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Students' Physics Problem-Solving Skills in Daily Life Context: Between Confession and Fact

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Abstract: Physics is a science that can solve various problems that exist in everyday life in the form of technology. Therefore physics problem-solving skills are trained in school learning. This study aimed to determine the profile of students' physics problem-solving skills with physics case studies in everyday life. This study used a quantitative descriptive method and involved 55 students of senior high school in XII class who were randomly selected. The data used in this study were student response data to questionnaires and test results through problem-solving skills questions. Based on the questionnaire results, students felt they had problem-solving skills at the medium level of 38% and 62% high. Meanwhile, for test results using problem-solving skills questions, there was a decrease in level. As many as 7% of students have very high problem-solving skills, 18% high, 58% medium, and 17% low. The differences that arise show that there are problems in learning and the problem models given in physics learning at school.

Keywords: Daily life; Physics; Problem-solving skills

Introduction

Physics is a natural science that studies the basic principles of the universe from the atomic scale to the universe (Serway et al., 2008). The study of physics obtains various postulates, theories, and laws of physics. This study helps solve various problems in the form of technological developments. Therefore, one of the goals of learning physics is to prepare a generation ready to work to solve future problems with physics solutions (Bao et al., 2019). This is in line with the goals of education in the 21st century that one of the competencies students need is problem-solving skills (Ince, 2018). Therefore, the ability to solve problems presents a significant learning achievement in universities in Indonesia (Siswanto et al., 2019). This follows one of the learning outcomes required in the Presidential Regulation of the Republic of Indonesia Number 8 of 2012 concerning the Indonesian National Qualifications Framework (INQF) Level 6 (Jatmiko et al., 2016). However, for decades, most educational institutions have been responsible for the accumulation of knowledge at all levels of education, contributing to a repetition of material without logical meaning for students (Scarlatos, 2013). Educational institutions are getting further away from their primary function of solving real problems around them (Mendez Hinojosa et al., 2020). Today, needs are more important than mastering content. Educational institutions must equip students with various skills that lead to problem solving (Malik, 2018). Problem solving skills are a person's skills in finding a solution to a problem in learning physics (Harskamp et al., 2006) in understanding and applying physics concepts (Becerra-Labra et al., 2012) especially by using physics principles and equations (Reddy et al., 2017). In solving problems, students do not only rely on memorization, but also in analyzing information (Mestre et al., 2011) and thinking critically to examine problems in everyday life (Syafril et al., 2020).

Before preparing or looking for solutions to overcome these learning problems, it is necessary to research to determine the profile of students' current problem-solving abilities. Indicators of physics problem-

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solving skills are needed to determine the profile of problem-solving skills. According to Heller et al. (2010), a person is said to be skilled in solving physics problems if he is able; (1) Visualize the problem, (2) Describe the problem in the description of physics, (3) solution plan; (4) implementing a solution plan; and (5) evaluate each problem item. Students can carry out this stage if students understand and have an awareness of the application of physics concepts to problems. Ainiyah et al. (2020) revealed that mastery of concepts would determine students' problem-solving difficulties. To help train students to become aware of physics concepts in a problem, students need to get used to being aware of and understanding the application of physics concepts used in everyday life. Therefore, learning in the 21st century, especially in physics materials, requires integration of learning with the processes of everyday life (Sarwi et al., 2019).

Learning physics in everyday life is needed to help improve students' ability to analyze things around them (Haryanto et al., 2019). This habituation can be done in the learning process following the learning assessment. By creating physics problems that are contextualized and anchored in students' lives, it is expected that solving physics problems is meaningful and exciting for students and relevant to their own lives (Fischer et al., 2021). Real-life contexts are essential in visualizing problems (Rennie et al., 1996). This is also in line with Asrizal et al. (2018) that education in schools needs to produce graduates not only possessing relevant knowledge but also one of them is literacy skills in their daily life. To find out problem-solving skills related to the context of everyday life, the authors conducted research related to the profile of physics problem-solving skills in the following case study of physics in everyday life.

Method

The type of research used in this research is descriptive quantitative research. This method was chosen to determine the profile of students' problem-solving skills at SMAN 1 Krian case study on physics in daily life. This study collected data through a written test of problem-solving skills on the physics of temperature and heat transfer, along with a research questionnaire on problem-solving skills.

The research was conducted in September 2022 using two samples of class XII MIPA at SMAN 1 Krian for the academic year 2022/2023. The class was chosen because the student in the XII class was learning temperature and heat transfer materials. The sample was taken using the Cluster Random Sampling technique to obtain 55 samples.

The problem-solving skills research questionnaire contains 20 statements corresponding to indicators of problem-solving skills in physics by Heller et al. (2010) and question about students' awareness of physics concepts in daily life. After that, the research instruments carried out by students are analyzed descriptively and quantitatively in the form of percentages. The results of students' answers were analyzed concerning the guidelines for assessing critical thinking according to problem-solving indicators by Heller and Heller. Determine students' problem-solving skills can be seen from the following percentage values as equation 1 (Susilowati et al., 2017).

$$Percentage\ Value = \frac{Gain\ Score}{Maximum\ Score}\ x\ 100\% \qquad (1)$$

The percentage value of problem-solving skills obtained from calculation is then categorized according to the following Table 1.

Table 1. Percentage Category of Problem-Solving Skills (Destalia et al., 2014)

Value Intervals (100%)	Category
76-100	Very high
51-75	high
26-25	Medium
<25	Low

The questionnaire has positive and negative statements. For calculation of the score of each statement on the questionnaire uses a likert scale in Table 2.

