

DESCRIPTION OF STUDENTS' CRITICAL THINKING ABILITY OF URBAN SCHOOL IN PHYSICS MATERIAL

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Abstract :

Critical thinking skills must be applied to students to evaluate information in the future. This study aims to describe students' critical thinking abilities in several Jambi and Lankaran schools in temperature and heat. The research method is mixed with a sample of 248 students in Jambi and Lankaran schools. The instruments used to collect quantitative data were essay questions that would be distributed to students. In contrast, qualitative data were obtained from interviews and supported by documentation studies relevant to the research topic. To analyze the data is done with SPSS-assisted descriptive statistics. The results obtained show students' critical thinking skills are high. The limitation of this research is that it only looks at students' critical thinking skills on temperature and heat. So that further research can add variables so that the results can be compared in more depth.

Keywords: Critical thinking skill, Learning physics, Students

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INTRODUCTION

Education has an important role in shaping individuals and society. As time goes by, life in the 21st century is marked by various significant changes and developments, especially as a result of technological advances, globalization, and social change. (Ramdani et al., 2020; Rawung et al., 2021). Technological developments and social changes that have occurred in this century have affected the way education is delivered, accessed, and implemented (Astalini et al., 2018; Nahak, 2019). According to Mardhiyah et al (2021); Prayogi & Estetika (2019); Somantri (2021), several important things that have happened in high school education in the 21st century, namely, the role of technology is getting bigger (textbooks have been replaced by digital books, blackboards have been replaced by projectors), project-based learning is routinely carried out to improve student skills. High school education in the 21st century continues to adapt to changing times and global needs.

At the high school level, one of the lessons that will be needed for the future is physics learning. Physics learning should aim to cultivate scientifically literate individuals who have an understanding of science content, can draw conclusions from scientific problems and know how to evaluate scientific cases (Khery et al., 2022). Applying a scientific approach allows physics learning to be achieved well. As for the steps of learning physics that apply a scientific approach according to

Siregar et al (2020) namely: observing, questioning, gathering information/trying out, processing information, and communicating. Until now, learning physics has entered the 21st century era which demands scientific literacy skills in facing future challenges.

Turning to the country of Azerbaijan, the physics learning profile cited from the study Shafiyeva (2021), the application of tests to learning is carried out as an assessment of student knowledge which is common in various countries. The test does not consider students with different learning abilities and treats them as equals, which may be disadvantageous to some students. In addition, teachers are pressured to ensure their students pass exams, leading to an excessive focus on the topics that are likely to be assigned rather than the entire curriculum. Assessment methods should enable students to debate, compare and analyze ideas through critical thinking, questioning, and understanding in order to apply the knowledge learned into real life. Thus, the importance of inquiry-based curriculum and assessment is emphasized.

Physics is a branch of natural science that studies the properties and behavior of matter, energy, and their relationship to forces and motion. Physics learning at the senior high school level aims to develop students' understanding of the basic principles of physics (Gasila et al., 2019; Priyadi et al., 2019; Sinaga et al., 2022). Students are invited to associate physics concepts with everyday life situations or natural phenomena that they experience (Fadhila & Kalsum, 2020; Khairunnisa et al., 2019; Monika et al., 2018). This helps students see the relevance of physics in their lives and strengthens their understanding of these concepts (Darmaji et al., 2022). That way, the involvement of critical thinking skills will also be honed in understanding the concept.

Critical thinking ability is a very important cognitive skill for students in the modern era. In this era of abundant information, students are faced with various sources of information (Aldila et al., 2023; Jamaluddin et al., 2020; Pentianasari et al., 2022). Critical thinking skills enable them to critically evaluate information, distinguish between facts and opinions, identify biases, and assess the reliability of information sources (Deke et al., 2022; Rahmi & Azrul, 2022; Usman et al., 2021). Through critical analysis and evaluation, students can explore deeper meanings, identify relationships between different concepts, and build strong and sustainable knowledge (Chusni et al., 2022; Khastini et al., 2021). These abilities are not only relevant in educational contexts, but also in everyday life and future careers.

Previous research conducted by Jamaludin et al (2022), aims to determine the effect of the inquiry-discovery learning model on students' critical thinking skills and students' mastery of physics concepts in the subject matter of temperature and heat. This encourages current research with the aim of updating it to find out the achievement of students' critical thinking skills in the provinces of Jambi and Lankaran. The variables used in this study were students' thinking skills on temperature and heat in several high schools in the provinces of Jambi and Lankaran. The limitation of this research is that it only looks at critical thinking skills in physics subject matter temperature and heat, so that for further research it can add variables to be studied and update the research location so that the results can be compared.

