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Profile Analysis of Students' Problem-Solving Abilities on Impulse-Momentum Physics Material

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Abstrak

The potential possessed by students is not only contextual. However, it must be comprehensive and essentially understand the concept of science. Based on the results of a preliminary study conducted at SMAN 2 Garut using interview techniques with Physics teachers, it was revealed that students' learning in schools had implemented various learning models. The achievement of learning outcomes from each learning model is different depending on how the implementation of the learning model is carried out by adjusting the appropriate learning materials. Characteristics of students who are different in the class cause various student responses to differ from the learning model. The average student learning achievement in the aspect of problem-solving at the school for physics is 22% overall. The learning model will be judged appropriate for the material if, in the delivery of learning materials, students can achieve appropriate learning objectives and with certain aspects of the learning component by using indicators of achievement of certain aspects. Students' problem-solving ability in learning Physics subjects has difficulty because students' understanding of learning materials is only theoretical and focused on problem-solving through various formulas or equations in Physics learning materials. Initiating learning with various active learning models with various stimuli and involving student participation makes it easier for students to understand learning materials. The highest answer analysis on problem description questions is 26.5625% with the lowest and lowest criteria on the assessment of the logical procession aspect of 12% which represents the student's problem ability profile is still low on this material.

Keywords: Learning Model, Momentum and Impulse, Problem-Solving Ability

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INTRODUCTION

The Golden Indonesia Vision 2045 has a high dependence on literacy, including achievements in creativity, innovation, and community competitiveness that must be critical and analytical in facing global demands (Wulandari et al., 2019). The unwise use of technology causes the Indonesian people to be complacent with the sophistication of technology and only make technology an object of entertainment without making a supportive learning media.

In facing the digital era, various things will undoubtedly experience a digitalization process by keeping pace with the existence of technology and the Industrial revolution 4.0 and currently have faced Society 5.0. Various fields are digitizing massively, supported by the rapid development of information technology(Prasetyo, 2019).

Competencies that students must master are not only related to hard skills but must master soft skills to be able to increase the potential of each personality(Lubis & ., 2020). The potential possessed by students is not only contextual. However, it must be comprehensive and essentially understand the concept of science. This is in line with the objectives of national education as stated in Law no. 20 of 2003 concerning the National Education System Article 3, which states that the purpose of national education is to develop the potential of students to become human beings who believe and fear God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become citizens. Democratic and responsible.

The spread of COVID-19 is growing rapidly throughout the world, including in Indonesia. The COVID-19 pandemic period in Indonesia is not over yet, and this is indicated by the number of cases of COVID-19 patients continuing to increase. Several strategies have been implemented to reduce the rate of increase in patients so that the number of disease spreads decreases. However, the community's normal routine has resumed with due observance of health protocols.

Indonesia currently has an emergency status for the Covid-19 pandemic, which refers to Presidential Decree No. 12 of 2020, which is still valid today. Facing a Covid-19 pandemic requires breaking all existing transmission chains and protecting population activities from the risks obtained. Breaking the chain of the Covid-19 pandemic can be done individually by wearing a mask and washing hands and in groups by keeping a distance (social distancing). Social distancing is an effort to stop the spread of the virus by widening the distance to everyone.

Currently, Indonesia has implemented new normal policies from various sectors, including the education sector. The government chose to implement a new policy normally in the education sector to increase productivity and accommodate the learning needs of students in schools.

In addition, it is conveyed so as not to hurry in determining the policies that will be applied in schools. The world of Indonesian education can be said to be greatly influenced by the clarity of the new normal policy guidelines that were initiated. Learning during the COVID-19 pandemic has made some very prominent differences, especially with students' problem-solving abilities, especially in science learning, including physics. Solving problems is a learning process of thinking; solving problems is a process of learning to think complex, where a complex, where a question is a problem, a question is a problem for students, if students have rules or how to solve problems, they have rules or how to solve problems.

The profile of students at SMAN 2 Garut with diverse student abilities shows several incompatible tendencies, where the student persona for the math specialization program does not mean that they like calculation-based learning even though in the realm of science, such as glasses subject, because it will be difficult to solve problems that Related to everyday life to find a correlation with the concept of a simple glass.

So far, most teachers think that what is important in science education is the mastery of subject matter (content, knowledge, concepts). At the same time, knowledge or subject matter is only a vehicle for developing thought processes and other related matters. When faced with real problems, it is applied to things that require students to be adaptive and find the right solution in solving problems with an empirical and logical approach(Perusso & Baaken, 2020).

