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Teacher and student perception of integrated science literacy in information, technology, and environment

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ABSTRACT

The development of technology and information in the 21st century is increasing rapidly. Meanwhile, Indonesia's science literacy levels remain categorized as low. Science literacy is among the most essential skills in the 21st century, so integrated technology, information, and environment are fundamental. This research aims to understand the perception of teachers and students towards science literacy integrated with technology, information, and environmental literacy in Junior High Schools (SMP). This research falls under the quantitative category and employs an observational descriptive design. The sample in this study consists of three junior high schools in the Indramayu Regency, representing the Indramayu region's western, central, and eastern regions. The questionnaire instrument determines students' science literacy ability towards information, technology, and the environment. Meanwhile, interviews were used to determine teachers' and students' perceptions of information-based science literacy, technology, and the environment. The research data were obtained using both questionnaires and interview instruments. The study results reveal that the integration of science literacy with information, technology, and the environment achieved percentages of 69.42% for information-integrated science literacy, 70.98% for technology-integrated science literacy, and 73.89% for environment-integrated science literacy, highlighting varying levels of proficiency across these domains. This indicates a moderate ability to integrate science literacy effectively.

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Environment, Information, Science literacy, Students and teachers, Technology.

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INTRODUCTION

Science literacy-based learning is essential in the 21st century. Science literacy is one of the most critical 21st-century skills. Therefore, science literacy is the main focus of 21st-century education. Indonesia's literacy skills are included in the low category based on the PISA score, which is still below the average for OECD countries. The low science literacy skills of students are not without reason. Many internal and external factors influence students' low science literacy. Science teachers need to fully understand science learning, leading to students' science literacy formation. (Setyaningsih et al., 2018).

According to Pertiwi et al (2018), developing scientific literacy is essential in education to increase knowledge. Biology learning is one of the forums for developing scientific literacy. In biology

learning, students are invited to foster an attitude of curiosity through the scientific process of direct observation to exploit the truth and construct theories, concepts, and laws (Usman, 2017). In addition, assessment is considered one of the problems in education. The assessments applied tend to use tests at the LOTS level, namely the cognitive level of the C1-C3 domain (Irvika et al., 2021). So, students need to be trained to answer questions based on scientific literacy. Meanwhile, the scientific literacy assessment instrument provides an understanding of scientific concepts and methods and the impact of technology and science on the environment.

Scientific literacy is one of the keys to success in facing the challenges of modern development (Sutrisna, 2021). In scientific literacy, students are trained to understand scientific concepts and processes and utilize science to solve problems in everyday life. So that students not only understand concepts or theories but can also apply them in everyday life. According to PISA 2018, scientific literacy is the ability to engage with issues related to science and with scientific ideas as reflective citizens (OECD, 2019). The science education students obtain is a provision for their present and future lives. Students' inability to learn scientific literacy will negatively impact their future (Mayasari & Paidi, 2022).

Indonesia's scientific literacy skills based on PISA 2018 data have decreased compared to the 2015 PISA results, which were 396, far below the OECD average score of 489, ranking 70th out of 78 countries (OECD, 2019). Based on the level of ability of the PISA assessment criteria, around 40% of Indonesian students reach level 2 or higher in science (OECD average 78%) (OECD, 2019). Indonesia's scientific literacy skills are in the low category. Several factors can influence this. Namely, students have yet to become accustomed to solving questions based on scientific literacy, and the question instruments that train students' scientific literacy are unavailable. Students are more accustomed to memorizing learning materials than learning materials, so they need help understanding and applying them in everyday life. Most teachers know and assume that science literacy is essential in schools (Limiansih et al., 2024), while according to Yuliana et al (2023) that, teachers think that science literacy has a significant influence on student learning outcomes. This aligns with Sudirman et al. (2024), who state that digital and science literacy activities positively enhance digital competencies among teachers and students. The novelty of this literacy research is that it is integrated with information, technology, and the environment.