RESEARCH METHOD

This study uses mixed research methods. By combining quantitative and qualitative research will get stronger results. This is supported by a sequential explanatory research design. The sequential explanatory research design is quantitative data reinforced by qualitative data. In a sequential explanatory research design, the initial phase of the research is carried out using quantitative research methods to collect data broadly and produce general findings.

The quantitative data is analyzed and interpreted in advance to provide a broader understanding of the research topic. Furthermore, the next stage is the use of qualitative research methods to dig deeper and explain the findings that emerge from the analysis of quantitative data. Qualitative research methods can involve interviews, observation, or content analysis to gain an in-depth understanding of the phenomenon being studied (Ergul & Dogan, 2022). According to (Kibirige et al., 2022) the sequential explanatory research design is suitable for use in situations where the researcher wants to gain a more complete and in-depth understanding of the research topic.

This research was conducted at several schools in the provinces of Jambi (Indonesia) and Lankaran (Azerbaijan). The choice of the research location was intended so that the results obtained could be compared based on gender and country. The place of the research can be seen in table 1.

Table 1. School data

School name	The number of students
State Senior High School 6 Jambi City	65
State Senior High School 8 Jambi City	62
Lankaran City School	60
Secondary School-Lyceum	61

The sampling technique in this study was purposive sampling. Purposive sampling is a method or sampling technique in research that is carried out purposively with a specific purpose. In this method, researchers select participants or sample units based on certain considerations that are relevant to the research objectives. Unlike the random sampling method, which selects a random sample to represent the population, purposive sampling is based on the researcher's considerations regarding the characteristics, expertise, experience, or information possessed by the individual or group being sampled (Laila et al., 2021). The purpose of using purposive sampling is to select the most informative, representative, or relevant participants in the research context.

Sampling based on purposive sampling technique conducted in Indonesia and Azerbaijan involved the following stages/processes:

1. Determination of research objectives: Researchers must understand the research objectives to be achieved by using purposive sampling method. Research objectives will affect the selection of relevant sample subjects. The purpose of this study was to describe students' critical thinking skills on temperature and heat at the senior high school level.
2. Identification of inclusion and exclusion criteria: The researcher must identify inclusion criteria (characteristics that must be possessed by subjects to be included in the sample) and exclusion criteria (characteristics that must be avoided in selecting subjects). This criterion will assist researchers in selecting subjects according to research objectives.
3. Subject selection: After the inclusion and exclusion criteria have been established, the researcher will select subjects that fit these criteria. Subject selection can be done in various ways, such as through observation, interviews, or document analysis.
4. Examination and verification: After the subject is selected, the researcher will check and verify whether the subject meets the predefined inclusion criteria. If there are subjects who do not meet the criteria, these subjects will be removed from the sample.
5. Data analysis: After the sample subjects are selected, the researcher will collect relevant data from these subjects. This data will then be analyzed according to the research objectives.

The research procedure carried out with a sequential explanatory research design makes the implementation stages different. Mixed research with quantitative & qualitative methods is divided into several stages as presented in figure 1 below.

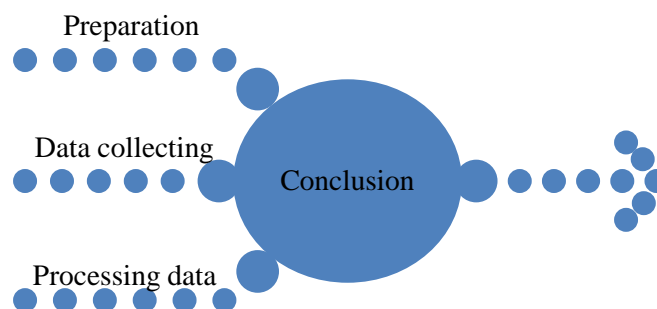


Figure 1. The procedure for carrying out the research

This research begins with quantitative methods followed by qualitative methods. This is done so that quantitative data can be strengthened by qualitative data. The preparatory phase begins with preparing the research site, determining the sample, designing the instrument to be used in collecting quantitative data through essay question sheets and qualitative data through interviews and relevant documentation studies. Furthermore, data collection was carried out at several schools in Jambi and Lankaran. After getting the results, they are processed and analyzed based on descriptive statistics using SPSS. In the final stage after getting the results analyzed, conclusions are drawn to prove the initial purpose of conducting the research.

In this study, in collecting data, different research instruments were used/adjusted to the type. The quantitative method utilizes essay sheets distributed to the research samples involved. Meanwhile, the qualitative method to strengthen the quantitative data was applied to interviews with teachers who teach physics subjects, then a study of the relevant documentation was also carried out. The indicators for the essay questions that will be included in the questions can be seen in table.

Table 2. Indicator critical thinking skills

Category	Indicator	Question number
Give a simple explanation	Ask and answer questions	2
Build basic skills	Assessing the results of observations	5
Draw conclusions	Do deduction, deduce logically	3
Make further explanations	Defining terms, defining content	4
Set strategy	Decide on an action, determine a way out	1

The indicators that will be used in designing essay questions will place students at several levels of achievement of these abilities. The achievement categories can be seen in table 3.

