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Creative Thinking-Oriented Students' Scientific Literacy Skills: Preliminary Study

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Abstract: This research is a descriptive quantitative that aims to determine the understanding of science teachers and students' knowledge in solving creative thinking-oriented scientific literacy questions. The instruments used in this research were a teacher interview questionnaire and creative thinking-oriented scientific literacy essay questions. Teacher interview data were analyzed using a descriptive percentage, and student test results were analyzed using descriptive statistics by calculating the average percentage score for creative thinking-oriented scientific literacy skills based on scientific literacy indicators and creative thinking indicators. The results of the analysis show that 83.33% of teachers still rarely and almost never use scientific literacy and creative thinking assessments in science learning. Meanwhile, in the results of the analysis of the students' test data, the average percentage for the scientific literacy indicator was 22.86% and the creative thinking indicator was 23.23% with the predicate of very poor and in the low category. Thus, it can be concluded that the understanding of junior high school science teachers in Langsa City in developing creative thinking-oriented scientific literacy assessments is still low. This has an impact on the students' abilities, which show that the creative thinking-oriented scientific literacy skills are classified as very poor in the low category.

Keywords: Creative thinking; Scientific Literacy; Skills

Introduction

Science literacy is one of the skills that students must have in 21st century learning among 16 other skills that have been formulated by the World Economic Forum (World Economic Forum, 2015). Scientific literacy is the ability to understand and use scientific knowledge in overcoming global problems related to nature and making decisions based on scientific evidence and scientific considerations (Pratiwi et al., 2019). Students who have scientific literacy skills can contribute actively in solving problems in society and have high attitudes and sensitivity towards themselves and their environment (Rustaman, 2017).

Scientific literacy is measured globally through the PISA (*Program for International Student Assessment*) assessment organized by the OECD (*Organization for Economic Cooperation and Development*) every 3 years (Putri, 2021). Indonesian students have participated since 2000 and as a result the scientific literacy skills of Indonesian students are always in the low category. The average Indonesian student achieves level 2 or higher in science (OECD average: 78%). Several studies that identified students' scientific literacy skills in Aceh also found that students' scientific literacy skills were still categorized at a low level (Kamil et al., 2021; Dwisetiarezi & Fitria, 2021; Suparya et al., 2022). The reason for the low scientific literacy of students in Aceh is that teachers do not understand the characteristics of scientific literacy, how to design and implement science learning oriented towards increasing scientific literacy, as well as teachers' difficulties in designing scientific literacy assessments (Kamil et al., 2021).

PISA establishes a scientific literacy assessment framework that includes context, knowledge and process (competency) domains. Science processes or

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competencies include the ability to explain phenomena scientifically, evaluate and design scientific investigations, and interpret data and evidence scientifically (Khery et al., 2022). The scientific process refers to the mental process of planning problem solving which requires creative thinking skills to find the best solution from a variety of answers (Rusdi et al., 2017). Scientific literacy is closely related to creative thinking skills. The development of scientific literacy assessments should be oriented towards creative thinking skills to support aspects of scientific literacy in the science process domain.

Research into the development of creative thinking assessment instruments in recent years is still separate from scientific literacy skills instruments which are equally feasible (Putra et al., 2021). Research is generally still limited to finding out the relationship between creative thinking skills and scientific literacy (Rusdi et al., 2017) or to look at the scientific literacy profile and scientific literacy skills of students (Ning et al., 2020). Therefore, the development of scientific literacy assessment instruments oriented towards creative thinking skills is urgently needed. Before developing a scientific literacy assessment instrument oriented towards creative thinking skills, researchers need to conduct a preliminary study to determine teachers' knowledge and understanding regarding scientific literacy assessment oriented towards creative thinking skills and how to develop it. Apart from that, students' initial abilities in solving scientific literacy questions oriented towards creative thinking skills also need to be known. This research is a preliminary study which aims to identify teachers' understanding and scientific literacy skills oriented towards students' creative thinking skills in the city of Langsa.

