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STUDENTS' REFLECTIVE THINKING ON THE TOPIC OF PROTOZOA

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Abstract: One of the materials studied in science learning is about the Filum Protozoa (one of the invertebrate animals). Students only know that protozoa generally cause harm to humans or animals because they are parasites but do not think about what the solution to overcome this parasite is. To overcome this, students are encouraged to have reflective thinking skills. Reflective thinking is the ability of individuals to select knowledge that they have acquired, which is relevant to the purpose of the problem and utilize it effectively in problem solving. To develop reflective thinking skills, we can use learning strategies that can sharpen students' thinking skills. The purpose of writing this article is to find out how experts think about reflective thinking, how to measure reflective thinking and how to develop reflective thinking skills in students. The method used in this research is a literature study, in the form of analysis and synthesis of several scientific articles. How to measure reflective thinking can be done with tests and non-tests. Researchers collected 10 previous studies in the range of 2011-2018 regarding reflective thinking skills then analyzed and concluded that reflective thinking is a student's ability to select knowledge that has been owned and stored in his memory to solve any problems faced to achieve his goals.

Keywords: Protozoa, Reflective Thinking

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INTRODUCTION

Biology is the study of all things related to life. The word Biology comes from the linking of two Greek words, namely Bios which means life or life and logos which means science. Here it is implied that the things studied in biology are all living things that are on planet earth, from microorganisms to plants and higher animals, along with all aspects of their lives. Aspects of organism life that are generally studied in biology are body structure, physiological processes, organ function, biodiversity, relationships with their environment, reproduction, molecular and conservation.

One of the things studied in science learning is about the Protozoa Philum (one of the invertebrate animals). Students' difficulty in understanding protozoan material is caused by several aspects, one of which is intelligence (Amaliyah et al., 2021). Intelligence is a general ability to make adjustments to a situation or problem (Anekasari, 2019). The characteristics of someone with high intelligence are the ability to understand and solve mental problems quickly, the ability to remember, high creativity and developed imagination (Ratnasari & Nurhidayah, 2020). In protozoan material, students may only memorize information without really understanding it so that they have difficulty in connecting protozoan topics with other biological concepts. Therefore, reflective thinking skills need to be possessed by students. In the learning process, students need to reflect on what they have learned and understand the benefits of learning it. This is one of the reasons that reflective thinking is important to apply in the learning process (Sholehudin, 2008).

The objectives of biology education include understanding biological concepts and their interrelationships and developing basic biological skills to foster scientific values and attitudes (BSNP, 2006). Learning should prioritize thinking processes and skills, such as defining and analyzing problems, formulating principles, observing, clarifying, and verifying. Hart & Kristonis say that the learning process is responsible for children's cognitive development and affects their survival. This cognitive development is reflected in the ability of students to master the content of the lesson, as determined for a particular lesson (Hart & Kritsonis, 2006). A supporting factor that can be used as a reference for a student's learning achievement is through understanding concepts. Understanding concepts is very important with the aim that students can remember the concepts they learn longer, so that the learning process will become more meaningful. The meaningfulness of this learning is in accordance with the nature of student center-based learning which is strongly influenced by the school of educational constructivism, namely how the teacher can activate students' prior knowledge, elaborate on that knowledge, so that actively the students' brains build their knowledge.

METHOD

The method used in writing this article is literature study both from books and journals related to reflective thinking in students. The journals used in writing this article are journals in the 2011-2018 time span. Furthermore, the data analysis technique in this study uses content analysis data analysis techniques. Data analysis begins by analyzing research results from those that are quite relevant, relevant and most relevant. Then by looking at the research year starting from the oldest, and gradually advancing to a more recent year. The researcher then reads the abstract of each study first to assess whether the problems discussed are in accordance with those to be solved in the study. Furthermore, the researcher noted the important and relevant parts of the research problem.

FINDING AND DISCUSSION

Learning is generally given in one direction, does not develop students' thinking skills. It is still dominantly taught with a lecture model (still teacher-centered), still does not stimulate students to think at a higher level, and still does not train students' scientific attitudes, both theory and practicum. Thinking skills are important to apply to students. The term skill in the context of reflective thinking means a skill that can be transmitted through the process of practicing, meaning that this skill has the opportunity to be trained to anyone according to their level of thinking (Ellianawati et al., 2013).

