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Student science literacy ability in Basidiomycota material content aspect

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Abstract

This research was conducted in relation to the demands of the 21st century, namely the ability to solve every problem encountered, with the measurement of scientific literacy skills in content aspects can overcome problems in everyday life for students. The research aims to determine scientific literacy skills in aspects of student content on the Basidiomycota topic. This research was conducted at the Biology Department, FMIPA, Medan State University. The population of this study were all 122 students of the Biology Study Program class of 2021 at Medan State University. The sample of this research is 31 people using purposive sampling technique. The research design is quantitative descriptive. The results of research on scientific literacy abilities on aspects of student content on the Basidiomycota topic are in the conceptual science literacy category with an average percentage of 78.02%. The results of this study indicate that the conceptual scientific literacy category of students is still at the stage of understanding the Basidiomycota topic conceptually or in general and does not yet have a specific understanding. These results can be improved by looking for accurate references to journals and books in order to better understand the Basidiomycota topic so that their scientific literacy skills reach the category of multidimensional scientific literacy.

Abstrak

Penelitian ini dilakukan berkaitan dengan tuntutan abad 21 yaitu kemampuan untuk menyelesaikan setiap permasalahan yang dihadapi, dengan adanya pengukuran kemampuan literasi sains pada aspek konten dapat mengatasi permasalahan dalam kehidupan sehari-hari bagi mahasiswa. Penelitian bertujuan untuk mengetahui kemampuan literasi sains pada aspek konten mahasiswa pada topik Basidiomycota. Penelitian ini dilaksanakan di Jurusan Biologi FMIPA Universitas Negeri Medan. Populasi penelitian ini adalah seluruh mahasiswa Program Studi Biologi angkatan 2021 Universitas Negeri Medan yang berjumlah 122 orang. Sampel penelitian ini berjumlah 31 orang dengan menggunakan teknik *purposive sampling*. Desain penelitian ini adalah deskriptif kuantitatif. Hasil penelitian kemampuan literasi sains pada aspek konten mahasiswa topik Basidiomycota dalam kategori literasi sains konseptual dengan persentase rata-rata 78,02%. Hasil penelitian tersebut menunjukkan kategori literasi sains konseptual mahasiswa masih pada tahap mengerti topik Basidiomycota secara konsep atau secara umum dan belum memiliki pemahaman secara spesifik. Hasil tersebut dapat ditingkatkan dengan mencari referensi jurnal dan buku yang akurat agar semakin memahami topik Basidiomycota sehingga kemampuan literasi sainsnya mencapai kategori literasi sains multidimensi.

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A. Introduction

In the 21st century, humans are required to work harder to adapt in all aspects of life, especially in the field of education (Mardhiyah et al., 2021). The key to success in addressing the challenges of the 21st century is "scientific literacy" because individuals who are scientifically literate must be able to solve problems in everyday life and produce useful scientific products (Fadlika et al., 2020). Indonesia must be able to develop a literacy culture as a prerequisite for 21st century life skills through basic literacy (Damaianti et al., 2020). Literacy level determines the quality of human resources (Pratiwi et al., 2019). As we know that the quality of human resources is the main requirement for the progress of a nation (Ekawati, 2018). Human resources will also determine student resilience in facing the 21st century challenges (Muslimin et al., 2020).

Scientific literacy makes a person have the ability in terms of knowledge, understanding scientific concepts, and solving problems or being a problem solver of problems encountered in society or in their daily lives, so that scientific literacy is important to be applied at various levels of education, including in tertiary institutions (Rini et al., 2021). Someone who does not have scientific literacy skills will find it difficult to adapt to increasingly modern technological developments and it is difficult to make decisions about various phenomena that occur in society (Muslihasari et al., 2022). The results of the PISA survey show that Indonesia has experienced a decline in the application of scientific literacy in 2018, namely Indonesia is at level 70 out of 78 countries participating in the field of scientific literacy. Scientific literacy ability has several aspects, one of which is the content aspect. Content or learning topic is a very important component in carrying out learning, because content relates to answers to questions found during learning (Sholeha et al., 2021).