METHOD

This study is a quantitative descriptive study with a survey method, describing information that occurs in the field about students' scientific literacy skills based on teacher and student perceptions. This study determines students' and teachers' perceptions of integrated scientific literacy of information, technology, and the environment. The subjects of this study were all junior high school science teachers and junior high school students throughout Indramayu Regency who were determined by Proportional Random Sampling, namely a technique for taking proportions to obtain representative samples, taking subjects from each stratum or region defined in a balanced or comparable manner (Arikunto, 2010). So, the research subjects were obtained, namely SMPN 1 Anjatan, SMPN 1 Lelea, and SMPN 1 Sindang. The instruments used in this study were questionnaire instruments and interview sheets. The questionnaire instrument determined students' scientific

literacy regarding information, technology, and the environment. Interviews were used to determine teachers' and students' perceptions of integrated scientific literacy of information, technology, and the environment. Data analysis of the interview results was done using data reduction, data presentation, and drawing conclusions. Meanwhile, the distribution of the questionnaire instrument was processed in the form of descriptive percentages. The formula used is as follows:

$$\text{Percentage score} = \frac{\text{Total Score}}{\text{The highest number of respondent's score}} \times 100\% \quad (1)$$

The score results are interpreted in the following categories:

Table 1. Questionnaire instrument data categorization

Percentage	Category
85% –100%	Very Good/Very High
69%–84%	Good/High
53% – 68%	Quite Good/Average
37% –52%	Poor/Low
20%–36%	Very Poor/Very Low

(Arikunto, 2013)

Figure 1 shows the researches flow in this study. Questionnaire Instrument Data Categorization.

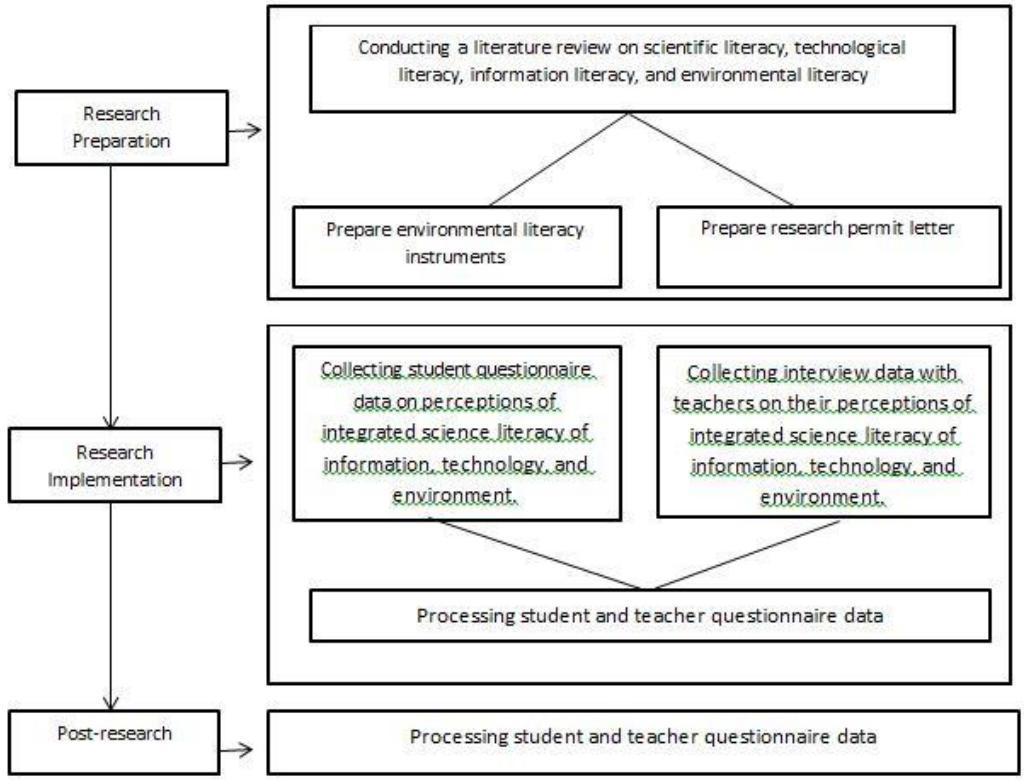

Figure 1. Research Flow

RESULTS AND DISCUSSION

The research on teacher and student perceptions was conducted in three schools at the Junior High School level; SMPN 1 Anjatan, SMPN 1 Lelea, and SMPN 1 Sindang. The teacher perceptions in question were reviewed from the perspective of junior high school Natural Sciences (IPA) teachers on integrated science literacy of information, technology, and the environment. The percentage of

achievement of science literacy skills towards information, technology, and the environment is explained descriptively based on the test score criteria set by Arikunto (2013) presented in Figure 2.