Method

The type of research used is quantitative descriptive research. The type of quantitative research consists of survey methods and experimental methods, but in this research the quantitative method chosen is a survey type quantitative method. The data were analyzed using a descriptive percentage formula. The research instruments used were teacher interview questionnaires and scientific literacy tests oriented towards creative thinking skills in science learning in the form of essays totaling 10 questions. This research involved 82 class VIII students to complete test questions and interview questionnaires with 6 science teachers from 3 junior high schools in Langsa City who were taken using purposive sampling. The research was carried out in August 2023. Next, based on the results of student tests and teacher interview questionnaires, they were analyzed and categorized based on high, medium and low intervals.

The scientific literacy indicators oriented towards creative thinking skills used as instrument questions in this research are presented in Table 1.

Table 1. Indicators of scientific literacy, creative thinking and question numbers

Scientific Literacy Indicators	Creative Thinking Indicators	Question No
Explain scientifically	Think fluency	3. 7
Explain scientifically	Think flexibly	9
Interpret data and evidence scientifically	Thinking assesses	4
Interpret data and evidence scientifically	Think original	10
Interpret data and evidence scientifically	Think flexibly	5
Evaluate and design scientific inquiry	Think flexibly	6
Evaluate and design scientific inquiry	Thinking assesses	1. 2
Identify scientific issues	Think original	8

The composition of questions based on scientific literacy indicators is presented in Table 2.

Table 2. Scientific literacy indicators and question numbers

Scientific Literacy Indicators	Question No
Explain scientifically	3. 7. 9
Interpret data and evidence scientifically	4. 5. 10
Evaluate and design scientific inquiry	1. 2. 6
Identify scientific issues	8

The composition of questions based on indicators of creative thinking ability is presented in Table 3.

Table 3. Indicators of creative thinking and question numbers

Creative Thinking Indicators	Question No
Think fluency	3. 7
Think flexibly	5. 6. 9
Thinking assesses	1. 2. 4
Think original	8. 10

To determine students' level of scientific literacy oriented towards creative thinking skills, student test results are analyzed by comparing the scores obtained by students with the maximum score for the overall questions and per question indicator. The formula for calculating it is as follows:

$$N = \frac{skor\ yang\ diperoleh}{skor\ maksimum} \times 100\ \% \quad (1)$$

The criteria for the level of scientific literacy oriented towards students' creative thinking skills can be seen in Table 4.

Table 4. Level of scientific literacy oriented towards creative thinking abilities.

Percent Value (%)	Predicate	Categories
86-100	Very good	High
76-85	Good	
60-75	Enough	Currently
55-59	Not enough	Low
<54	Very less	

Source: (Nurfadillah, et al., 2023)

Results and Discussion

Results

Based on the analysis of the answers to the science teacher's understanding questionnaire regarding the scientific literacy assessment oriented towards creative thinking skills, the following results were obtained:

Knowledge about assessment for learning, scientific literacy and creative thinking

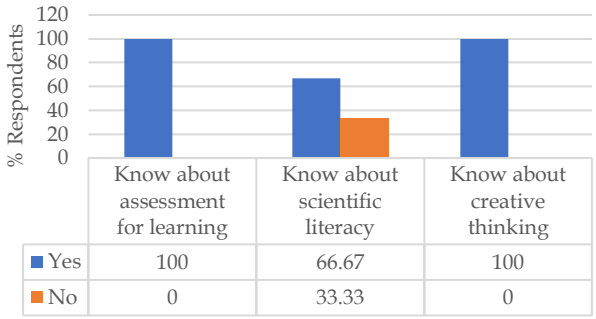

Figure 1. Teacher knowledge about assessment for learning, scientific literacy and creative thinking

From Figure 1, it can be seen that 100% of respondents know about assessment for learning and creative thinking skills, while only 66.67% of respondents know about scientific literacy.

Frequently used assessment techniques

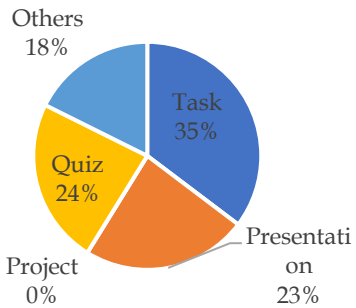

Figure 2. Frequently used assessment techniques

Based on Figure 2, teachers have used various types of assessment, the most dominant of which is using tasks.