METHODS

Data Collection Techniques

The data used in this study are qualitative and quantitative data sourced from various relevant literature and several existing sources and references. According to the Big Indonesian

Dictionary, qualitative data is not in the form of nanum numbers nor obtained from recordings, observations, interviews, or written reference materials. Quantitative data can be measured or calculated directly as variable numbers or numbers. The sources include data from educational literature through access to national and international government websites to obtain specific databases and national and international journals and books that are under the problems raised. The research was conducted to determine the profile of students' problem-solving ability tested on students at SMAN 2 Garut. Several 32 people with the samples taken were students with homogeneous characteristics.

Data Analysis Techniques

The research method used is descriptive analysis. The descriptive analysis examines the status of a group of people, an object, a set of conditions, a thought system, or a class of events in the present. The data to be analyzed are data sourced from literature studies. Literature studies are a series of activities related to collecting literature data, reading and recording, and managing research materials (Ajat Rukajat, 2018).

The research was conducted in May 2022, with data collection procedures through interviews with student subject teachers for grade ten, short interviews with students, and providing research instruments in the form of questions that experts have validated. Data analysis was carried out using student answer sheets based on the assessment rubric for problem-solving skills in momentum and impulse physics material.

Data Processing Technique

Visual representation data can be in the form of pictures, diagrams, photos, graphs, symbols, tables, maps, and formulas. The supporting instrument used is field notes. the data was analyzed using the mean answer score. Examples of rubrics and scoring answers are presented in Table 1. The mean result is then made to certain criteria

Tabel 1 Problem Solving Skills Knowledge Acquisition

Assessed aspects	Shoe					
	5	4	3	2	1	0
Useful description	Use of a complete and precise concept	Proper use of concepts but containing minor or complete omissions	There are parts of the concept that are missing and or contain errors	Most concepts are imprecise, missing, and or contain errors	All concepts are imprecise and or contain errors	No Answer
Physics approach	Precise and complete physics proximity	The physics approach contains minor omissions	Some concepts and principles of physics are missing or irrelevant	Most physics concepts are missing or irrelevant	The chosen concept of physics is irrelevant to the problem	No Answer
Specific physics applications	The specific physics application is precise and complete	Specific physics applications contain omissions or errors	Some concepts and principles of specific physics applications are missing or irrelevant	Most of the concepts and principles of specific physics applications are missing or irrelevant	All concepts and principles of the specific application of physics selected are irrelevant to the problem	No Answer
Proper mathematical procedure	Precise and complete mathematical procedure	Mathematical procedures used accordingly	Some mathematical procedures exist that are missing and or contain errors	Most mathematical procedures are missing or contain errors	All mathematical procedures are incorrect and or incorrect	No Answer
Logical Progression	The solution to the problem is clear, focused, and logical	Clear and logical solutions but lack focus	There is a clear and focused but illogical solution	Most solutions are vague, unfocused, and or illogical	The whole solution is unclear, unfocused, and or illogical	No Answer

Rubric

Scoring guidelines:

$$Score = \frac{score\ obtained}{maximum\ score}\ x\ 100\%$$

Tabel 2 Achievement Criteria on the scoring

Achievement Percentage	Criteria
86%-100%	Excellent
76%-85%	Good
60%-75%	Sufficient
55%-59%	Fair
≤ 54%	Low

The following are questions tested on students with impulse-momentum physics material in testing students' problem-solving ability profiles ((*Penerapan Model Context Based Learning (CBL) Berbantu PhET Simulation Untuk Meningkatkan Kemampuan Pemecahan Masalah Peserta Didik Pada Materi Momentum Dan Implus - Digital Library UIN Sunan Gunung Djati Bandung*, n.d.)).

1) Andi visited Taman Angrek Mall in Jakarta. He is going to buy a helmet for his sister, who just got a SIM C. Arriving at the store,
Andi sees various types of helmets with attractive designs that are very popular with teenagers. The shop assistant offers a variety of helmets with modern designs. Here are some pictures of the helmets on offer:

Figure 1 Helmet offers design

Andi is confused about what kind of helmet is safe for his younger brother to ride a motorcycle. Answer the questions below to help Andi find a solution to the problem.

a. Describe the problem contained in the phenomenon above! What information can be drawn from the events above?
b. What physics concept does Andi need to understand to buy a helmet?
c. Based on the picture above, explain which helmet is safe for motorcyclists?
d. Write the relationship between momentum and impulse using a mathematical equation!
e. If you are a helmet designer. Make a helmet design that can protect the motorcycle rider's head in the event of an accident, and explain the function of the parts of the helmet you make!