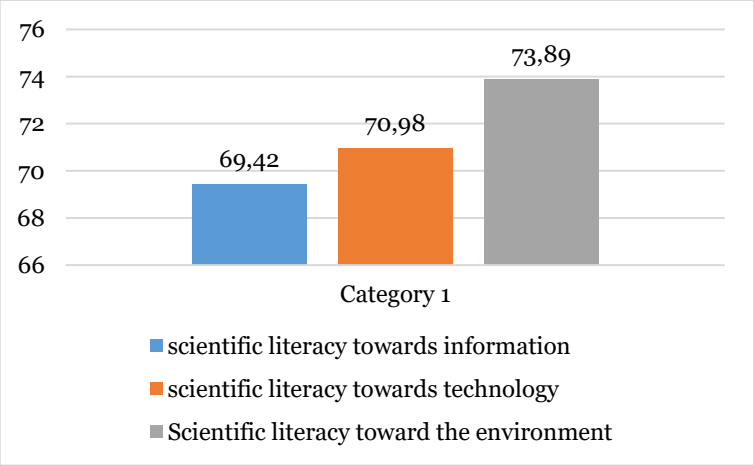

Figure 2. Graph of percentage of students' science literacy skills towards information, technology and the environment

A descriptive analysis was conducted to determine students' scientific literacy skills in information, technology, and the environment. Based on Figure 2, students with scientific literacy skills are in the high category for information, technology, and the environment. However, the highest presentation was in the section on students' scientific literacy towards the environment, which was 73.89%, while students' scientific literacy skills towards information had the smallest percentage, which was 69.42%. This is because most students use and utilize technology through their smartphones. Therefore, it will never be possible to be separated from technological developments in the current era. In addition, according to Sadia (2015), there is an interrelation and interdependency between science, technology and society. Students' overall scientific literacy skills in the three schools were obtained based on student questionnaires. The results of scientific literacy toward information are described in Table 2.

Table 2. Data on percentage of student literacy towards information

No.	Indicator	Percentage	Category
1.	Reading table data	79,23	High
2.	Understanding table data	75,77	High
3.	Explaining table data in descriptive form	67,31	High
4.	Giving responses to table data information	69,62	High
5.	Reading graphs	74,23	High
6.	Understanding graphs	74,23	High
7.	Explaining graphs in descriptive form	63,85	Average
8.	Giving responses to graph data	64,23	Average
9.	Reading charts	75,38	High
10.	Understanding charts	73,85	High
11.	Explaining charts in descriptive form	60,77	Average
12.	Giving responses to charts	70,00	High
13.	Understanding information from teaching materials	74,23	High
14.	Explaining information and solutions from teaching materials in narrative form	64,62	Average
15.	Giving responses to information and solutions	67,69	Average
16.	Understanding information from article analysis	71,15	High
17.	Explaining information and solutions from article analysis in narrative form	62,31	Average
18.	Explaining information and solutions from analysis in learning	60,38	Average
19.	Giving responses to information and solutions in learning	71,92	High

Table 2 shows students' perceptions of scientific literacy toward information. Students' scientific literacy abilities towards information are mainly in the high category, 12 out of 19. However, of the 12 numbers, the one with the highest percentage is reading table data at 79.23%.

Meanwhile, seven numbers are included in the medium category. Among the seven numbers, the lowest rate is about explaining information and solutions from analysis in learning, at 60.38%. From the table, students find it easier to understand and express information from table data in narrative form than data in graphs and other forms. Therefore, students can easily understand several forms of information, namely tables, graphs, charts, and narratives. However, students still need help pressing the information obtained in other forms. For example, students are still in the medium category when explaining graphs in descriptive form. This is also in line with the results of teacher interviews, which showed that students find it challenging to describe graphs in descriptive form. Only 30% of students can express and explain information in tables. Several factors can cause this, including needing more student knowledge in explaining graphs, tables, and charts in descriptions (Mustain, 2015). Therefore, information technology can be obtained, but not all information can be understood by all groups. Thus, information literacy is critical when facing challenges in the digital era (Rusdiyanti et al., 2023).

