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Preliminary Study: Profile of Students' Interpretation Skills on the Topic of Kinematics

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Abstract: A graph is a type of representation that is useful in summarizing data, and processing and interpreting new information from complex data. One of the reasons why it is important to understand graphical representation is because graphs can provide quantitative information that is easy to understand. Kinematics is the science of dealing with the movement of an object. Learning can not be separated from pictures and graphics. This study aims to see the initial ability of prospective physics teacher students in interpreting graphs. This mapping is useful for making policy plans for lecturers in planning future physics lessons. This type of research is descriptive research involving 79 respondents. Data collection is done by giving a graph interpretation ability test which consists of 3 indicators, namely graphs interpretation to mathematics, graphs interpretation to descriptions, and graph interpretation to images. From the results of data analysis using descriptive statistics, it was found that the student's ability to interpret graphs was in a low category. This gives information to lecturers that training and strengthening graphic interpretation skills still need to be a concern.

Keywords: Graphic Interpretation Ability; Kinematics; Preliminary Study

Introduction

Currently, we are in the era of globalization where science and technology are experiencing rapid development which is a feature of the 21st century (Hasibuan et al., 2019). Keeping pace with the times, adjustments are needed in education, where there are 4 21st-century skills that must be possessed by students including critical thinking skills, creative and innovative thinking skills, communication skills, and collaboration skills (Rosnaeni, 2021).

21st-century skills will develop well if learning is done by constructing students' knowledge. The theory of constructivism is a theory that is often encountered in the world of education, which has a constructive meaning. From an educational point of view, philosophical constructivism is an attempt to build an order of life that leads to a modern direction (Suparlan, 2019). This constructivism theory also refines other learning theories, namely behavioristic learning theory and cognitive learning theory (Masgumelar et al., 2021). There are two main concepts contained in constructivism theory to create new knowledge, namely accommodation and assimilation (Sugrah, 2020).

Graphs are a type of representation that is useful in summarizing data, processing and interpreting new information from complex data. One of the reasons why understanding graphical representations are important is because they can provide quantitative information that is easy to understand. Moreover, data presented graphically becomes easier to understand when compared to data presented in the form of descriptive sentences. TIMSS and PISA studies, to look at students' scientific literacy, also often contain graphic representation questions, where Indonesian students get scores that are categorized as low compared to other countries. In 2012 Indonesia was ranked 64 out of 65 countries and in 2015 Indonesian students were ranked 62 out of 69 and were below the world average (OECD, 2016).

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This low level of multi-representation ability is not only among students, even prospective physics teachers still have poor multi-representation skills (Yustiandi et al., 2017). Research results Bunawan et al. (2015) revealed that the graphic representation skills possessed by prospective physics teachers are still inadequate.

Kinematics is the science of motion, which deals with the movement of an object that can be described in a graph. Learning physics on the topic of Kinematics is inseparable from pictures, graphics, and mathematics. Graphic interpretation skills are included in one of the process skill indicators, namely interpretation skills and are also included in the ability to think at a high level in the analysis indicator.

Various types of graphs and charts are needed to present the results of an experiment. Graphs and charts need to be properly drawn and labeled. Use patterns in data to reach conclusions in experiments (Sunarti, 2022). To overcome the problem of students' low ability in interpreting graphs, there is a need for learning strategies that can train these abilities, but before implementing these strategies it is necessary to carry out an initial study to see the profile of graphic interpretation in prospective teacher students.

Graphic interpretation skills cannot be ignored in the student's education period, because this ability is included in the student's ability to be able to analyze. The ability to analyze is also a high-order thinking ability. Good analytical skills will be a capital for students in the future to be successful in work.

The purpose of this study was to look at the profile of students' initial graphic interpretation abilities, where this initial ability will become the teacher's basis for planning a strategy to improve graph interpretation skills.