Scientific literacy can be applied to all courses for students (Pujiastutik, 2018), one of the courses that can be analyzed for scientific literacy skills is the Low Level Organisms Taxonomy (TOTR) course. In this course there is Basidiomycota topic. In RPS (Semester Learning Plan) Basidiomycota topic is required to be able to describe principles, classification, nomenclature, identification, description, habitat, ways of breeding and roles in life. The learning achievement is closely related to the content aspect. Aspects of content in scientific literacy can be applied in tertiary institutions in order to achieve the objectives of the learning process, one of the efforts to achieve educational goals and improve the quality Higher education institutions in Indonesia, the government issued Presidential Regulation Number 8 of 2012 concerning the Indonesian National Qualifications Framework (KKNI) which forms the basis for the preparation of the college curriculum. The IQF at Medan State University in its application is by compiling learning outcomes that must be carried out by students in each course taken. The learning achievement is with six mandatory assignments, which consist of Routine Assignments (TR), Critical Book Report (CBR), Critical Journal Review (CJR), Idea Engineering (RI), Projects, and Mini Research (MR) (Dasopang et al., 2022).

Mini research is the application of problem-solving abilities that are owned by each student, this is because research (research) conducted by students requires various abilities to solve problems contained in problem research, formulate hypotheses, plan experiments, collect data, and conclude. So that through this mini research assignment, students can implements their abilities in understanding and exploring the natural surroundings scientifically so as to gain a deeper understanding of science (Hasruddin, 2014). Practicum activities should be able to make students develop several skills, such as thinking skills, problem-solving abilities, and the ability to conduct research as a necessity in the context of an increasingly fast changing world, so that problem-based learning becomes one of the learning concepts in the 21st century (Hamim et al., 2021). Mini research reports done by students in the form of practicum reports. The report is to look at scientific literacy skills in terms of content owned by students (Rasyida, 2022).

Based on the results of initial observations of students of the 2021 biology study program at Medan State University, students stated that they were very happy with the observation/research activities because they could see the object being studied directly. Students have also made observations/research in practicum activities such as observing, collecting, and analyzing data. In working on practicum reports, some students find it difficult to do this due to difficulties in finding sources of information. In understanding Basidiomycota topic, students stated that the topic included contextual topic, because in everyday life they already knew some of the species of Basidiomycota fungi and were able to differentiate between these species. With direct observation of Basidiomycota in everyday life, it is included in the content aspect component, namely being able to describe and explain phenomena that occur in

nature. Observation/research activities carried out by students regarding the topic of Basidiomycota fungi can be set forth in a mini research report, to see students' understanding of scientific literacy aspects of the content they have. This research was conducted because so far there has been no measurement of scientific literacy on content aspects in Basidiomycota topic. Based on the background above, it is important for researchers to conduct research with the title "Student Scientific Literacy Ability In Basidiomycota Materials Content Aspects"

This research is related to research conducted by (Nurhidayah, 2020) entitled "Analysis of Student Science Literacy in Microbiology Courses at Semarang State University", the results of procedural knowledge show a very poor category, while epistemic knowledge is quite good. From this study it can be concluded that it is included in the category that is able to give scientific opinions quite well in solving various scientific problems. Relevant research was also carried out by (Antika & Marpaung, 2023). The scientific literacy of Biology Education students averages 38.67 with very poor criteria. This low scientific literacy ability can also be caused the learning process in lectures does not involve scientific processes. This can be caused by the limited supporting facilities and infrastructure in implementing literacy-based and experimental learning methods. Relevant research was also carried out by (Wibowo, 2019) with the results of research on students' scientific literacy skills on basic biology concepts for both competencies dominated by the nominal category with a percentage range of 62%-80%, a small portion in the functional category of 13%-34%. The conceptual category is in the range of 4%-7% and multidimensional is 0%. The results obtained are in accordance with previous research which states that scientific literacy skills are mostly at a low level.

The research conducted is more focused on content aspects than previous studies which cover several aspects of research. This research is important to do because the content aspect aims to solve every problem in everyday life so that it is related to the demands of the 21st century. The purpose of the research conducted was to determine the ability of scientific literacy aspects of student content on Basidiomycota material.

B. Material and Method

The variable of this research is the ability of scientific literacy in the content aspect of Basidiomycota material. The research design is a quantitative descriptive research. The research instruments were scientific literacy assessment sheets and questionnaires. The procedure in this research includes research preparation stage, research implementation stage, and final research stage.

Research Preparation Stage

1) Arrange for a permit to conduct observations for students majoring in Biology at Medan State University.
2) Conduct initial observations to determine the level of scientific literacy in the content aspect of students.
3) Prepare content aspect scientific literacy assessment sheets.
4) Prepare research proposals assisted by thesis supervisors.