Table 2. Likert Scale for Calculation Score on the Questionnaire

Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
Positive	4	3	2	1
Negative	1	2	3	4

Meanwhile, the test instrument consists of four physics questions on temperature and heat transfer materials related to problems that exist in daily life. The four test questions are also arranged based on problem-solving indicators. The problem-solving hands refer to the problem-solving indicators compiled by Heller et al. (2010), as shown in Table 3.

Tabel 3. The Problem-Solving Indicators Compiled by Heller et al. (2010)

Questions | **Question indicators**

1. A chili and tomato farmer found information through online media such as the following.


Tak Banyak yang Tahu, Menyiram Tanaman dengan Air Panas Bikin Tanaman Makin Wow, Lihat Hasilnya!

Maulina Kadiranti - Sabtu, 15 Mei 2021 | 14:00 WIB

Air panas juga aman bagi tanaman karena ini hanyalah sebuah air biasa yang dipanaskan. Tidak ada kandungan obat kimia apapun didalamnya.

Jadi sudah terbukti keamanannya.

Tapi yang dimaksud air panas disini bukanlah air panas yang baru saja mendidih ya, IDEA lovers.

Karena jika IDEA lovers menyiram tanaman dengan air panas yang baru saja mendidih ini malah akan menjadi bumerang bagi IDEA lovers.

Tanaman hias akan mati begitu saja. Kalau mau menggunakan air panas yang mendidih untuk mengusir gulma dan hama sebaiknya gunakan pada tanaman seperti tomat atau tanaman cabai.

Melansir dari *Gardening Know How*, IDEA lovers boleh menggunakan air panas dengan suhu 48 derajat agar gulma dan hama pada tanaman hias cepat hilang.

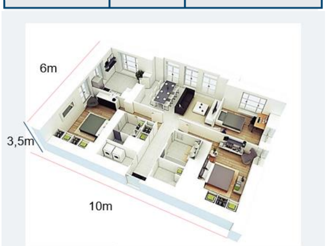
Therefore, these farmers want to apply it to their chilli and tomato plants. However, the farmer does not have a thermometer to measure the water temperature at exactly 48°C. Suppose in the farmer's house, half an alcohol conductor is left by the farmer making disinfectant. In that case, a scientist applies heat and heat transfer materials to help the farmer solve this problem with the help of the following steps!

a. Try to identify and write down the problem and visualize the situation above if necessary!
b. What physics concept do you want to use to solve the problem? Please describe the issue by relating it to the idea of physics!
c. Try to plan what solutions you want to do to help the farmer! Explain using physics concepts, and if necessary, use physics calculations or formulas to get an accurate answer!

Question indicators:
a. Students can identify and visualize problems.
b. Students can describe and associate problems using physics concepts.
c. Students can plan problem-solving by utilizing the physics concepts they have learned.

2. In addition to designing the roof of a house, it is also necessary to create walls. If the area of the house is 6x10 m, the height of the wall of the house is 3.5 m. then try to help me to choose the appropriate wall material based on the following table, so that heat from outside of 30°C does not move easily into a room with a temperature of 25°C

Material type	Thickness (mm)	Thermal Conductivity ($\frac{W}{m\,K}$)
Concrete	90	1.448
light concrete	100	0.303
Gypsum board	80	0.125

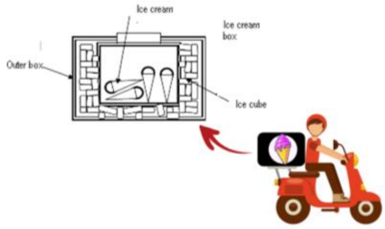


Question indicators:
a. Students can conceptualize solutions to material selection problems based on materials' thermal conductivity and their influence on everyday life.
b. Students can give arguments and prove a plan to solve the problem of choosing the material type based on the material's thermal conductivity and its influence on everyday life.

3. An ice cream seller had a problem with his ice cream box, which was not strong enough to keep the ice cream he was selling frozen. Initially, the ice cream box specifications were type P, as shown in

Question indicators: Students can evaluate the selection of ice cream box materials based on heat capacity, type of material, and color.

Questions	Question indicators
the table below. The ice cream seller needs clarification about buying a new box but doubts whether the other types, Q, R, and S boxes, will work better than the P box he already has.	



The following is a selection of ice cream box specifications available on the table. Help the ice cream seller choose whether to keep the old box or buy one of the new ones! Give your reasons when selecting and making the decision!

Specification	P	Q	R	S
Specific heats	high	high	low	low
Outer material box	copper	PVC plastic	PVC plastic	aluminum
outerbox color	dark	light	light	dark

The score of four test calculations with the right number or false score of student answers. And the last step in analyzing the data is the conclusion, the results obtained from the research objective are to determine the profile of students' problem-solving skills.

Result and Discussion

In this study, there are two kinds of results. First is the result of a questionnaire about how students know their problem-solving skills. And the second is the results of students' problem-solving skills based on the test of problem-solving skills in the context of physics in daily life. From the method section above, it is known that there are 20 statements in the questionnaire; the 20 statements are divided into five sections based on the indicators of problem-solving skills Heller et al. (2010). So, in this section analyze research results based on each section of the problem-solving skills indicator from questionnaire representation in figure 1 to figure 5.