Some research results discuss the importance of reflective thinking in learning, namely Sezer in Chee states that reflective thinking is defined as awareness of what is known and what is needed, this is very important to bridge the gap in learning situations (Choy, 2012). Gurol defines reflective thinking as a process of directed and precise activities where individuals analyze, evaluate, motivate, gain deep meaning, use appropriate learning strategies (Suharna et al., 2013). Thus reflective thinking aims to achieve learning targets and generate new learning approaches that have a direct impact on the learning process. According to Widiawati reflective thinking ability is a thinking ability that connects the knowledge obtained to solve new problems related to old knowledge to get a conclusion (Widyawati, 2016). Based on some of the opinions above, it can be concluded that reflective thinking is a directed and precise process where individuals interpret, identify, analyze, evaluate, and draw conclusions in solving a problem.

Sezer and Gurol stated that reflective thinking is very important for students and teachers (Suharna et al., 2013). However, this is very different from the facts in the field, that in learning, reflective thinking receives less attention from teachers. Sometimes teachers only pay attention

to the final results of problem solving that students do, without paying attention to how students solve problems. If a student's answer is different from the answer key, the teacher usually immediately blames the student's answer without exploring why the student answered that way. Speaking of teachers, the goal of the teacher education program should make prospective teachers technically competent, reflective, and self-critical. Here it can be seen that teachers must have excellent competence (Núñez Pardo & Téllez Téllez, 2015).

The importance of providing reflective thinking skills to prospective teachers should be of more concern in improving the quality of education. However, when looking at the way of learning, generally thinking skills are not trained. This can be seen in the assessment carried out on the achievement of learning outcomes, which reveals more about the ability to remember or memorize and rarely leads to problem solving skills (Fuady, 2017). Based on the preliminary study, it is known that almost 60% of students have not been able to achieve the indicators of achieving mathematical reflective thinking ability (Nindiasari, 2013). In addition to complex problem solving, learners tend to learn new knowledge without connecting it with their existing knowledge, in other words, learners generally do not reflect on the knowledge received with their basic knowledge. Therefore, in learning only basic thinking skills such as remembering or skills that are memorizing facts to then express them if asked in the assessment.

One of the science lessons is about the Protozoa phylum (one of the invertebrate animals). The benefits of knowing Protozoa are many, for example, the cause of malaria which is endemic in Papua. How to transmit and overcome the transmission can be information for the community. However, because learning is done mostly conventionally and not accompanied by practicum or media that can explain or describe protozoa, students tend to only know that there are invertebrate animals, namely protozoa. Protozoa has its own characteristics, its habitat to examples of species, but students do not get to how malaria is transmitted caused by plasmodium, what is the best solution to prevent the spread of malaria, malaria is only a common disease but do not understand that malaria can be dangerous to sufferers if not handled properly. In addition, students only focus on the characteristics of protozoa, up to the example but students do not develop their reflective thinking skills such as how toxoplasmosis can occur in humans even though toxoplasma is one of the protozoan animals.

Students only know that protozoa generally cause harm to humans or animals because they are parasites but do not think about the solution to overcome this parasite. They are not directed to reflect on their understanding of protozoa so that their understanding only reaches the stage of knowing but not the development of thinking. Students have difficulty in describing the real animal form of protozoa, tend to understand from a theory but are unable to relate their

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understanding of protozoa to everyday life. With the elimination of practicum as one of the parts that can clarify students' understanding, they tend not to develop thinking skills and the knowledge they understand is not comprehensive so that sometimes it can cause misconceptions.

Seeing the explanation above, thinking skills need to be developed in student learning to be able to follow the development of education (21st century), it is necessary to be taught to develop thinking skills, one of which is reflective thinking skills. More details about some research conducted to see the importance of reflective thinking skills to be given to students, especially prospective biology teachers, can be seen in Table 1.

Table 1. Some previous research on reflective thinking skills

No	Researcher	Year	Findings/Conclusions
1	Oner, d & Adadan, E.	2011	This study proposes a series of reflection- based tasks to develop prospective teachers' reflective thinking skills. The prospective teachers developed reflective thinking skills using a web- based portfolio and showed that there was an increase in the reflective thinking skills of the prospective teachers through the portfolio. This web- based platform was also perceived by the participants (prospective teachers) as a medium that allows easy access and better development of portfolios for prospective teachers (Oner & Adadan, 2011)
2	Choy, S.C & OO, P.S	2012	The concept of reflective thinking as a precursor to the incorporation of critical thinking has not been adequately researched. Most research has not provided any effective strategies on how to combine these two concepts. There is a constant need to incorporate critical thinking into the classroom but it has not been done. This research attempts to show the relationship between reflective thinking and reflective thinking's ability to stimulate critical thinking. Teachers often perceive critical thinking as a skill that needs to be taught, but research shows that teachers may not know how to combine these two concepts effectively. The use of reflective thinking may be an initial skill before stimulating critical thinking in teachers. However, results show that most teachers do not reflect deeply on their teaching practice. They do not seem to practice the four learning processes: assumption analysis, contextual awareness, imaginative speculation and reflective skepticism that are indicative of reflection. This suggests that it is important reflective thinking is minimally practiced among teachers. Further research needs to be done on how to realize reflective