Use of scientific literacy and creative thinking assessments

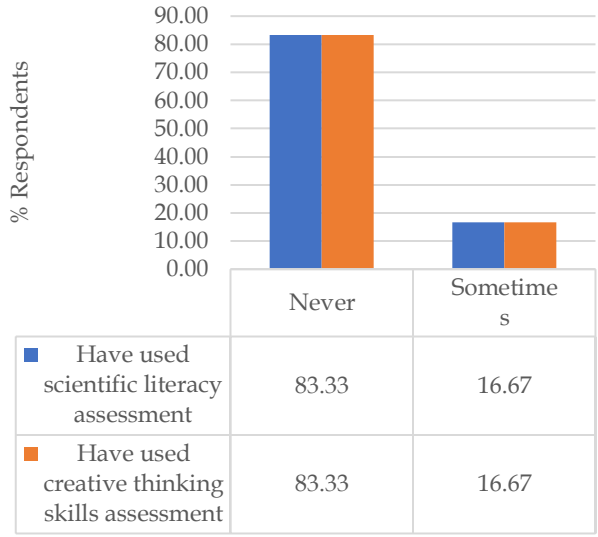

Figure 3. Use of scientific literacy and creative thinking assessments

Based on Figure 3, the use of scientific literacy assessments and creative thinking is rarely and almost never used by teachers in science learning.

The importance of developing creative thinking-oriented scientific literacy assessments

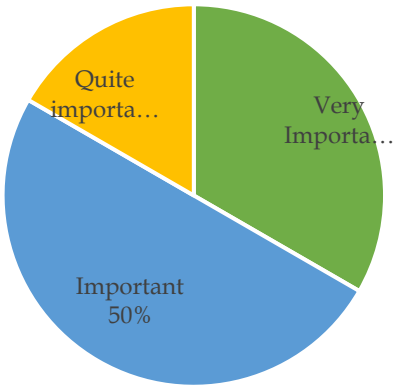

Figure 4. The importance of developing creative thinking-oriented scientific literacy assessments

Based on Figure 4, 33% of respondents answered that developing creative thinking skills-oriented scientific literacy assessments was very important, 50% answered important and the other 17% answered quite important.

Based on the analysis of students' answers to the 10 questions tested, the following results were obtained:

1. *Creative Thinking Skills* -oriented *Science Literacy* skills in students based on Scientific Literacy Indicators

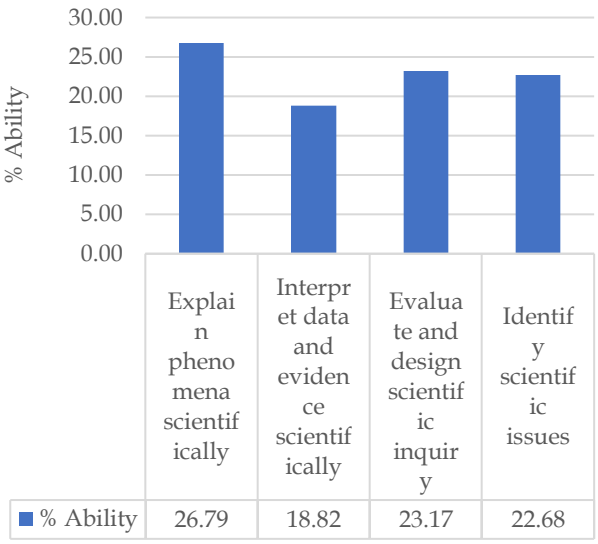

Figure 5. *Creative Thinking Skills* -oriented *Science Literacy* skills in students based on Scientific Literacy Indicators

Based on Figure 5, students' creative thinking skills-oriented scientific literacy skills are based on scientific literacy indicators with the highest percentage, namely the indicator of explaining phenomena scientifically at 26.79% and the lowest is the indicator for interpreting data and evidence scientifically with a gain of 18.82% . Overall the average percentage is 22.86%, including the predicate of very less in the low category.