Research Implementation Stage

Collecting Basidiomycota research mini reports in the subject of taxonomy of low-level organisms.

Final Research Stage

1) Processing the data obtained from the results of the mini Basidiomycota research report in the low-level organism taxonomy course.
2) Make conclusions from the results of research that has been carried out.
3) Make a final report of the research results obtained.

Analysis of student assessment sheet data uses the Formula 1.

$$P = \frac{F}{N} \text{ X } 100\% \text{ ……Formula 1}$$

Information:
P = Percentage of Assessment Sheet
F = Respondent Answer Score
N = Maximum Total Score

The categories of student scientific literacy can be seen in Table 1.

Table 1 Student Science Literacy Criteria

Percentage Score (%)	Category
84-100	Multidimensional Scientific Literacy
68-83	Conceptual Scientific Literacy
52-67	Functional Scientific Literacy
36-51	Nominal Scientific Literacy
20-35	Scientific Illiteracy

The explanation for each scientific literacy category is in Table 2.

Table 2 Science Literacy Category

Science Literacy Category	Explanation
Scientific illiteracy	Not able to connect or respond to a scientific question regarding issues related to science.
Nominal scientific literacy	Able to recognize concepts related to science, but the level of understanding still shows misunderstandings/misconceptions.
Functional scientific literacy	Able to explain and describe a scientific concept appropriately, but has limitations in vocabulary and understanding.
Conceptual scientific literacy	Be able to develop some understanding of conceptual schemes and relate them to a general understanding of science.
Multidimensional scientific literacy	Able to integrate a broader understanding of science by covering the philosophical, historical and social dimensions of science and technology.

C. Results and Discussion

Based on the results of the data obtained from the mini research report using student assessment sheets with a total of 31 students covering three aspects of content that are measured, namely content knowledge, procedural knowledge, and epistemic knowledge can be seen in Table 3.

1. Content Aspect

The results of data analysis on each indicator and item of scientific literacy assessment statement on the content aspect can be seen in Table 4.

The ability of scientific literacy in the content aspect contained in the descriptor of applying Basidiomycota to daily life and drawing the body structure of Basidiomycota based on direct observation shows that students are in the category of multidimensional scientific literacy. The multidimensional scientific literacy in the aspect of student content is already able to understand where it grows, the body structure of Basidiomycota such as the shape of an umbrella, buttons and resembles a touge. Students are also able to identify the color of each Basidiomycota correctly and are able to utilize Basidiomycota in everyday life by consuming and using it as herbal medicines. Basidiomycota mushrooms based on the literature are usually used by the community for food processing or consumption and can be used for both conventional and modern medicine (Al Ulya et al., 2017).

Students in compiling their reports have been able to make background problems and are included in the category of conceptual science literacy. In this category students are able to make a background of Basidiomycota problems but still in general terms and have not explained specifically the Basidiomycota problems observed. Students still find it difficult to compose good and correct sentences to connect one paragraph to another. Most of the students in the mini research reports explained extensively about fungi, but only a few were discussed in Basidiomycota on the background of the problems regarding the observed specimens. Other researchers also stated that generally students have not been able to provide background regarding the subject matter or issues raised in accordance with the research conducted (Gani, 2019).

Students have been able to come up with theories obtained from various literatures but most of these theories are not closely related to Basidiomycota topic, students put forward the theories obtained regarding Basidiomycota in general and only a few theories were found based on observations of the observed Basidiomycota fungi. In the mini research report, some students cited theories but did not include the name of the expert who provided the theory. Students generally describe theories obtained from various sources, but do not study/explain these theories with research needs so that it is difficult to find links between the theories used. In practicum learning, scientific literacy skills have been acquired by students when they carry out scientific experiments (Daniel & Taneo, 2019). In accordance with the definition that a scientific experiment is a series of observations that are connected and give rise to theories capable of explaining, concluding, and predicting the phenomena that occur(Wardani, 2019).

The same thing is also found in describing the connection of facts to Basidiomycota topic in mini research reports for most students it is also difficult to find facts related to Basidiomycota functions. It is evident from the student research mini reports that they have not been able to reveal facts based on the literature obtained such as explaining the various ingredients in Basidiomycota fungi which can be used for daily needs such as herbal medicines for healing diseases, then how to cultivate Basidiomycota so as to produce high selling power in society. These facts have not been disclosed in a clearer and more

detailed manner so that in their reports most of them still explain the facts to consume Basidiomycota only. Students should have the ability to find facts so that it will make it easier to do research (Noviani, 2019). Students are also not able to compare some of the information obtained and provide arguments to produce good information, so students must be accustomed to be able to analyze a problem based on facts and data (Rezeqi et al., 2020).

