognitive conflict approach to reduce student misconceptions at SMP 1 Semarang found that student learning outcomes increased after student misconceptions were successfully minimized. From the results of these two studies, it can be seen that there is an influence of misconceptions on learning outcomes.

Miskonsepsi dapat menghambat kemajuan pembelajaran (Mufit et al., 2019). Hal ini dalam pembelajaran fisika memiliki dampak atau pengaruh yang sangat besarterhadap peserta didik. Kesalahpahaman pembelajaran fisika oleh peserta didik akan mempengaruhi pembelajaran fisika selanjutnya (Mufit et al., 2019). Pada mata pelajaran fisika sangat banyak miskonsepsi yang terjadi, salah satunya adalah materi gerak lurus (Yolanda, 2017). Gerak lurus adalah materi pembelajaran fisika yang mengamati gejala alam yang berkaitan dengan

pergerakan suatu benda yang membentuk lintasan lurus.Pemahaman konsep yang tepat sangat dibutuhkan dalam membangun pengetahuan peserta didik secara terstruktur untuk me mecahkan beragam fenomena yang terjadi pada materi gerak lurus.

In rectilinear motion material, students find it difficult to identify the magnitudes of velocity, acceleration, distance and displacement (Tarisalia et al., 2020). (Rohmahet al., 2018) explains that students' misconceptions about straight motion material include 44% on free fall motion, 21% on the concept of speed and acceleration, 32% on vertical upward motion, 5% on the concept of distance and displacement, 32% on the concept of speed. , 16% on GLB, and 39% on the GLBB concept. Apart from misconceptions by the students themselves, in physics learning there are also misconceptions caused by educators.

The causes of misconceptions can come from students or others. The causes of misconceptions from students include incorrect initial concepts of students, associative thinking of students, humanistic thinking, incomplete/incorrect reasoning of students, wrong intuition, stages of cognitive development of students, can also be caused by other things, namely: teachers /teacher, textbook, and context. The causes of errors from teachers are lack of mastery of the material, inappropriate teaching methods or the teacher's attitude in relating to students is not good (Suparno, 2013). Reason Misconceptions from textbooks are usually found in incorrect explanations or descriptions in the book. Context, such as culture, religion and everyday language also influences students'

misconceptions. Meanwhile, teaching methods that only emphasize one aspect of truth often give rise to problems of understanding in students.

A number of misconceptions are very difficult to change, even though attempts have been made to refute them with logical reasoning by showing differences with actual observations, obtained from demonstrations and experiments specifically designed for that purpose (Suwarto, 2013). It should be noted that misconceptions can hinder students in the process of receiving new knowledge (Van den Berg, 1991). If a material that students study requires mastery of other material as a prerequisite, then students must master the material as a prerequisite before students proceed to the next material (Suwarto, 2013). Although misconceptions are difficult to correct, if they can be detected early, preventive action can be taken as soon as possible (Van den Berg, 1991). So, if misconceptions can be identified, efforts can be made to overcome these misconceptions, so that the misconceptions that occur will not continue to the next level of education or so that the misconceptions that occur will not be repeated in the next period.

According to (Suparno, 2013) in general the steps used to help overcome misconceptions are: 1) finding misconceptions held by students 2) trying to find the cause of their occurrence student misconceptions 3) look for appropriate treatment solutions to overcome them. Several tools are provided to resolve misconceptions that are incorrect or unsuccessful because educators cannot know the exact cause of the misconception, so the method used is not appropriate. Misconceptions and causes of misconceptions experienced by students can be

identified through diagnostic tests. Diagnostic tests are used to find out whether the student experiences misconceptions or not and also the reasons for the student's failure in the learning process (Suwarto, 2013).

Diagnostic tests are tests that can be used to find out precisely and ascertain students' weaknesses and strengths in certain lessons (Zaleha et al., 2017). In teaching and learning activities, there needs to be a test that can diagnose student success after going through a learning process. The word diagnostic is widely used in the world of medicine, psychology and education. Rupp (2018) in (Zaleha et al., 2017) states that diagnostics means an effort to find out precisely (to know precisely), to decide (to decide), and for consensus (to agree upon). Rajeswari (2004) in (Zaleha et al., 2017) states that diagnostic tests are tests used to diagnose the weaknesses and strengths of students in certain subjects. Zhao (2013) in (Zaleha et al., 2017) stated that the main diagnostic test is to find out the strengths and weaknesses of students and give input to teachers and students to make decisions related to improving the teaching and learning process.

Based on these three opinions, it can be concluded that the diagnostic test is a test that can be used to accurately know and ensure the weaknesses and strengths of students in certain subjects. For teachers, diagnostic tests are information that can be used to improve the learning process, while for students, they can be used to improve the learning process (Zalehaet al, 2017).

The Ministry of National Education (2008) defines diagnostic tests as tests that can be used to determine students' weaknesses and strengths. Therefore, the results of diagnostic tests can be used as a basis for providing further action in

the form of appropriate treatment and in accordance with the students' weaknesses..