Method

This type of research is survey research involving 79 respondents who come from prospective physics teacher students. The instrument in this research is an essay test. This instrument is built based on indicators of graphic interpretation ability. Graphic interpretation indicators in this study are graphic interpretation to mathematics, graphic interpretation to images, and graphic interpretation to descriptions.

The instrument to be used was tested on 30 students and then analyzed using SPSS 25 to see the validity of the items used. After being declared valid and reliable, it was continued by giving students a test on kinematics material simultaneously to all respondents.

The data analysis that will be used is descriptive analysis by determining the average score, percentage and bar charts to explain the results of the study. The framework of thought in this study is as shown in Figure 1.

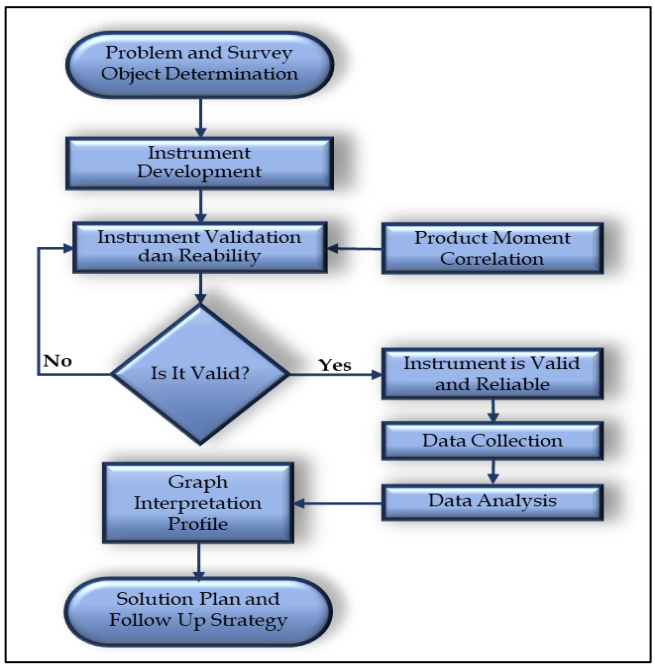

Figure 1. Flowchart of the interpretation graph research

The questionnaire consists of question items from 2 indicators which can be seen in Table 1.

Table 1. Instrument Question Indicator

Indicators Interpretasi	Number of Question Items
Graph to Mathematical	2
Graph to Picture	2
Graph to Description	2

The form of the instrument is an Essay test. Before the questionnaire is distributed, the questionnaire will be tested for validation and reliability of the instrument using the Pearson correlation test. This test was then carried out with the help of SPPS 25.

Result and Discussion

Research on the analysis of students' initial graphic interpretation skills using graphic interpretation instruments. Before this instrument was used to conduct survey research, this instrument was tested on 30 Physics Education students, then the test results were analyzed using the Product Moment Correlation formula using SPSS, to obtain item validity and instrument reliability. This validity test is carried out to measure the validity or invalidity of a measuring

instrument (Ghozali, 2009). The results of item validity can be seen in Table 2.

Table 2. The Validity of the Question Items

Items	Pearson Correlation	Description
1	.514**	Valid
2	.670**	Valid
3	.621**	Valid
4	.596**	Valid
5	.597**	Valid
6	.607**	Valid
7	.150	Invalid

**. Correlation is significant at the 0.01 level (2-tailed)

Based on Table 2, it can be seen from the 7 validated item items, there is 1 invalid item item, namely question number 7. So, this question must be discarded, so that the question only consists of 6 questions, where the number of questions represents each interpretation indicator chart. After these 6 items were tested for the reliability of the instrument, the Cronbach's Alpha value was 0.652. The results of this reliability can be categorized as reliable. According to Chua (2006), this value is categorized as satisfactory. According to Jackson (2012) a valid measuring instrument can carry out its functions properly. Instrument reliability means that the information obtained from the instrument can be trusted as a data collection tool capable of obtaining actual information contained in the field (Sitinjak JR et al., 2006).