Figure 3. Mentimeter forms of information and sources of information obtained by students

Based on Figure 3, all forms of information students obtain come from textbooks available at school. According to Ningsih (2015), with the help of textbooks, students can absorb lesson materials faster than without textbooks. This is supported by the opinion of Rohani et al. (2020) that textbooks provide information that can expand students' knowledge and give a more concrete learning experience so that they can stimulate students' thinking to be more critical and develop further into positive things if learning resources are arranged, designed and prepared correctly. For students, information sourced from the Internet is rarely accessed due to network constraints, and some students need smartphones. Look for journals related to information sourced from the Internet that is more up-to-date. According to Tobing, changes in libraries, books, and other printed media have made the Internet a source of accessible and up-to-date information. This is in line with the opinion of Reza & Nora (2022) that information on the Internet is constantly increasing and developing. The update is very helpful in getting complete and up-to-date information, which benefits its users.

The Internet is a technology that cannot be separated in today's era. Technological information cannot be separated from the development of the times. In this study, students often use several easy-to-access and understand applications such as YouTube, WhatsApp, and Google Classroom. For students, YouTube is an exciting literacy media because the information presented is in the form of audiovisuals with a display adjusted to technological developments. Suwarto et al (2021) stated that through YouTube, many activities are carried out, such as uploading videos, searching for videos, watching videos, discussing/asking questions about videos, and, at the same time, sharing video clips for free. Likewise, with the WhatsApp application, there are features that teachers can use to communicate with students online (Hakim et al., 2022).

In addition to these two applications, Google Classroom is also used in learning. Google Classroom is a free platform created to facilitate the learning activities of educators and students (Sewang, 2017). Google Classroom is an application that allows the formation of classes in cyberspace (Utami, 2019). Google Classroom is a free platform created to facilitate the learning activities of educators and students (Sewang, 2017). According to Agustina & Hidayati, (2020), Google Classroom has benefits, including distributing assignments, submitting assignments, uploading learning materials and videos, and assessing assignments. In addition, according to Dewi & Afriansyah (2022) in Google Classroom, there can be interaction between teachers and students in the comments column, and each student can take attendance before learning begins. In addition to using several platforms, which are technological developments, the environment can also be used as a source of scientific literacy. The data on student literacy towards technology is presented in Table3.

Table 3. The percentage of scientific literacy towards technology

No.	Indicator	Percentage	Category
1.	Understanding computer software and hardware	71,15	High
2.	Using computer software and hardware	71,15	High
3.	Using computer software and hardware in Biology learning	70,00	High
4.	Giving feedback on the development of Biology learning technology	70,77	High
5.	Understanding android applications	79,23	High
6.	Using android applications	82,31	High
7.	Using android applications in Biology learning	86,15	Very High
8.	Giving feedback on the development of Android applications	76,15	High
9.	Understanding IT-based presentation applications	69,23	High
10.	Using IT-based presentation applications	68,08	Average
11.	Using IT-based presentation applications in Biology learning	65,00	Average
12.	Giving feedback on the development of presentation applications	69,23	High
13.	Understanding E-Learning applications	66,15	Average
14.	Using E-Learning applications	65,00	Average
15.	Using E-Learning applications in Biology learning	60,77	Average
16.	Giving feedback on E-Learning applications	65,38	Average

Student perceptions of student science literacy towards technology Based on Table 3, there is 1 number that is included in the very high category, namely using Android applications in Biology learning. Meanwhile, eight numbers that are included in the high category include understanding computer hardware and software, using computer software and hardware, using computer software and hardware in Biology learning, providing responses to the development of biology learning technology, understanding android applications, using android applications, providing responses to

the development of android applications, understanding IT-based applications, providing responses to the development of IT-based presentation applications.