2) Ilham is practicing skateboarding in Malang City Square. Many children are playing and enjoying the facilities available. This exercise was done for the first time, so he did not know the skateboarding techniques. When Ilham plays his skateboard with a speed of 6 m/s and a skateboard mass of 2 kg. Suddenly at a distance of 5 m, several children are playing. Ilham was surprised and thought he had to stop his skateboard. However, Ilham did not know how he had to jump so that his skateboard could stop and not hit the children. Please answer the questions below to help Ilham stop his skateboarding.

a. Describe the problem in the above event! What information can be drawn from the events above?
b. What physics concepts are related to the above problem?
c. In which direction should inspiration jump?
d. What is the speed of the skateboard when Ilham jumps forward with a speed of 2 m/s, and Ilham's mass is 25 kg?
e. Give your opinion on what kind of skateboard design can make it easier for players to stop the skateboard if it goes at high speed even though the player is still a beginner.

3) Friday, January 10, 2020, there was an accident of train A which crashed into train B, which was standing still at Rancaekek station, Bandung. Train A is traveling at a speed of 50 km/hour. The driver did not know that another train had been stopped. Because the train cannot stop suddenly, train A hits train B (the mass of both trains is the same). Not long after the accident, a police officer came to the scene to investigate the accident.

Figure 2 Train Accident

Please answer the questions below to help the police investigate this accident.

An

a. Describe the problem in the above phenomenon! What can important information be retrieved?
b. Explain the physics concepts related to the above problems!
c. What are train A's and train B's directions after colliding?
d. What are train A's and train B's speeds after colliding?
e. Express your opinion on how to anticipate the accident

RESULT AND DISCUSSION

The term momentum that will be studied in this chapter is linear momentum (p), which is defined as follows: The momentum of an object in motion is the product of the object's mass and velocity. Therefore, every object in motion has momentum. Mathematically, linear momentum is written as follows:

$$P=m.v$$

When viewed from the equation, the direction of the momentum is always in the direction of the velocity. Based on the above formula, we can conclude that the object's momentum will be greater when the object's mass and velocity are greater. This will also apply vice versa; the smaller the mass or velocity of an object, the smaller its momentum will be. In physics, there is such a thing as the law of conservation of momentum, which reads, "the momentum before and after the collision will always be the same."(Shobrina et al., 2020)

On conventional face-to-face education paradigm immediately changed to distance learning (PJJ) using online facilities such as Zoom meetings, WhatsApp, Google meets, and so on since the COVID-19 pandemic, which has transformed education towards digital faster. This results in educators who must be more literate about the development of existing information technology to make it easier to keep up with developments.

Tabel 3 student problem solving ability profile

Problem Solving Capability Indicators	Valuation	Category
Issue Description	26.5625	Low
Physics approach	17.71875	Low
Specific application of the concept of physics	18.5625	Low
Mathematical procedures	18.4375	Low
Logical progression	12	Low
Average	18.65625	Low

The highest answer analysis is in the problem description question, which is 26.5625% with the lowest criteria and the lowest is in the assessment of the logical procession aspect, which is 12%. Code of Indicators at the Question Sheets:
A= Issues Description
B= Physics Approach
C= Spesific Application of The concepts of Physics
D= Logical Preogression, and
E= Average

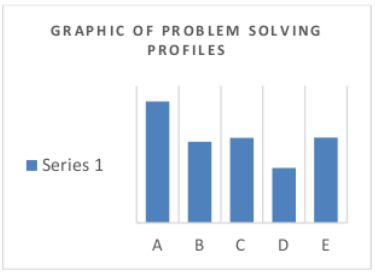

Figure 3 Analysis of Students Problem Solving Skills

The average student learning achievement in the aspect of problem solving at the school for physics is 22% overall. Preliminary studies were conducted not only using interviews and direct observation but also testing the problem-solving ability test questions using the problem-solving ability instrument of previous researchers with the same variable, namely the students' problem-solving ability. The questions tested follow the problem-solving ability indicators according to Doctor & Heller (Nurzakiyah et al., 2021a)which include five indicators, namely 1) useful descriptions, students can explain the core of the problem and can summarize important information symbolically. 2) physics approach, students can choose relevant concepts to be used in problem-solving. 3) In applying specific physics, students can apply the chosen concept to specific conditions in the problem. 4) proper mathematical procedures, students can use the right mathematical rules. 5) logical progression, students can evaluate the overall problem solution. There are three questions asked. It was tested on 32 students in class X MIPA 1 using problem-solving indicators and rubrics as shown in table 1.