After the instrument has been declared valid and reliable, data is collected to see the initial profile of student graphic interpretation. The results obtained can be seen in Figure 2.

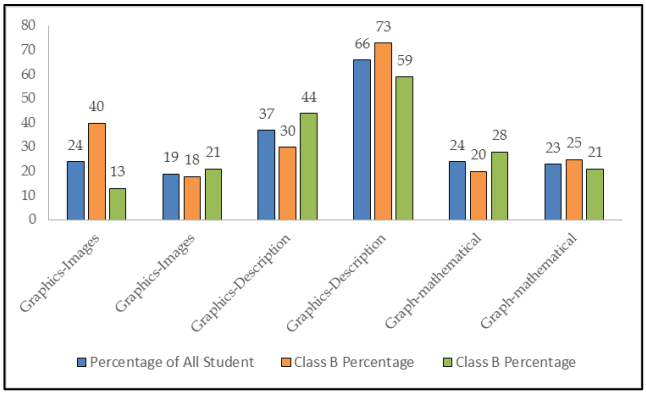

Figure 2. Interpretation of graphs to mathematical (item 1)

In this problem, to find the distance, it is enough to calculate the length of the path traveled, which is 12 km and the displacement by connecting the initial and final positions of the object's motion (AD), which are 6 squares to the right and 8 squares up, so the diagonal is 10 km. In this question, only 24% of students answered correctly, out of 79 students who took the test.

For the question of interpreting graphs into descriptions, questions have been made as follows, a person brakes his motorbike. The speed graph when braking is shown in the image below. If deceleration is defined as the change in velocity of an object over time, narrate the descriptive information about the graph!

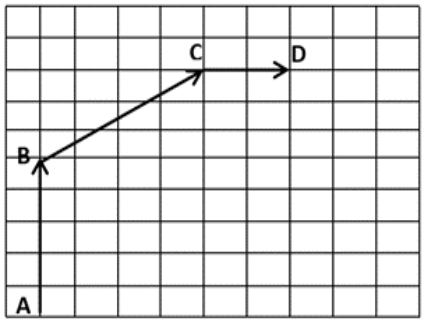

Figure 3. Graph interpretation to mathematical (item 1)

In this problem, to find the distance, it is enough to calculate the length of the path traveled, which is 12 km and the displacement by connecting the initial and final positions of the object's motion (AD), which are 6 squares to the right and 8 squares up, so the diagonal is 10 km. In this question, only 24% of students answered correctly, out of 79 students who took the test.

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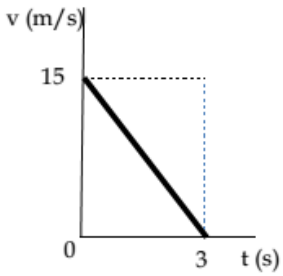

Figure 4. Graph interpretation to description (item 3)

In item 3, the answers obtained only tell the information obtained from the graph, that is, there is a deceleration, where the speed decreases from 15 m/s to 0 m/s in 3 seconds, meaning that at 3 seconds the motorcycle has stopped. For this question 37% of students could answer correctly out of a total of 79 students.

Interpreting the graph to the figure, given the following questions, Cyclists A and B both start

moving at t=0 seconds, as shown in the image below. Determine the speed of bicycles A and B, then describe the movement of the bicycle in an image on the horizontal axis (x), x in meters.

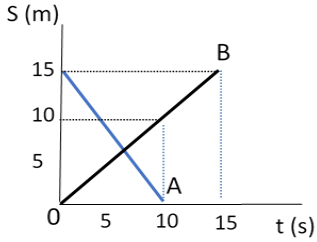

Figure 5. Graphic to image interpretation (item 5)

In item 5, students are asked to describe A and B (no need to be bicycles) moving closer to each other. The initial position of A and B is 15 meters, where A is moving with a speed of 1.5 m/s to the left and B with a speed of 1 m/s is moving to the right. The results of the answers of all students were only 24% of students who answered correctly out of a total of 79 students. Of all these types of graphic interpretation, it can be seen that the ability of prospective teacher students still has low interpretive abilities.