Table 3 Recapitulations of Scientific Literacy Data Results Based on the Aspects Measured

No.	Aspect	Percentage (%)	Category
1.	Content Knowledge	83,87	Multidimensional Scientific Literacy
2.	Procedural Knowledge	73,23	Conceptual Scientific Literacy
3.	Epistemic Knowledge	76,98	Conceptual Scientific Literacy
Average		**78,02**	**Conceptual Scientific Literacy**

Table 4 Content Knowledge Indicator Data Results

Indicator	Descriptor	Percentage (%)	Category
Understanding Basidiomycota relevant to real life	Application of basidiomycota	94,19	Multidimensional Scientific Literacy
	Create a problem background	80,65	Conceptual Scientific Literacy
	Drawing body structure, image caption	94,19	Multidimensional Scientific Literacy
	Average	**89,68**	**Multidimensional Scientific Literacy**
Understand theory, facts, and information	Explain the relationship of theory	79,35	Conceptual Scientific Literacy
	Explain the relationship of facts	70,97	Conceptual Scientific Literacy
	Average	**75,16**	**Conceptual Scientific Literacy**

2. Procedural Aspects

Based on the results of the descriptive analysis of the percentage on the indicator to collect and analyze the data needed to support solving the Basidiomycota material on the procedural aspect can be seen in detail in Table 5.

Scientific literacy in student's procedural aspects is included in the category of conceptual science literacy. In this category students are able to collect data needed to support research but are still abstract and have not provided accurate data regarding Basidiomycota in the needs of the research carried out. It has been proven that students are able to get various sources from journal articles and books, but they are still at the broad understanding stage of function, but there are only a few journal articles about Basidiomycota. Even though students have found relevant journal articles, some of the journal articles obtained do not yet have complete Basidiomycota topic.

Table 5 Procedural Knowledge Indicator Data Results

Descriptor	Percentage (%)	Category
Using journal article references to analyze data	72,90	Conceptual Scientific Literacy
Use books to solve problems	70,32	Conceptual Scientific Literacy
Presents the number of journal references	74,84	Conceptual Scientific Literacy
Presents the number of book references	74,84	Conceptual Scientific Literacy
Average	**73,23**	**Conceptual Scientific Literacy**

Most students do not provide up-to-date journals (journals of the last 5 years). Students use more journals that have accreditation and only a few students' use journals that do not have complete identity. The quality of journals obtained by students has not been able to provide additional accurate data regarding the characteristics of Basidiomycota. Students are less able to search for journal articles on the internet and the limitations of students know that the site provides the latest

research journals about Basidiomycota. The number of journal references used in the research shows that students have entered the stage of being able to collect data, but have not been able to analyze the data needed to support solving problems regarding Basidiomycota more clearly. Students often make a bibliography of journals, but after reviewing it, it turns out that there are no quoted sentences from the journals used in the research mini report.

The solution to finding the right publication journal requires training for students, this training is used, it is hoped that students will more easily determine which journal publication to use or use as a reference for research conducted in accordance with opinions (Tundo & Mufti, 2022). The availability of higher education library information sources does not guarantee that it will be used by lecturers or students. Knowledge of the availability of information sources and the ability to access and use these sources is one of the factors for utilizing information sources for students, especially strata 1 (Heriyanto, 2020).

Students use relevant books, but do not fully disclose the morphological conditions of the Basidiomycota observed. Students tend to use books that are not up-to-date (last 5 years) or old, so they don't provide the latest information about Basidiomycota Many students have used books that have the complete identity of the book publisher and only a few students have used books that do not have an identity. Namely 70% of students rarely look for books or other sources related to the topic being studied, students in utilizing and searching for relevant sources are still relatively minimal (Badjeber, 2020). Students have difficulty finding reference journals, students have difficulty citing articles from other authors, and students have difficulty making bibliography. Students only expect book sources from libraries which have limited availability regarding Basidiomycota and lack of ability for students to search for or access English-based books that provide more information about Basidiomycota. Some students use too few books in working on mini research reports. Then also when students made a bibliography of books, they only wrote down the identity of the book, but it turned out that after the researchers reviewed the mini research reports, students did not quote sentences from the books used (Laga, 2022).