Meanwhile, seven numbers have a medium category, namely using IT-based presentation applications, IT-based presentation applications in biology learning, understanding E-learning applications, E-learning applications in biology learning, and responding to E-Learning applications. However, the lowest percentage of using E-Learning applications in Biology learning is 60.77%. This can be caused by most students having androids that are easy to access anytime and anywhere. The centimeter data can be seen in Figure 4.

Figure 4. Mentimeter of scientific literacy towards technology

There are several technologies that educators use both in learning media and as assignments. The technology is internet-based, as presented in Figure 4. The figure shows some information technology (IT) used. Of the several IT used, there are three forms: YouTube, WhatsApp, and Google Classroom. Students widely access the three information technologies via smartphones, which students use more than laptops, Chromebooks, or tablets. This is because many students have smartphones compared to other technology media; besides that, students understand smartphone applications (android) better than they understand E-learning applications. This is also shown in Table 4, where students use more Android applications in Biology learning, a very high category with a percentage of 86.15. Meanwhile, students' perceptions of scientific literacy towards the environment are presented in Table 4.

Science literacy is related to the environment (Yanti, 2022). The environment is one of the sources of learning science literacy for students. Based on Table 4, 3 numbers have a medium category out of 15 numbers, namely providing solutions from the results of identification and analysis of environmental issues, explaining, providing responses to knowledge of physical and ecological systems of the environment, and providing responses to knowledge of physical and environmental systems of the environment. However, those with the highest category are 12 numbers with the most significant percentage, namely understanding strategic actions towards the environment at 81.54%. Students think responding to the physical and ecological environment is more accessible than just seeing and understanding the environment. Some of the environments used as science literacy for students can be seen in Figure 5.

Table 4. Table of percentage of environmental science literacy

No.	Indicator	Percentage	Category
1.	Understanding strategic actions towards the environment	81,54	High
2.	Providing participation and strategic actions toward the environment	79,62	High
3.	Providing positive responses to strategic actions toward the environment	75,38	High
4.	Understanding solutions to environmental problems	76,15	High
5.	Understanding and finding solutions to environmental problems	79,23	High
6.	Providing responses and solutions to environmental problems	73,08	High
7.	Understanding the identification and analysis of environmental issues	71,15	High
8.	Explaining the results of the identification and analysis of environmental issues	70,38	High
9.	Providing solutions from the results of the identification and analysis of environmental issues	67,69	Average
10.	Understanding the cultural, social, and political systems in the surrounding environment	78,08	High
11.	Preserving the cultural, social, and political systems in the surrounding environment	77,69	High
12.	Responding to cultural, social, and political systems in the surrounding environment	71,92	High
13.	Understanding knowledge of physical and ecological systems of the environment	72,69	High
14.	Explaining responding to knowledge of physical and environmental systems of the environment	65,00	Average
15.	Responding to knowledge of physical and ecological systems of the environment	68,85	Average

The environment can be used as a source of learning for students and science literacy for students. Based on the picture, five environments are most often used as sources of science literacy in schools: the schoolyard, school garden, field, school front yard, and school garden. Through the environment, students can understand and find solutions to environmental problems; this is also based on the students' science literacy abilities towards the environment. Namely, 79.23% of students can understand and find solutions to environmental issues.

Figure 5. Mentimeter of scientific literacy towards the environment

The environment is a place where various events and phenomena occur that can be learned by students. According to Suryada & Paramadhayaksa (2017), environmental literacy is a conscious effort to act realistically based on understanding, skills, attitudes, and concern about various principles of sustainable ecological life. In this study, the environment that many students use for scientific literacy is the environment around the school. The environment around the school is accessible for students to observe and understand (Kristyowati & Purwanto, 2019). In addition to the natural environment, students also use the Internet as a source of scientific literacy. The Internet is

an alternative that can be used for scientific literacy. This is because students can easily access a lot of information on the Internet. However, some obstacles or constraints arise in accessing the Internet, such as no quota, weak signal, and not all students having smartphones or other supporting tools to access the Internet.

CONCLUSION

Based on the results and discussion, it can be concluded that students' and teachers' perceptions of integrated scientific literacy skills of information, technology, and the environment have respective percentages, namely 69.42% for integrated scientific literacy of information, 70.98% for scientific literacy towards technology, and 73.89% for scientific literacy towards the environment.

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