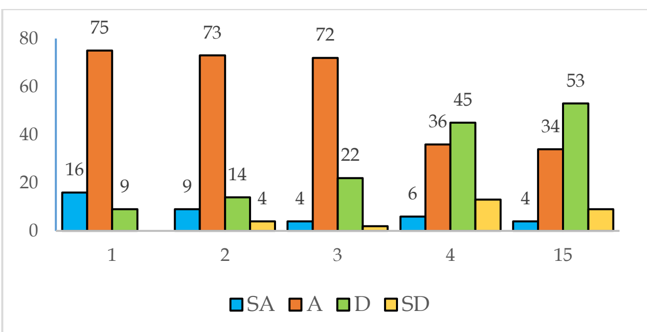


Figure 1. The results of the questionnaire on the first indicator of problem-solving skills are visualizing the problem

Note:

SD : Strongly Disagree
D : Disagree
SA : Strongly Agree
A : Agree
1 : Reading or listening to a narrative about an event, I can easily describe the event in simple, meaningful pictures.
2 : Reading or listening to a narrative about an incident, I can easily identify the problems that occur in that incident.
3 : Reading or listening to a narrative about an event, I can easily write down the problem statement regarding the incident.
4 : By looking at natural phenomena or reading narratives of events, I need help identifying physics concepts related to these natural phenomena or events.
15 : I often have difficulty imagining problems related to physics concepts, so I also need help finding solutions to problems.

There are three sub-indicators on the first problem-solving indicator, namely problem visualization. The first sub-indicator is identifying information that is known in the form of meaningful narratives or images. This first sub-indicator can be seen in statements 1 and 2 in Figure 1. Based on Figure 1, it is known that in statements 1 and 2, students respond more in agreement with successive percentages of 75% and 73%. It shows that most students already feel able to identify information from an event and turn it into a meaningful narrative or image. In addition, the second sub-indicator of problem visualization is to state precisely the question or problem to be solved. This second sub-indicator can be seen in statement 3 in Figure 1. Student responses to statement 3 also showed that 72% agreed to be able to state the problem precisely. Whereas for the third sub-indicator, which is reflected in statements 4 and 15, identifying a physics approach that might be useful for solutions, there is a slight difference. In negative statements 4 and 5 in Figure 1, it would be seen that the percentage difference is not much difference between agree and strongly agree with disagree and strongly disagree. In the statements of 4 students, 6% strongly agree, 36% agree, 45% disagree, and 13% strongly disagree. Moreover, in statement 15, 4% of students strongly agree, 34% agree, 53% disagree, and 9% strongly disagree. However, both have a slightly higher percentage of disagreeing and strongly disagreeing than the percentage of agreeing and strongly agreeing. It shows that many students still need help identifying a physics approach that might be useful for solving a problem.

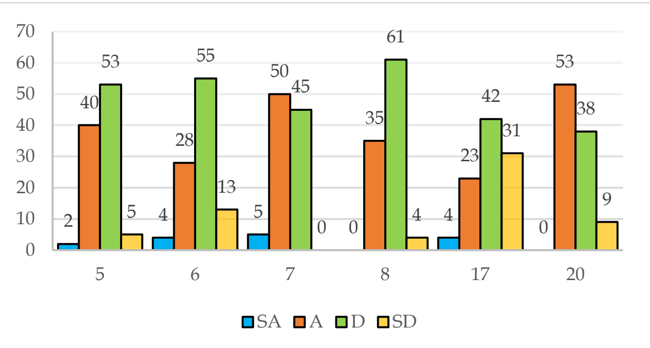


Figure 2. The results of the questionnaire on the first indicator of problem-solving skills are a description of the problem in the description of physics

Note:
SD : Strongly Disagree
D : Disagree
SA : Strongly Agree
A : Agree
5 : By looking at natural phenomena, reading or listening to the narrative of an event, I can identify the physical quantities acting on the incident.
6 : I still need help distinguishing the dependent, independent, and control variables.
7 : I still need help representing the data through diagrams or graphs.
8 : I can easily tell sequentially the combination of concepts, equations or physical laws contained in an incident.
17 : I can only memorize formulas but often need to learn how to apply them.
20 : Solving problems with physics concepts will complicate the situation.

There are also three sub-indicators on the second problem-solving skill indicator, namely, describing the problem with a physical description. The first sub-indicator is to identify the physical quantities and variables involved in the problem. To identify the physical quantities of students' problem-solving skills reflected in statement 5 in Figure 2, the results of student responses are 2% strongly agree, 40% agree, 53% disagree, and 5% strongly disagree. It shows that more students still need help to identify the physical quantities that exist in events or problems that exist in everyday life. Most students can determine the control, independent, and response variables, shown by the results of student responses to negative statements 6. As many as 4% of students feel strongly agree, 28% agree, 55% disagree, and 13% strongly disagree. It further confirms that students need to become more familiar with the physical quantities around them. Figure 3 the results of the questionnaire on the first indicator of problem-solving skills are a solution plan.

The second sub-indicator of the problem description with the physics description is to create meaningful diagrams or graphs according to the chosen physics approach. It can be reflected in negative statement 7, which received positive and negative responses from students who were not much different. As many as 5% of students answered strongly agree with the statement, 50% agreed, 45% disagreed, and no students stated strongly disagree. It shows that more students feel they can convert data into diagrams or graphs, and quite a few still need help.

Moreover, the last sub-indicator, namely compiling equations, principles, or laws of physics, as well as constraints in the chosen physics approach, can be reflected in statements 8, 17, and 20. In Figure 2, as many as 61% of students disagree, and 4% strongly disagree with statement 8. It shows that most students still need help to tell the concepts, equations, or laws of physics contained in an event. If we look back at the results in the previous indicators, this might happen because the students still need help determining the physical quantities. Therefore, determining concepts, equations, and even laws of physics in an event and then telling them sequentially will be more difficult. The student's response to statement 7 in Figure 2 contradicts the previous response. As many as 42% of students disagree, and 31% strongly disagree if they can only memorize physics formulas but cannot apply these formulas to a problem. It can be a big question, what kind of application of physics formulas in learning, the form of questions that teachers usually given to students, so they feel they have applied physics formulas but have difficulty identifying physics quantities in solving physics problems in everyday life. This condition is reinforced by student responses to statement 20, which can be seen in Figure 2. From the percentage in statement 20, it is known that more students feel that solving problems with physics solutions will complicate the problem.