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			practice among teachers and how this will improve the quality of learning in terms of critical thinking (Choy, 2012).
3	J. Sabandar	2013	Teachers have many tasks on a daily basis, it is often understood why teachers do not move from their teaching habits. However, in order to optimally improve mathematical ability, improving creative and critical thinking skills is actually very necessary so that students become productive and become independent students (Fuady, 2017)
4	Mirzaei, F., Phang, F.A., Kashefi, H.	2014	Observation, communication, teamwork, judgment, and decision-making are important things that teach reflective thinking skills necessary for teachers if they want to become reflective thinkers. Measuring teachers' reflective thinking ability with several instruments in this study helps identify teachers' reflective thinking, weaknesses and strengths and find ways to improve their reflective thinking (Mirzaei et al., 2014)
5	Nindiasari, H., Kusumah, Y., Sumarmo, U & Sabandar. J.	2014	This study was part of a dissertation research involving 201 students from three high, medium and low-level high schools in Tanggerang. The study took a pretest-posttest and control group design and administered an initial mathematics ability test and a mathematics reflective thinking ability test. The study found that on the achievement and improvement of reflective thinking skills in mathematics, the metacognitive approach played the largest role compared to the role of regular learning, the role of school level and the role of initial mathematics ability. However, the role of initial mathematical ability is inconsistent with the achievement and improvement of reflective thinking skills in mathematics. Another finding is that overall and at each school level, the achievement and improvement of reflective thinking skills in mathematics, students who received learning with a metacognitive approach were better than students who received ordinary learning. In addition, it was also found that there was no interaction between learning approaches and school levels and between learning approaches and initial mathematical abilities on the achievement and improvement of mathematical reflective thinking skills (Nindiasari et al., 2014)
6	Dervent, F.	2015	This study shows that reflective thinking has an effect on prospective physical education teachers' professional teaching practices. As evidenced by at the beginning of reflection, the participants were already at the technical level of the reflective framework; then they began to reflect on both the contextual and dialectical levels. In addition, the reflective framework allowed prospective physical education teachers to focus on the application of their knowledge and enabled them to generate

			awareness of their professional development. As a result, prospective physical education teachers demonstrated professional development of proper planning, time management, and use of school facilities. In addition, students' level of development and approach to teaching through their experiences and reflection on prescribed experiences (Dervent, 2015)
7	Fuady, A.	2016	Reflective thinking can occur when students experience confusion, obstacles or doubts in solving the math problems they face. Basically, reflective thinking is a student's ability to select knowledge that has been owned and stored in his memory to solve any problems faced to achieve his goals. Therefore, to solve problems in mathematics students need the ability to think reflectively. Students who think reflectively are more likely to perform tasks such as remembering structured information, reading by understanding and interpreting text, solving problems and making decisions (Fuady, 2017)
8	Rashid, M. A.	2017	This study describes the reflective thinking of junior high school students in solving fraction problems in terms of *gender* differences. The results showed that male subjects did *reacting*, *elaborating* and *contemplating* at the stage of understanding the problem, developing a plan, implementing the plan and checking back in solving fraction problems. Meanwhile, female subjects did *reacting*, *elaborating* and *contemplating* at the stage of understanding the problem, developing a plan, implementing the plan and checking back in solving fraction problems. However, at the stage of preparing the plan, the female subject did *contemplating* only to the extent of believing without considering based on her experience in solving fraction problems (Rasyid, 2017)
9	Mentari, A., Nindiasari, H., & Pamungkas, A. N.	2018	Students' mathematical reflective thinking ability is divided into Visual, Auditorial and Kinesthetic. The mathematical reflective thinking ability of visual students is able to provide interpretation but not complete and correct calculations. The mathematical reflective thinking ability of auditorial students is that auditorial students have been able to provide interpretation and correct calculations. The mathematical reflective thinking ability of kinesthetic students is able to provide good interpretation with correct calculations. The research suggests that students can know their learning style and can determine the right activities and ways to absorb and process information according to their learning style type. Teachers can give the right direction to students to learn according to their learning style type. Teachers can use learning models, methods and strategies that can facilitate

			all students based on their learning styles. Teachers should try to improve students' mathematical reflective thinking skills so that students often do exercises and increase students' experience or references regarding mathematical reflective thinking exercises (Pamungkas et al., 2018)
10	Fatmana hik, U.	2018	A person's thinking ability is one of the benchmarks for achieving math learning goals. One of the thinking abilities that support skills in learning mathematics is reflective thinking. Reflective thinking can occur when in the process of solving math problems students experience confusion, difficulty, and doubt. Reflective thinking ability is the ability to think by using the knowledge that has been owned to solve problems faced in achieving goals. To find out how students' reflective thinking ability, students need to do an activity to solve math problems, which in the process not only involves the reflective thinking process but also requires hard work and resilience (adversity quotient) in overcoming these problems. This study describes reflective thinking patterns in solving mathematical problems, especially in flat building material in terms of the Adversity Quotient of the climber category owned by students (Fatmahanik, 2018)