Table 3. Critical thinking ability level category

Percentage (%)	Levels
$81.25 < x \leq 100.0$	Very high
$71.50 < x \leq 81.25$	High
$62.50 < x \leq 71.50$	Currently
$43.75 < x \leq 62.50$	Low
$0.0 < x \leq 43.75$	Very low

As for the data processing technique with descriptive statistics, namely statistics used to analyze data by describing or describing the data that has been collected as it is without intending to make general conclusions or generalizations. In this study the data was processed with the help of IBM SPSS Statistics 25. There are several data sizes that will be generated through descriptive statistical analysis, namely mean, min, median and max. These measures have different uses such as the mean which describes the average value or the most commonly occurring value in a data set and provides an idea of the center of distribution of the data and can be used for various purposes of analysis and comparison (Prisuna, 2021). Min is used to identify the lowest value in the data. It provides information about the lower bound of the data range. By looking at the minimum value, we can identify whether there is a value that is very low or far below other values. These values can be considered as outliers that need attention. The median is the middle value in an ordered data set. The median is often used as a better alternative to the mean when the data contains outliers or the data distribution is not symmetrical, the median is also used to divide the data into two equal parts, namely the lower quartile and the upper quartile (Auliah et al., 2021). Maximum is the highest value in a data set. Max is used to identify the highest value in the data. It provides information about the upper bound of the data range.

RESULTS AND DISCUSSION

Critical thinking ability is the ability to analyze, evaluate, and interpret information carefully and rationally. This involves the ability to question assumptions, construct logical arguments, recognize fallacies in thinking, and reach deeper understanding (Istiningsih, 2016; Wahjusaputri & Nastiti, 2022). Critical thinking involves the ability to solve problems systematically, use relevant evidence, and make decisions based on intelligent thinking. It also involves the ability to recognize biases and different perspectives, as well as the ability to communicate effectively with others in order to gain a better understanding (Asamoah, 2022; Gastreich & Milakovic, 2017). The ability to think critically is an important intellectual skill in many contexts, including education, the world of work, and everyday life.

Overall, critical thinking skills are important in education because they help students develop deep understanding, problem-solving skills, analytical skills, independent learning, preparation for the world of work, and communication skills (Usman et al., 2021). In an ever-evolving and complex world, the ability to think critically is an invaluable skill for students to be successful in their lives. Based on the data that has been processed, the results of the critical thinking skills of students of State Senior High School 6 Jambi City and State Senior High School 8 Jambi City in terms of indicators of critical thinking ability can be seen in table 4.

Table 4. Description of students' critical thinking abilities in Jambi

School	Interval	Category	F	%	Mean	Med	Min	Max
State Senior High School 6 Jambi City	$81.25 < x \leq 100.0$	Very high	17	19.2	56	60	44	82
	$71.50 < x \leq 81.25$	High	33	66.7				
	$62.50 < x \leq 71.50$	Currently	6	8.3				
	$43.75 < x \leq 62.50$	Low	3	2.7				
	$0.0 < x \leq 43.75$	Very low	6	2.1				
State Senior High School 8 Jambi City	$81.25 < x \leq 100.0$	Very high	12	15.7	68	45	44	82
	$71.50 < x \leq 81.25$	High	23	70.0				
	$62.50 < x \leq 71.50$	Currently	10	4.9				
	$43.75 < x \leq 62.50$	Low	10	6.3				
	$0.0 < x \leq 43.75$	Very low	7	3.1				

Through the table it can be seen that in State Senior High School 6 Jambi City students' critical thinking skills are achieved and included in the very high category at a frequency of 17 people with a percentage of 19.2%, high category with a frequency of 33 people with a percentage of 66.7%, currently in the category of frequency 6 people with a percentage of 8.3%, low category with a frequency of 3 people with a percentage of 2.7%, and very low category with a frequency of 6 people with a percentage of 2.1%. Meanwhile, in State Senior High School 8 Jambi City students' critical thinking skills were achieved and included in the very high category at a frequency of 12 people with a percentage of 15.7%, high category with a frequency of 23 people with a percentage of 70.0%, currently in the category of 10 people with a percentage 4.9%, low category with a frequency of 10 people a percentage of 6.3%, and very low category with a frequency of 7 people a percentage of 3.1%. Furthermore, the data that has been processed with indicators of students' critical thinking skills at Lankaran City School and Secondary School-Lyceum are presented in table 5 below.