Figure 3 reflects the response of students' awareness of their problem-solving skills on the third problem-solving skill indicator, namely, planning solutions. In Figure 3, it can be seen that 48% of students disagree and 7% of students regarding the statement that they can plan problem-solving solutions using a combination of the application of physics concepts learned in school. It is reinforced by student responses to statement 10 in Figure 3 that as much as 49% disagree and 5% strongly disagree with the statement that they can logically analyze a physics problem to find a solution plan for a problem. The results of the two responses indicate that more students than the existing sample find it difficult to determine a plan for solving problems with the help of physics. This result shows what is relevant from the previous results. This problem is in line with previous relevant research conducted by Johnstone et al. (1993), Pol et al. (2009), et al. (2013), Wenno (2015), Pratama et al. (2020), and Rohayah (2022) that students have difficult to solve problems using physics concepts.

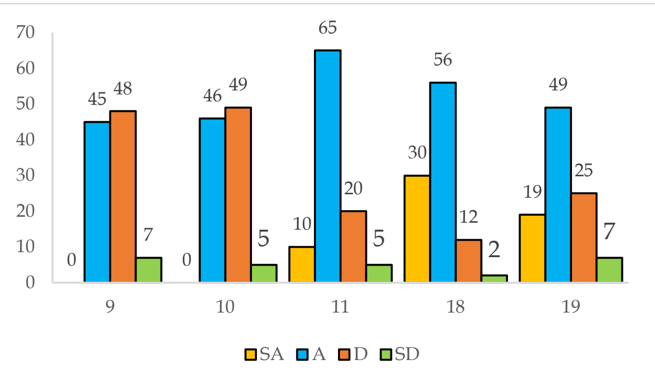


Figure 3. The results of the questionnaire on the first indicator of problem-solving skills are a plan solution

Note:
SD : Strongly Disagree
D : Disagree
SA : Strongly Agree
A : Agree
9 : I can make a plan to solve a problem through a combination of applications of physics concepts that I have learned at school.
10 : I can logically analyze a physics problem that finds a solution to the problem.
11 : It is easier to plan a solution to a problem by utilizing data or mathematical calculations.
18 : Developing strategies for solving problems is better than just finding the right answer.
19 : Memorization is the only way to solve problems.

However, if we see figure 3, in statement 11, 10% of students strongly agree, and 65% of students agree that planning a solution to a problem with the help of data and mathematical calculations helps. In addition to statement 19, 30% of students strongly agree, and 56% of students agree that developing problem-solving strategies to find the correct solution to a problem is better than just knowing that the solution is correct. Based on statement 19, it is known that as many as 19% of students feel strongly agree, 49% agree, 25% disagree, and 7% students strongly disagree that memorizing is the only way to solve the problem. It can illustrate that so far; most students have only relied on memory to solve problems. In line with the results of the previous response that most students are less able to identify physics concepts and solve problems with physics analysis.

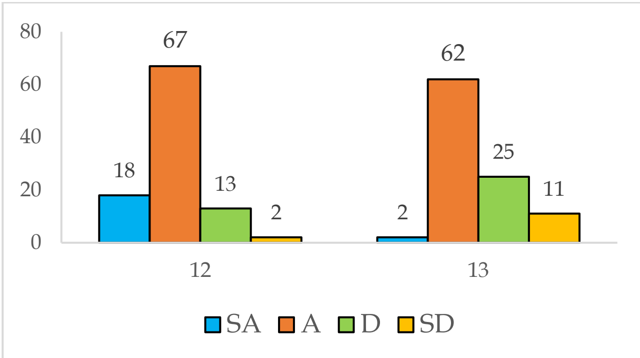


Figure 4. The results of the questionnaire on the indicator of problem-solving skills are implementing the solution plan

Note:
SD : Strongly Disagree
D : Disagree
SA : Strongly Agree
A : Agree
12 : I am used to solving problems following the solution plan that I have planned.
13 : I like solving problems that exist in everyday life by relating them to physics concepts.

The fourth indicator is regarding the implementation of the solution plan. The results can also be seen through the responses to statements 12 and 13 in Figure 4. Through statement 12, it is known that as many as 18% of students strongly agree, and 67% agree that they are used to solving problems following the solution plan I have planned. Moreover, in statement 13, it is known that as many as 2% of students strongly agree, and 62% of students agree that they like problem-solving by associating problems with physics concepts. It shows that although the positive response obtained in statement 13 is as much as in statement 12, many still like learning physics, which helps solve problems.