The result of the analysis and synthesis of various studies on reflective thinking above is that reflective thinking skills play a crucial role in academic and professional development. Research by Oner and Adadan (2011) confirmed the effectiveness of web-based portfolios in developing prospective teachers' reflective thinking skills, suggesting that technology can facilitate more structured and integrated reflection. However, Choy and OO (2012) revealed a lack of implementation of deep reflective thinking among teachers and highlighted the need for further research to integrate reflective practices in teaching to stimulate critical thinking. These findings emphasize the importance of using technology and planned reflective strategies to support the development of reflective thinking skills.

Furthermore, research by Sabandar (2013) and Mirzaei et al. (2014) suggest that the hectic routines and established teaching methods can hinder changes in educational practices that encourage creative and critical thinking. The research highlights the need for more flexible and purposeful approaches in teaching to improve students' reflective thinking skills. Metacognitive approaches, as found in the study by Nindiasari et al. (2014), was also found to be effective in improving students' mathematical reflective thinking skills at various school levels, suggesting that this approach can be widely applied with positive results. The integration of aspects such as observation, communication, and assessment in the development of reflective skills for

teachers, as expressed by Mirzaei et al. (2014), provides insights on how to improve overall teaching practices.

Meanwhile, other studies such as by Rasyid (2017) and Fuady (2016) revealed the existence of gender and learning style differences in the application of reflective thinking, which affects the way students solve mathematical problems. This research emphasizes the importance of adjusting teaching methods according to students' individual differences to increase the effectiveness of reflective thinking. In addition, Fatmanahik (2018) emphasized that success in mathematical problem solving depends not only on reflective thinking ability, but also on students' resilience.

Overall, the synthesis of this research suggests that reflective thinking is a skill that needs to be developed through strategies that are varied and appropriate to the context and individual needs of students, to achieve optimal learning outcomes. Reflective thinking is an important ability that enables individuals to select and apply acquired knowledge to solve problems and achieve goals. It includes self-evaluation and effective utilization of knowledge in new or complex situations. The results show that reflective thinking not only helps in facing academic challenges, but also in professional development, as seen in the teacher candidates and teachers involved in the study.

Reflective thinking can be measured through various methods, both tests and non-tests. Tests specifically designed to assess reflective aspects, such as problem solving and application of knowledge, can provide a clear insight into an individual's reflective skills. In addition, non-test instruments such as web-based portfolios, observation, and performance assessment are also effective in measuring the development of reflective thinking skills. Research shows that a combination of these methods can provide a comprehensive picture of an individual's reflective abilities.

The development of reflective thinking skills can be done through various structured and sustainable learning strategies. For example, the use of web-based portfolios, metacognitive approaches and regular practice in situations that demand reflective thinking can improve these skills. Research shows that integration of technology, emphasis on reflective practice in teaching, as well as customization of learning strategies according to students' learning styles, are effective ways to improve reflective thinking skills. In addition, it is important to overcome barriers such as busy routines and ensure that the reflective process is in-depth and structured. Some researchers have tried to explain reflective thinking by describing the importance of this ability owned by students and prospective teachers. Researchers also suggest how to solve problems reflectively and how to measure reflective thinking skills. Reflective thinking is

important to equip prospective teachers to improve their work experience and create innovations in teaching.

CONCLUSION

Basically, reflective thinking is a student's ability to select knowledge that has been owned and stored in his memory to solve any problems faced to achieve his goals. Reflective thinking can occur when students experience confusion, obstacles or doubts in solving problems, so reflective thinking is very important to be supplied to students and students (prospective teachers) in order to be able to develop knowledge and improve their teaching experience. To measure reflective thinking, the methods used include tests that assess problem solving and knowledge application, as well as non-test instruments such as web-based portfolios and observations, which together provide a comprehensive picture of the skill. The development of reflective thinking skills can be achieved through structured learning strategies, such as the use of technology, metacognitive approaches, and customization of methods according to students' learning styles. It is important to overcome barriers such as hectic routines and ensure reflective processes are carried out in depth to improve the effectiveness of learning and professional development.

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