Many diagnostic tests have been developed to analyze students' misconceptions more deeply. Diagnostic tests can be in the form of multiple choice questions or descriptions. A good diagnostic test can provide an accurate picture of the misconceptions experienced by students based on information about the errors they make. Good diagnostic questions not only show that students do not understand certain parts of the material, but can also show how students think in answering the questions given even though their answers are not correct (Fariyani & Rusilowati, 2015).

Misconceptions diagnostic tests themselves can be presented in various methods. A study examining scientific articles about diagnostic tests published between 1980-2014 in England revealed that of the 273 articles examined, 53% used the interview method, 34% open-answer tests, 32% multiple choice, 13% gradual multiple choice tests, and 9% with other methods (Gurel et al., 2015). Each method has its advantages and disadvantages, but Reynolds in (Caleon & Subramaniam, 2010) states that multiple choice tests have the advantages of being versatile, efficient, objective, easy to use, and less influenced by a person's tendency to answer multiple choice questions in a certain way. Multiple choice is easier to use than other methods, especially if you want to test it on a population. On the other hand, it is also explained that multiple choice has one main weakness, namely that it cannot differentiate the correct answer for the right reason or the wrong reason (Caleon & Subramaniam, 2010). As a result, a multi-stage choice

test was developed with the aim of compensating for the shortcomings of general multiple choice tests in diagnosing student misconceptions.

Multiple choice questions to detect student misconceptions have been developed from one-tier become two-tier, three-tier, four-tier and five tier. Diagnostic tests five-tier It consists of a question, the level of confidence in the answer, the reason, the level of confidence in the reason and one additional open-ended question. The addition of one question to the misconception diagnostic test can overcome the possibility of guessing made by students (Bayuni et al., 2018). One additional question can be in the form of a drawing test, drawing conclusions or other tests according to the needs of each question item (Anam et al., 2019). Through diagnostic tests five-tierThis will provide more data about students' conceptions in more depth (Fajriyyah et al., 2020).

In rectilinear motion material, instruments five-tier developed by Hidayatullah (2021) is used for the process of analyzing students' misconceptions. Meanwhile, the material is about parabolic motion of instruments five-tier developed by Tomi Putra Wijaya (2021) is used for the process of analyzing students' misconceptions. Use of instruments five-tier multiplechoice It is needed to detect misconceptions experienced by students as well as analyze students' understanding of rectilinear motion material and the causes of these misconceptions.

Based on the results of interviews using Google Form conducted at 5 schools in Muara Bungo, it was found that the level of students' understanding of the concepts of rectilinear motion and parabolic motion was still relatively low.

Based on the results of interviews via Google Form, teachers of physics subjects at SMA Negeri 16 Bungo and SMA Negeri 7 Bungo found that students had misconceptions about the material on rectilinear motion and parabolic motion, one of which was on the sub-material of distance and displacement. The results of interviews conducted via Google Form, physics subject teachers at SMA Negeri 1 Bungo also said the same thing, the misconceptions that occur among students regarding rectilinear motion material are very high. Students still think that distance and displacement are the same, even though in essence they are very different. Apart from that, teachers have never carried out an identification process for the misconceptions experienced by students. Based on the problems above, an appropriate identification process is needed to detect misconceptions experienced by students regarding rectilinear motion material. Therefore, in research. In this study, an analysis of students' misconceptions will be carried out on the material on rectilinear motion and parabolic motion at Bungo Regency High School.

B. Identify the Problem

In the background, the main problem was found, namely the occurrence of students' misconceptions about physics learning. The results of the analysis found a number of factors thought to be the cause of the problem, namely:

1. There is a misconception among students when learning about physics regarding straight motion and parabolic motion
2. An analysis of misconceptions about rectilinear motion and parabolic motion has never been carried out for students in Bungo Regency

C. Issue Limitation

Based on the results of problem identification, problem limitations were held, namely:

1. Analyzing student misconceptions at 5 schools in SMA Bungo Regency

D. Problem Formulation

Based on the research problem proposed, it can be formulated as follows:

1. What is the profile of students' misconceptions when studying physics regarding rectilinear motion and parabolic motion in Bungo Regency?

E. Research Objectives

Based on the problem formulation proposed, the objectives of this research are:

1. Analyze the profile of students' misconceptions when learning physics and material about rectilinear motion and parabolic motion in Bungo Regency

F. Research Benefits

It is hoped that the results of the research conducted by researchers will be useful for various parties, including:

1. For researchers, as a provision of knowledge and experience as prospective teachers as well as to complete educational studies in the physics department FMIPA UNP
2. For educators, as a tool to identify misconceptions and their causes, and it is hoped that they can develop new learning models that are able to reduce misconceptions.

3. For students, as information regarding misconceptions in rectilinear motion material.
4. Other researchers, as input for continuing and developing research in the future