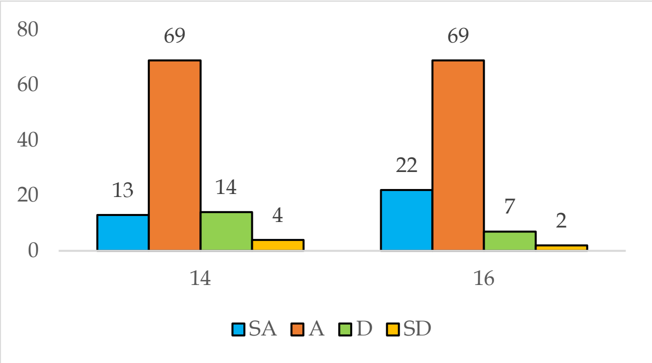


Figure 5. The results of the questionnaire on the first indicator of problem-solving skills is evaluating each problem item

Note:

SD : Strongly Disagree
D : Disagree
SA : Strongly Agree
A : Agree
14 : After solving problems, I often evaluate errors in the solutions to the issues I make
16 : Apart from getting the correct solution, the most important thing is knowing why the answer is valid

Student responses regarding the last indicator of problem-solving skills, namely evaluating each problem item, can be seen in statements 14 and 16 in figure 5. In statement 14 in figure 5, it is known that 13% of students strongly agree and 69% agree that after solving the problem, they are used to it. Evaluate the errors that may occur from the solutions made—furthermore, supported by the response from statement 16 in Figure 5 that the essential part of getting the right solution is knowing why the solution is correct. It can be known at the end of the evaluation. Student responses regarding the statement were 22% strongly agree, 69% agree, 7% disagree, and 2% strongly disagree. From the results of these student responses, it is known that most students know that evaluation is a crucial part of finding out whether the problem-solving solutions that have been made are appropriate or if there are still things that need to be improved.

From the result of a questionnaire of 20 research questions, students related problem solving skills; the following results are obtained in Table 4.

Table 4. Students' Problem-Solving Skill Level from Questionnaire

Value Intervals (%)	Many Students	Category
76-100	0	Very high
51-75	34	high
26-25	21	Medium
<25	0	Low

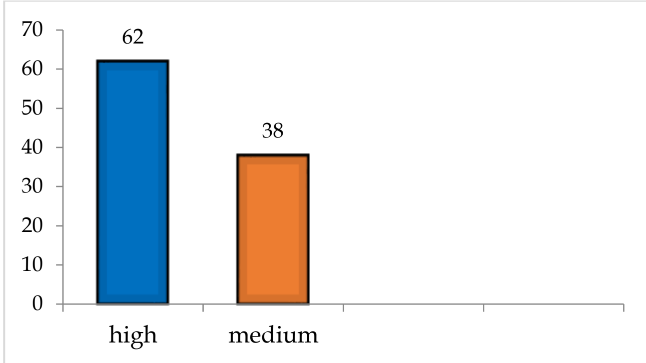


Figure 6. Percentage of students' problem-solving skills from questionnaire

From the data in Table 4, it is known that the comparison of the percentage of students' problem-solving skills form questionnaire can be seen in Figure 6. Based on Figure 6, it is known that students feel that they can do problem solving quite well. It is represented by the percentage of problem-solving skills, namely 62% high and 38% medium. But another result from a question by problem-solving instrument test in a case study on daily physics, knowing that like Table 5.

Table 5. Students' Problem-Solving Skill Level from Question by Problem Solving Instrument Test in Case Study on Daily Physics

Value intervals (%)	Many Students	Category
76-100	4	Very high
51-75	10	high
26-25	32	Medium
<25	9	Low

From the data in Table 5, it is known that the comparison of the percentage of students' problem-solving skills form a question by problem-solving instrument test in a case study on daily physics can be seen in Figure 7.

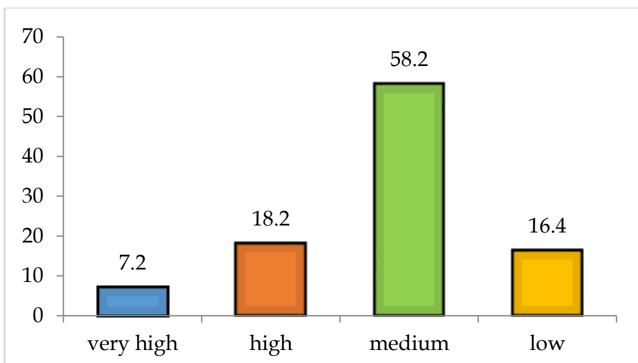
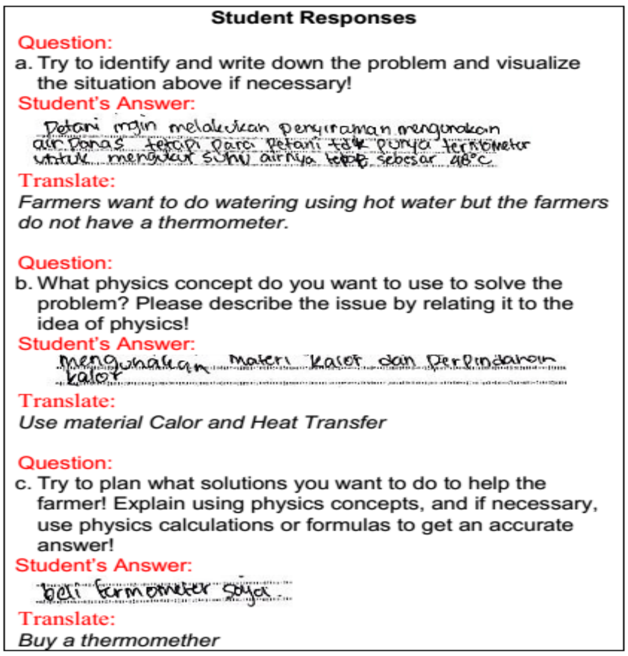


Figure 7. Percentage of Students' Problem-solving skills from question by problem-solving instrument test in case study on daily physics

Based on Figure 7, it can be seen that there is a difference between the percentage of students' problem-solving skills using questionnaires and test questions. In the questionnaire, the student's problem-solving skills tended to be high, but when the test results were carried out with questions based on physics case studies in everyday life, there was a decrease in the students' problem-solving skills. Students' problem-solving skills tend to be at the medium level, and even 17% of students have low problem-solving skills. However, some students have high skills of 18% and very high skills of 7%.