Table 5. Description of students' critical thinking abilities in Azerbaijan

School	Interval	Category	F	%	Mean	Med	Min	Max
Lankaran City School	$81.25 < x \leq 100.0$	Very high	15	23.6				
	$71.50 < x \leq 81.25$	High	20	49.7				
	$62.50 < x \leq 71.50$	Currently	10	21.5	45	63	50	85
	$43.75 < x \leq 62.50$	Low	8	3.8				
	$0.0 < x \leq 43.75$	Very low	7	1.4				
Secondary School-Lyceum	$81.25 < x \leq 100.0$	Very high	11	22.8				
	$71.50 < x \leq 81.25$	High	19	53.1				
	$62.50 < x \leq 71.50$	Currently	13	17.1	40	60	50	85
	$43.75 < x \leq 62.50$	Low	8	2.8				
	$0.0 < x \leq 43.75$	Very low	10	4.2				

Through the table it can be seen that at Lankaran City School students' critical thinking skills were achieved and included in the very high category at a frequency of 15 people with a percentage of 23.6%, high category with a frequency of 20 people with a percentage of 49.7%, currently in the category of 10 people with a percentage of 21.5%, low category with a frequency of 8 people a percentage of 3.8%, and very low category with a frequency of 7 people a percentage of 1.4%. Meanwhile, in the Secondary School-Lyceum students' critical thinking skills were achieved and included in the very high category at a frequency of 11 people with a percentage of 22.8%, in the high category with a frequency of 19 people with a percentage of 53.1%, currently in the category with a frequency of 13 people with a percentage of 17.1%, the low category with a frequency of 8 people is a percentage of 2.8%, and a very low category with a frequency of 10 people is a percentage of 4.2%. To support the processing of quantitative data, interviews were also conducted with students at State Senior High School 6 Jambi City, State Senior High School 8 Jambi City, Lankaran City School, and Secondary School-Lyceum.

The results of interviews with students on the variable critical thinking skills indicator ask and answer questions were carried out by students in class when the teacher explained the material and gave directions to do practicum or project work. Indicator assessing the results of observations is carried out when students are doing project work on temperature and heat material, then logically deduction indicators are carried out when students process the results data they get when doing research together with study groups. Whereas in the indicator defining terms, defining content is carried out when students compile results and discuss the teaching material provided by the teacher, and the indicator decide on an action, determine a way out is carried out when students determine and find information obtained through the explanation of teaching material by the teacher.

Applied critical thinking skills in students have a variety of significant positive impacts. According to Heeg & Avraamidou (2021); Saykili (2019), here are some of the positive impacts that can occur:

1. Development of analytical thinking: Critical thinking skills help students develop strong analytical abilities. They learn to analyze information carefully, understand its context, and identify valid arguments. This helps them become more trained thinkers and able to construct arguments based on relevant evidence.
2. Improved problem-solving skills: Critical thinking involves the ability to break down complex problems into smaller parts, identify possible solutions, and evaluate the effectiveness of these solutions. Students who are skilled in critical thinking can face challenges more confidently and find better solutions.
3. Development of decision-making skills: Critical thinking helps students develop good decision-making skills. They learn to evaluate various options, weigh the consequences of each choice, and make rational decisions based on the available evidence. This is useful in various aspects of life, both inside and outside the academic environment.
4. Improved argumentation skills: With critical thinking skills, students can learn how to compose and deliver strong arguments. They learn to back up their opinions with sound reasons, relevant

evidence, and consistent logic. This improves their overall communication skills, both orally and in writing.

5. Development of independence and self-confidence: Critical thinking involves the ability to question information, explore multiple points of view, and develop deeper understanding. Students who are skilled in critical thinking become more independent in their thinking and have greater confidence in facing problems and making decisions.
6. Encourages creativity: Critical thinking involves creative and innovative thinking. Students who are skilled in critical thinking can see unusual relationships between ideas, combine different concepts, and create unique solutions. Critical thinking skills stimulate imagination and open the door to greater creative potential.

Overall, the application of critical thinking skills to students has a broad positive impact, preparing them to better face life's challenges. These abilities are not only relevant in an academic context, but are also important for personal development, wise decision-making and the ability to adapt to constantly changing in a complex world.

Previous research on critical thinking skills has been carried out by Arisoy & Aybek (2021), this study used Mathematics subjects. And this was updated in this study by using Physics subject on temperature and heat material to determine students' critical thinking skills. This research is also updated from more diverse research sites so that the results obtained are varied and valid. The limitation of this study is that it only looks at students' critical thinking skills on temperature and heat material so that the research focus is well measured. Therefore, recommendations can be given for further research in order to expand the variables and change the location so that the results obtained can be compared in more depth.

CONCLUSION

The results showed that the students' critical thinking skills in the material temperature and heat averaged in the high category. The importance of having critical thinking skills for students is to improve and prepare students to study and absorb information received both in friendship, education and family environments, especially in this era of increasingly rapid globalization.

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