Literature and library sources should be relevant and up-to-date (the last 10 years) sourced from books and articles in journals that are both national and international (Susetyo & Noermanzah, 2020). Students experience difficulties in finding literature due to a lack of student effort to find appropriate journal and book references, marked by several references used by students coming from incomplete identities and some references that are not relevant to the problem at hand (Daniel & Taneo, 2019).

3. Epistemic Aspect

Based on the results of descriptive analysis on each indicator and item statement on the scientific literacy ability assessment sheet on the epithemic knowledge aspect can be seen in Table 6.

Table 6 Epistemic Knowledge Indicator Data Results

Indicator	Descriptor	Percentage (%)	Category
Provide data justification or scientific evidence	Explanation of the issues investigated in detail, clearly, precisely and sequentially	65,81	Functional Scientific Literacy
	Answer the set number of questions	94	Multidimensional Scientific Literacy
	Average	**79,90**	**Conceptual Scientific Literacy**
Give scientific arguments	Provide appropriate conclusions based on morphological characteristics	70,97	**Conceptual Scientific Literacy**
	Average	**70,97**	**Conceptual Scientific Literacy**

Science literacy in the epistemic aspect of students as a whole is included in the category of conceptual science literacy. The category of conceptual scientific literacy is in the epistemic aspect, namely students provide scientific evidence that includes general ideas and thoughts but have not provided specific evidence. Epistemic aspects of students are required to understand the role of a theory to explain its priority in building an understanding of science (Rahmayanti et al., 2021).

Epistemic knowledge can be said to be advanced knowledge that is strengthened by mastery of content knowledge and procedural knowledge. Epistemic knowledge is the highest knowledge where students conduct an analysis (analysis) of scientific investigation processes and

products (facts, concepts, principles, procedures, laws, theories, or models), perform sorting and assessment (evaluation), generate new ideas (synthesis) or conclusions (inference) (Fadilah et al., 2020). Humans, who are said to be literate towards science, will be willing to be involved in matters related to science and technology so that they need competencies to explain scientific phenomena, evaluate and design scientific investigations and interpret scientific data and evidence (Simatupang et al, 2019).

This can be seen from the students find it difficult to explain issues related to Basidiomycota, they tend to provide explanations about theories based on experts only. Students should explain the currently circulating issues regarding Basidiomycota such as the presence of metabolites from Basidiomycota fungi which are harmful to humans when consuming them, so that through these circulating issues students and even the public can anticipate when consuming these fungi. Scientific issues can be improved by recognizing keywords from investigations such as variables that are measured or controlled and information needed by researchers (Putri et al., 2014).

Students in providing general research conclusions and there were several students who did not provide conclusions based on the objectives of the practicum carried out regarding the morphological characteristics of Basidiomycota fungi (Fajarianingtyas & Hidayat, 2019). Making a research conclusion requires several processes that must be achieved in order to be able to find or draw scientifically appropriate conclusions, namely with good reasoning, reasoning is a process of critical thinking to draw a conclusion, so that with good reasoning researchers can draw conclusions according to the results of the research conducted (Sumartini, 2015).

In student research mini reports in answering questions that have been set on student worksheets, it shows that most students are able to answer questions correctly and precisely in every question given by researchers to students. Students answered questions about the characteristics of each Basidiomycota fungus well, then students also mentioned Basidiomycota fungi which had a unique shape based on observations made by students in practicum activities. According to Simanik et al. (2021), to improve the epistemic aspect of scientific literacy, students need to be trained, learning methods need to be changed, and they need to read more.

D. Conclusion

Based on the results of the study, it was concluded that the ability of scientific literacy in the content aspect of Biology Study Program students at Medan State University on the Basidiomycota topic with a percentage of 78.02% was included in the category of conceptual scientific literacy, namely students in understanding Basidiomycota topic conceptually, can be seen from the students' ability to distinguish morphology each Basidiomycota species and able to explain back the information obtained from various sources. This is related to mini research assignments, namely simple research on a concept problem that is carried out so that students' scientific literacy is at the level of conceptual science literacy. At this stage students already have good scientific literacy skills in the development of the 21st century so that it is hoped that this conceptual literacy ability can be used by students to solve a problem in everyday life.

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