Based on the test results above, it is known that there is a difference between the level of students' problem-solving skills by questionnaire and students' problem-solving skills by test using a problem-solving test instrument. It might happen because students' existing problem-solving skills usually differ from the problem-solving skills questions given. Students still need to get used to working on problem-solving skills closely related to the context of physics in everyday life. It can be seen from how students answer the questions, as shown in Figure 8.


Student Responses

Question:
a. Try to identify and write down the problem and visualize the situation above if necessary!
Student's Answer:
Petani ingin melakukan penyiraman menggunakan air panas tetapi para petani tidak punya termometer untuk mengukur suhu airnya tetap sebesar 48°C
Translate:
Farmers want to do watering using hot water but the farmers do not have a thermometer.

Question:
b. What physics concept do you want to use to solve the problem? Please describe the issue by relating it to the idea of physics!
Student's Answer:
Menggunakan materi kalor dan perpindahan kalor
Translate:
Use material Calor and Heat Transfer

Question:
c. Try to plan what solutions you want to do to help the farmer! Explain using physics concepts, and if necessary, use physics calculations or formulas to get an accurate answer!
Student's Answer:
beli termometer saja
Translate:
Buy a thermomether

Figure 8. Example of student's response on first question.

First question on figure 8, as shown in table 3 for the method section, it is known that students have yet to be able to solve problems with physics solutions. Most of them have been able to solve part questions, namely identifying and writing problems. However, for question part b, regarding the description of the physics concept, the answer to the physics concept given is still too general. In the statement, one part b should be re-explained, namely taking advantage of the fluid nature of alcohol. Alcohol which expands quickly because alcohol is thermometric material (Young et al., 2012). Heat from the water can be transferred to the alcohol container by conduction and heat from the container is transferred to alcohol. Conduction is the process of heat transfer by molecular motion, supplemented in some cases by the flow of free electrons and lattice vibrations, through a body (solid, liquid, or gas) from regions of high temperature to regions of low temperature (Yener et al., 2008). The elaboration of this physics concept affects the planning of problem-solving solutions. It can be seen from the student responses in Figure 8, namely the solution to the problem that students generally give is "buying a thermometer". This response shows that the physics concept that is generally understood results in students' confusion. Finally, students need help to provide solutions following the chosen physics concept.

Based on the physics concept, the solution to the problem can be solved by:
1. Preparing a clear bottle with a scale,
2. Fill the bottle with coloured alcohol,
3. Preparing plasticine to attach the bottle to the water container without touching the container,
4. Measure the boiling and freezing points by measuring boiling water and ice cubes.

Then use equation 2 (Halliday et al., 2011) to determine the scale measured on the thermometer is precisely 48°C.

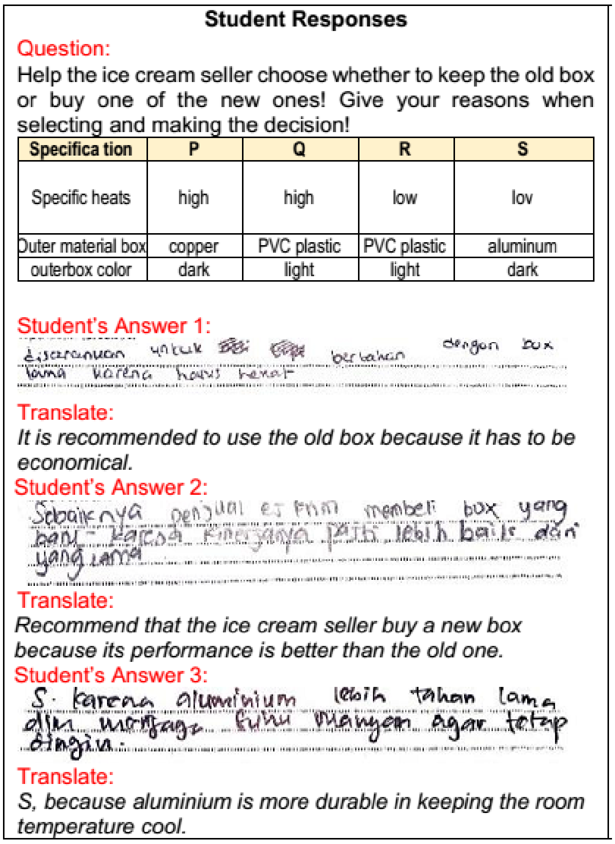
$$\frac{X-X_b}{X_d-X_b}=\frac{Y-Y_b}{Y_d-Y_b} \quad (2)$$

Where,

X	=	Measurement point corresponding to 48°C on the thermometer being made
X_b	=	Freezing point of thermometer X
X_d	=	Boiling point of thermometer X
Y		Measurement point of 48°C
Y_b		Freezing point of thermometer in Celsius scale (0°C)
Y_d	=	Boiling point of thermometer in Celsius scale (100°C)

Students' problem-solving skills can also be seen through student responses in Figure 9 regarding the last question, as shown in Table 3.