The lack of graphic interpretation skills for prospective physics teachers is due to many factors, namely learning during the covic 19 pandemic which took place online, learning while in high school mostly memorized and worked on questions and also this student teacher candidate was still in his second year at college and the input of these prospective teachers also came from various sub-districts and villages spread throughout the Riau region.

Graphical interpretation is an important part of learning science. Graphic interpretation is part of the representation that shows students' conceptual understanding. Rivaldo et al. (2018) stated that students' understanding of interpreting kinematics graphs is still low.

The results that are similar to this study are the interpretation of kinematics graphs for high school students in Banten. The results showed that some of the most difficult students were ranked as follows. First, about determining the change in the speed of objects for accelerated objects, only 9.52% could answer correctly. Second, describing a graph of the position of an object as a function of time for an object moving with a certain acceleration, only 14% of students answered correctly. Third, determining the change in position of an object when the object's velocity all the time is explained in the graph, only 19% of students answered correctly. Fourth, determining the instantaneous speed of objects from the position graph as a function of time 3.29% of students are correct (Yustiandi et al., 2017).

The ability to interpret these graphs needs to be trained. Previous studies stated that there was a significant relationship between students' ability to interpret graphs and their ability to complete straight lines movement question (Anisa et al., 2017). There is a relationship between students' multi-representation abilities in working on problems with student learning outcomes (Murniati et al., 2021).

What is the need for chart interpretation skills? Graphic interpretation skills are equivalent to analytical skills in Bloom Andeson's taxonomy. This ability is developed before the ability to create, so it is important for a student to understand Graph Interpretation. Glazer (2011) argues that graphic interpretation skills should be taught explicitly, given their importance and complexity.

Analysis and interpretation of data and graphs is an important part of science process skills and science curricula. So, refers to the visual display of data using relevant graphical representations. One of the tools used in science courses is a graph which serves to explain the relationship between each concept and therefore it is important to know data analysis, graph construction and interpretation (Ergül, 2018).

Graphic reading and graphic interpretation skills of prospective physics teachers are still inadequate and also skills in analyzing graphs depend on the type of graph and the level or type of questions developed (Bunawan et al., 2015). Figure and graphic representation are 0% because students as a whole do not use 2 representations. The high category has a more dominant value, namely representation (Mole et al., 2022).

The use of various representations helps students in knowledge, concept mastery, and problem solving in learning physics; 3) Stating that the ability to multi-representation is an effort to increase the achievement of learning physics 4) The success of students in solving problems and understanding physics concepts needs to be balanced with successful understanding and use of multi-representations (Sunarti, 2022).

Using multiple representations can improve one's understanding of mathematical and physical concepts. Research conducted by Bollen et al. (2017) explains that there are difficulties for students in interpreting, constructing, and switching to other representations.

This graphic interpretation ability needs to be trained by teachers with a scientific approach in a lesson, such as observing, classifying, measuring, predicting, explaining and concluding. The implementation of these processes will be assisted by the teacher, but the assistance provided by the teacher

must decrease as students grow older (Nurdyansyah et al., 2016).

Selection of the right media can be used as a solution to improve students' multi-representational abilities. Arif et al. (2021) find the feasibility of implementing media in facilitating understanding and increasing the ability to represent science (physics) during a pandemic. Ningrum et al. (2018) through their research found that the use of media is appropriate for improving multi-representational skills.

After collecting and recording data, scientists often enter their data onto graphs or charts. This provides useful chart interpretation and helps scientists draw conclusions.

Conclusion

The results of data analysis using descriptive statistics, it was found that the student's ability to interpret graphs was in a low category. This gives information to lecturers that training and strengthening graphic interpretation skills still need to be a concern. In the study, only initial profiles of students' graphic interpretation abilities were obtained. Henceforth, it is necessary to apply learning strategies to improve graphic interpretation abilities.

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