2. Science Literacy skills are oriented towards Creative Thinking Skills in students based on Creative Thinking Indicators

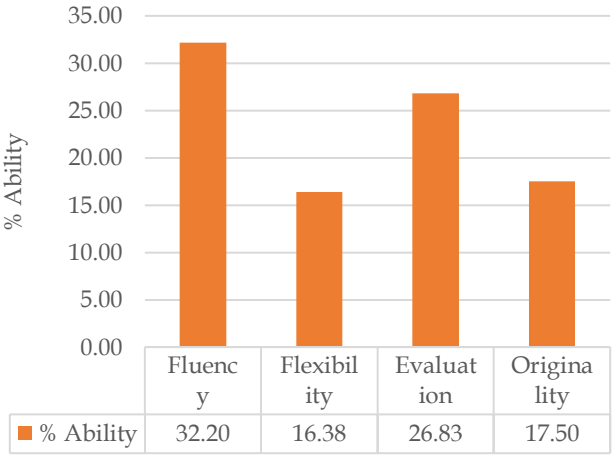

Figure 6. Creative Thinking Skills-oriented Science Literacy skills in students based on Creative Thinking Indicators

Based on Figure 6, students' creative thinking skills-oriented scientific literacy skills are based on creative thinking indicators with the highest percentage, namely the fluency indicator of 32.20% and the lowest on the flexibility indicator with a gain of 16.38%. Overall, the average percentage is 23.23%, including the predicate very less in the low category.

Discussion

The results of the teacher understanding questionnaire show that teachers still rarely or almost never use scientific literacy and creative thinking assessments because teachers do not yet understand how to develop these assessments. This course has a big impact on students' ability to solve problems related to this matter in the future, because students are never faced in their daily learning process in class by teachers with model questions like this.

Assessment techniques that are often used by teachers in the classroom learning process are by giving assignments to students, presentations, projects, quizzes and so on. Thus, teachers believe that it is very important to dåevelop scientific literacy assessments oriented towards creative thinking skills. This is because, by developing a scientific literacy assessment oriented towards creative thinking skills, it can help teachers in terms of efficiency and effectiveness over time because there is already a collection of questions that match these criteria and can be directly applied in learning without having to carry out further feasibility testing. Apart from that, it also broadens teachers' understanding of creative thinking skills-oriented scientific literacy assessments.

As a result of the actions of teachers who have never trained students in working on scientific literacy and creative thinking questions, this results in low students' scientific literacy and creative thinking abilities. This is proven by research results which show that students' creative thinking skills-oriented scientific literacy skills based on scientific literacy indicators and creative thinking indicators are classified as very less in the low category.

Many studies show that the scientific literacy abilities of junior high school students are still relatively low, such as the results of Putri's (2021) research in one of the schools in Bengkulu province which found that students' overall scientific literacy abilities and each indicator of scientific literacy was in the very low category.

There are many factors that cause students' low scientific literacy skills, especially if the scientific literacy questions are oriented towards creative thinking skills. Some of the causes are students' low interest in reading, students are not used to questions in the form of discourse, diagrams, graphs and pictures (Hasasiyah, et al., 2020). Decontextualized learning is also the cause of students' low scientific literacy abilities. Students are unable to relate scientific knowledge to phenomena that occur in the world (Fuadi et al., 2020).

The reason for the low scientific literacy of students in Aceh is that teachers do not understand the characteristics of scientific literacy, how to design and implement science learning oriented towards increasing scientific literacy, as well as teachers' difficulties in designing scientific literacy assessments (Kamil et al., 2021). Teacher competence in developing creative thinking skills-oriented scientific literacy questions needs to be improved so that teachers can design and use these assessments and familiarize students with scientific literacy questions. This can be a solution to improve students' scientific literacy skills. Based on the results of this research, it is recommended that further research be carried out in developing creative thinking skills-oriented scientific literacy assessments, especially in Aceh province.

Conclusion

Based on the research results, it was concluded that the understanding of junior high school science teachers in the city of Langsa, Aceh in developing creative thinking skills-oriented scientific literacy assessments was still low. This has an impact on students' abilities which show that students' creative thinking skills-oriented scientific literacy abilities based on scientific literacy indicators and creative thinking indicators are classified as very less in the low category. The recommendation from the results of this research is that further research is needed to develop a creative thinking skills-oriented scientific literacy assessment and apply this assessment to teachers and students, especially in the province of Aceh.

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Author Contributions
Seprianto: Conceptualization, data collection and data analysis. Coryna Oktaviani: Methodology, data collection, review and editing. Mentari Darma Putri: Instrumentation, validation, data collection, writing-review and editing.

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Conflicts of Interest
The authors declare no conflict of interest.

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