Based on the answers of students 1, 2 and 3 in Figure 9 above, it is known that students still need help to relate to the answers and evaluate based on the physics concepts they have learned in class IX. Both answers 1 and 2 do not reflect any relation to the concept of physics. Answer 3 also mentions the relationship between the type of material and temperature. According to physics, students have yet to explain the concept of specific heat, the color of the box, and its effect on temperature. The box that should be chosen is the R box because it has low specific heat, is made of PVC plastic. Bright color makes the box easy to cool, does not absorb heat quickly from its surroundings and is easier to carry (Wu et al., 2021). In addition, PVC plastic is a poor conductor of heat (Karayildirim et al., 2006).



Student Responses

Question:

Help the ice cream seller choose whether to keep the old box or buy one of the new ones! Give your reasons when selecting and making the decision!

Specifica tion	P	Q	R	S
Specific heats	high	high	low	lov
Outer material box	copper	PVC plastic	PVC plastic	aluminum
outerbox color	dark	light	light	dark

Student's Answer 1:

disarankan untuk berbahan dengan box lama karena harus hemat

Translate:

It is recommended to use the old box because it has to be economical.

Student's Answer 2:

Sebaiknya penjual es krim membeli box yang baru karena kinerjanya pasti lebih baik dari yang lama

Translate:

Recommend that the ice cream seller buy a new box because its performance is better than the old one.

Student's Answer 3:

S. karena aluminium lebih tahan lama dalam menjaga suhu ruangan agar tetap dingin.

Translate:

S, because aluminium is more durable in keeping the room temperature cool.

Figure 9. Example of student's response on last question

Conclusion

The research concludes a difference between students' problem-solving skills through questionnaires and the results of students' problem-solving skills through tests with skill-based questions. Through analysis of research data in the results and discussion section, known that most students feel they can apply the concepts and formulas of physics in problems with an average skill percentage of 38% and 62% high. However, this percentage decreased when students were given problems in the context of physics in everyday life. Based on the test results, it is known that 17% of students are at a low level, 58% medium, 18% high and 7% very high. It can happen if the problems that are usually given in learning or the context of learning given are not the context of physics in everyday life. Therefore, the author's suggestion from this research is that teachers are more active in learning and physics problems in everyday life. It helps train students' problem-solving skills using physics concepts in everyday life.

References

Ainiyah, Q., Yuliati, L., & Parno, P. (2020). Analisis penguasaan konsep dan kesulitan belajar materi alat-alat optik pada siswa kelas XI MAN Tuban. *Jurnal Riset Pendidikan Fisika*, *5*(1), 24–29. https://journal2.um.ac.id/index.php/jrpf/article/view/15904

Asrizal, A., Amran, A., Ananda, A., & Festiyed, F. (2018). Effectiveness of Adaptive Contextual Learning Model of Integrated Science by Integrating Digital Age Literacy on Grade VIII Students. *IOP Conference Series: Materials Science and Engineering*, *335*(1). https://doi.org/10.1088/1757-899X/335/1/012067

Bao, L., & Koenig, K. (2019). Physics education research for 21st century learning. *Disciplinary and Interdisciplinary Science Education Research*, *1*(1). https://doi.org/10.1186/s43031-019-0007-8

Becerra-Labra, C., Gras-Martí, A., & Martínez Torregrosa, J. (2012). Effects of a Problem-based Structure of Physics Contents on Conceptual Learning and the Ability to Solve Problems. *International Journal of Science Education*, *34*(8), 1235–1253. https://doi.org/10.1080/09500693.2011.619210

Destalia, L., Suratno, S., & Aprilya, S. (2014). Peningkatan keterampilan pemecahan masalah dan hasil belajar melalui penerapan pembelajaran berbasis masalah (PBM) dengan metode eksperimen pada materi pencemaran lingkungan. *Pancaran Pendidikan*, *3*(4), 213–224. https://jurnal.unej.ac.id/index.php/pancaran/article/view/1003

Fischer, H. E., & Kauertz, A. (2021). *Physics Tasks BT - Physics Education* (H. E. Fischer & R. Girwidz (eds.); pp. 231–267). Springer International Publishing. https://doi.org/10.1007/978-3-030-87391-2_9

Halliday, & Resnick. (2011). *Fundamentals of Physics* (10th editi). John Wiley & Sons, inc.

Harskamp, E., & Ding, N. (2006). Structured Collaboration versus Individual Learning in Solving Physics Problems. *International Journal of Science Education - INT J SCI EDUC*, *28*, 1669–1688. https://doi.org/10.1080/09500690600560829

Haryanto, P. C., & Arty, I. S. (2019). The Application of Contextual Teaching and Learning in Natural Science to Improve Student's HOTS and Self-efficacy. *Journal of Physics: Conference Series*, *1233*(1). https://doi.org/10.1088/1742-6596/1233/1/012106

Ignjatović, M. (2006). Historical review of the development of military medical corps--part 1. *Vojnosanitetski Pregled. Military-Medical and Pharmaceutical Review*, *63*(4), 415–423.

https://scindeks-clanci.ceon.rs/data/pdf/0042-8450/2006/0042-84500604415I.pdf

Ince, E. (2018). An Overview of Problem Solving Studies in Physics Education. *Journal of Education and Learning*, *7*(4), 191. https://doi.org/10.5539/jel.v7n4p191

Jatmiko, B., Widodo, W., Martini, Budiyanto, M., Wicaksono, I., & Pandiangan, P. (2016). Effectiveness of the INQF-based learning on a general physics for improving student's learning outcomes. *Journal of Baltic Science Education*, *15*(4), 441–451. https://doi.org/10.33225/jbse/16.15.441

Johnstone, A. H., Hogg, W. R., & Ziane, M. (1993). A working memory model applied to physics problem solving. *International Journal of Science Education*, *15*(6), 663–672. https://doi.org/10.1080/0950069930150604