Problem solving abilities can have a positive impact on real action in the form of social contributions if the problems that occur involve the community or help solve real

problems in everyday life with a scientific approach (Safitri et al., 2019). One of the materials that require a high level of understanding, especially problem-solving skills in Physics subjects that often have difficulty is an understanding of the momentum and impulse materials(Jua et al., 2018). Whereas in everyday life there many activities and phenomena that involve the concepts of momentum and impulse(Yennita et al., 2018). The results showed that the problem solving profile of students was still low. The data from the test results for the problem-solving ability on momentum and impulse material are as follows:

Tabel 4 Problem Solving Profiles

Initials Students	A	B	C	D	E	Score	Ctegory
SH	40	18	20	10	0	17.6	Low
RN	10	14	10	10	0	8.8	Low
TU	10	20	20	5	0	11	Low
WMP	20	5	5	5	10	9	Low
NRO	20	0	18	20	10	13.6	Low
AS	25	25	20	20	10	20	Low
MR	25	20	20	20	20	21	Low
ASSF	20	15	13	15	0	12.6	Low
SAR	15	10	10	10	0	9	Low
DSM	20	15	20	20	0	15	Low
LKD	20	20	20	20	12	18.4	Low
NSRA	20	20	15	10	10	15	Low
SF	20	20	15	15	5	15	Low
DS	30	10	20	10	5	15	Low
SED	30	20	30	20	17	23.4	Low
AMDP	25	20	20	15	20	20	Low
KNS	20	0	12	25	5	12.4	Low
IAN	25	20	18	20	20	20.6	Low
MRFM	30	20	25	20	20	23	Low
PNS	40	30	15	20	30	27	Low
RNHT	40	30	25	30	20	29	Low
YH	40	20	23	15	5	20.6	Low
CP	40	30	15	25	10	24	Low
MRS	50	40	35	40	20	37	Low
SN	30	35	20	30	25	28	Low
MFA	20	20	25	15	15	19	Low
RR	30	15	18	15	5	16.6	Low
PW	35	10	10	25	25	21	Low
AM	25	15	17	20	20	19.4	Low
HRNW	25	5	10	20	5	13	Low
N	25	20	25	20	25	23	Low
FA	25	5	25	25	15	19	Low
Average	26.5625	17.71875	18.5625	18.4375	12	18.65625	Low

Based on the results of a preliminary study conducted at SMAN 2 Garut using interview techniques with Physics teachers, it was revealed that students' learning in schools had implemented various learning models. The achievement of learning outcomes from each learning model is different depending on how the implementation of the learning model is carried out by adjusting the appropriate learning materials(Ilma* et al., 2022). Characteristics of students who are different in the class cause various responses from students to differ from the learning model. The learning model will be judged appropriate for material if, in the delivery of learning materials, students can achieve appropriate learning objectives and with certain aspects of the learning component by using indicators of achievement of certain aspects(Nurzakiyah et al., 2021b).

The problem-solving ability of students in learning Physics subjects has difficulty because students' understanding of learning materials is only theoretical and focused on problem-solving through various formulas or equations in Physics learning materials. When reviewing the level of students' abilities, they cannot be equated with each other in terms of students' understanding of learning. Initiating learning with various active learning models with various stimuli and involving student participation makes it easier for students to understand learning materials(Andrews et al., 2019). If students have been actively involved, the learning process can meet learning achievement indicators, one of which is problem-solving

CONCLUSION

The highest answer analysis is in the problem description question, which is 26.5625% with the lowest criteria and the lowest is in the assessment of the logical procession aspect, which is 12.5. The decomposition of the problem is still low because students have not been able to describe the problem precisely in a more essential substance, and the low logical procession aspect shows the level of logical thinking of students who have not been able to think systematically to fulfill aspects of problem-solving ability. The problem ability profile of students is still low on the impulse-momentum material so that is appropriate. The learning methods are needed to be applied to students to be able to improve skills that support, the aspect of problem-solving on students' abilities

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