Karayildirim, T., Yanik, J., Yuksel, M., Saglam, M., Vasile, C., & Bockhorn, H. (2006). The effect of some fillers on PVC degradation. *Journal of Analytical and Applied Pyrolysis*, *75*(2), 112–119. https://doi.org/10.1016/j.jaap.2005.04.012

Koponen, I., & Nousiainen, M. (2013). Pre-service physics teachers' understanding of the relational structure of physics concepts: Organising subject contents for purposes of teaching. *International Journal of Science and Mathematics Education*, *11*(2), 325–357. https://doi.org/10.1007/s10763-012-9337-0

Malik, R. S. (2018). Educational Challenges in 21St Century and Sustainable Development. *Journal of Sustainable Development Education and Research*, *2*(1), 9. https://doi.org/10.17509/jsder.v2i1.12266

Mendez Hinojosa, L. M., Rodriguez, M. C., & Ortiz Paez, C. A. (2020). Measurement of metacognition: Adaptation of metacognitive state inventory in Spanish to Mexican university students. *European Journal of Educational Research*, *9*(1), 413–421. https://doi.org/10.12973/eu-jer.9.1.413

Mestre, J. P., Docktor, J. L., Strand, N. E., & Ross, B. H. (2011). Conceptual Problem Solving in Physics. In *Psychology of Learning and Motivation - Advances in Research and Theory* (Vol. 55). Elsevier Inc. https://doi.org/10.1016/B978-0-12-387691-1.00009-0

Pol, H. J., Harskamp, E. G., Suhre, C. J. M., & Goedhart, M. J. (2009). How indirect supportive digital help during and after solving physics problems can improve problem-solving abilities. *Computers and Education*, *53*(1), 34–50. https://doi.org/10.1016/j.compedu.2008.12.015

Pratama, N. D. S., & Sakdiyah, H. (2020). Analisis Kesulitan Siswa dalam Memecahkan Masalah Fisika pada Masa Pandemi COVID-19. *Prosiding Seminar Nasional Fisika6.0*, *6*(0), 63–70. http://proceedings.upi.edu/index.php/sinafi/article/view/1248

Reddy, M. V. B., & Panacharoensawad, B. (2017). Students Problem-Solving Difficulties and Implications in Physics: An Empirical Study on Influencing Factors. *Journal of Education and Practice*, *8*(14), 59–62. https://eric.ed.gov/?id=EJ1143924

Rennie, L. J., & Parker, L. H. (1996). Placing Physics Problems in Real-Life Context: Students' Reactions and Performance. *Australian Science Teachers Journal*, *42*(1), 55–59. https://search.informit.org/doi/abs/10.3316/aeipt.71579

Rohayah, D. (2022). Analisis Kemampuan Pemecahan Masalah Pada Pembelajaran Kimia. *Jurnal Wahana Pendidikan*, *9*(2), 107. https://doi.org/10.25157/wa.v9i2.8243

Sarwi, S., Ellianawati, E., & Suliyanah. (2019). Grounding physics and its learning for building global wisdom in the 21st century. *Journal of Physics: Conference Series*, *1171*(1). https://doi.org/10.1088/1742-6596/1171/1/012001

Scarlatos, L. (2013). Book Review: The One World Schoolhouse: Education Reimagined. In *Journal of Educational Technology Systems* (Vol. 41, Issue 4). https://doi.org/10.2190/et.41.4.g

Serway, R. a., & Jewett, J. W. (2008). Physics for Scientists and Engineers with Modern Physic, 7 ed. *Brooks/Cole*, *Cengage Le*, 739(1215).

Siswanto, Karimullah, Prasetyawati, R., & Nurhayati. (2019). Environmental cultured education and its implication on the student's competencies in an adiwiyata school. *Cakrawala Pendidikan*, *38*(3), 552–564. https://doi.org/10.21831/cp.v38i3.23154

Susilowati, Sajidan, & Ramli, M. (2017). Analisis keterampilan berpikir kritis siswa madrasah aliyah negeri di Kabupaten Magetan. *Prosiding SNPS (Seminar Nasional Pendidikan Sains)*, *21*(2000), 223–231. https://jurnal.fkip.uns.ac.id/index.php/snps/article/view/11417

Syafril, S., Aini, N. R., Netriwati, Pahrudin, A., Yaumas, N. E., & Engkizar. (2020). Spirit of Mathematics Critical Thinking Skills (CTS). *Journal of Physics: Conference Series*, *1467*(1). https://doi.org/10.1088/1742-6596/1467/1/012069

Wenno, I. H. (2015). The Correlation Study of Interest at Physics and Knowledge of Mathematics Basic Concepts towards the Ability to Solve Physics Problems of 7th Grade Students at Junior High School in Ambon Maluku Province, Indonesia. *Education Research International*, *2015*, 1–6. https://doi.org/10.1155/2015/396750

Wu, X., & Fu, C. (2021). Near-field radiative heat transfer between uniaxial hyperbolic media: Role of volume and surface phonon polaritons. *Journal of Quantitative Spectroscopy and Radiative Transfer*, *258*. https://doi.org/10.1016/j.jqsrt.2020.107337

Yener, Y., & Kakac, S. (2008). *Heat Conduction* (4th Editio). Taylor & Franciss Group. https://doi.org/https://doi.org/10.1201/9780203752166

Young, H. D., & Freedman, R. A. (2012). *University Physics with Modern Physics* (N. Whilton, C. Madhavan, L. Kenney, S. Le, & C. Benson (eds.); 13th Editi). Jim Smith.