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The Quality of Electronic Student Worksheet on the Protists Concept to Improve Critical Thinking Skills at the High School Level

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Abstract: The use of electronic student workhsheet as a support for learning the concept of protists has not been utilized optimally and has not trained students to think critically which is a skill that is much needed in facing challenges in the 21st century. This study aims to describe the effectiveness of the electronic student worksheet on the protista concept in improving students' critical thinking skills. The research subjects through the small group test in development research were four students of class X State Aliyah Madrasah Kapuas. The critical thinking skills instrument from Facione was used to explore this data. The data analysis technique of the effectiveness of expectations is percentage. The results showed that evaluation and inference skills had increased. Other critical thinking skills did not show improvement, but the categories were at least good, namely interpretation, analysis, explanation, and self-regulation. Thus, electronic student workhseet on the protist concept can improve critical thinking skills at the high school level and can be used as an alternative learning to train students' critical thinking skills.

Keywords: Critical Thinking Skills, Electronic Student Workhsheet, Prorists

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INTRODUCTION

The development of an increasingly advanced era requires innovation in the development of learning tools in the form of student worksheets. One of the things that is needed is to adjust to the development of information and communication technology. This is in line with one of the skills needed to face challenges in the 21st century is critical thinking skills (Binkley et al., 2012). The term development is defined as an effort to improve (*improve*) through stages (micro cycles) in formative evaluation.

The development of electronic student worksheet is a requirement to combine critical thinking skills and mastery of information and communication technology. The use of worksheets used in schools as learning support is not optimal in training students' critical thinking skills because they are not yet in accordance with the demands of 21st century learning. Therefore, it is necessary to develop electronic student worksheets that can train students to think critically, in accordance with the current developments in the digital era

Selection of high school biology concepts for the development of electronics student worksheets is a protist concept. Learning protists during a pandemic can be carried out without reducing its meaning. One of the things that can be done is using information and communication technology facilities, but this option is an offer depending on the real conditions in the field. Of course, the ideal is learning such as the 2013 curriculum.

The 21st century is known as the century of globalization, which demands quality human resources with various advances in technology, and demands both hard skills and soft skills. The 2013 curriculum is designed to strengthen skills, knowledge competencies, and attitudes (Zaini & Hidayati, 2019). One of the important aspects in the 2013 Curriculum is the skill that must be possessed by students, namely 4C skills (Critical thinking, Creative, Communication and Collaborative) (Putra & Nurlizawati, 2019).

Development of information and communication technology by developing electronics student worksheets will make it easier for students to learn. Budiman (2017) explains that the development of information and communication technology requires the world of education to constantly adapt developments to efforts to improve the quality of education, especially in the learning process.

Based on the description above, research will be carried out on electronic student worksheets on protist material to improve students' critical thinking skills. This research aims

to describe the effectiveness of the electronic student worksheet on the protista concept in improving students' critical thinking skills.

METHOD

Developing electronic student worksheet is included in the type of educational design research, namely EDR (*Educational Design Research*) using Tessmer (1993) formative evaluation design. The stages of formative evaluation in this study are self-evaluation, expert opinion, individual test, and small group test. EDR has a goal, namely from a creative development approach to solving learning problems and performance problems (Zaini, 2018).

The development research was carried out for five months (September 2020-January 2021) at State Madrasah Aliyah Kapuas, Central Kalimantan Province. The research was conducted online in the odd semester of 2020/2021.

The expert subjects were determined by two lecturers from the biology education study program as academics and one biology teacher at State Madrasah Aliyah Kapuas as practitioners. Individual test subjects were three students of class X State Madrasah Aliyah Kapuas. Small group test subjects four students of class X State Madrasah Aliyah Kapuas. Determination of the subject heterogeneously, based on the academic ability of students obtained from the biology teacher information.

Types of data and data collection instruments in development research using validation assessment sheet instruments, content practicality test sheets, expectations practicality test sheets, and students' critical thinking skills assessment sheets. Data collection techniques are only obtained from the effectiveness of expectations. Expected effectiveness data is obtained from the tasks given on the students' critical thinking skills assessment sheet through the small group test.

The data analysis technique of the effectiveness of expectations, recapitulation of the effectiveness of expectations for each critical thinking skill is obtained from the results of the recapitulation of each student worksheet electronic critical thinking skills, then the average value is divided by the maximum score per skill and multiplied by 100%. The effectiveness of expectations using a modified category from Akbar (2013) is presented in **Table 1**.

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Table 1. Effectiveness category

Score Percentage Critical Thinking Skills (%)	Category
85.01 – 100.00	very good
70.01 – 85.00	good
50.01 – 70.00	poor
01 .00 – 50.00%	not good

FINDING AND DISCUSSION

Development of student worksheets the protist concept electronics produced consists of five electronics student worksheets with each topic, namely: (1) general characteristics of protists; (2) mushroom-like protists; (3) plant-like protists; (4) animal-like protists, and (5) the role of protists in life.

Effectiveness of expectations student worksheet electronic tests were carried out on a small group test, namely four students of X Mathematics and Science at State Madrasah Aliyah Kapuas. The results of research on the effectiveness of expectations through the small group test stage electronics student worksheets are presented in **Table 2**.

Table 2. Average effectiveness of electronic student worksheet

Aspects of Critical Thinking Skill	Score Max.	I	II	III	IV	V	Score (%)	Category
		%	%	%	%	%		
Interpretation	14	86.64	89.29	87.50	90.50		88.48	Very Good
Analysis	10	86.30	87.50	87.50	82.50	86.30	86.02	Very Good
Evaluation	20	77.50		82.50	83.75	86.25	82.50	Good
Inference	24	83.67	80.21	87.50	88.21	85.32	86.25	Very Good
Explanation	20	87.00		73.75	91.25	88.15	84.85	Good
Self-regulation	12	71.92	79.17	91.67	81.25	83.33	81.47	Good

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Description:

1. Categories are 85.01 – 100.00% (very good), 70.01 – 85.00% (good), 50.01 – 70.00% (poor), 01.00 – 50.00% (no good) (Akbar, 2013)
2. I = General Characteristics of Protists, II = Fungus-like Protists, III = Plant-like Protists, IV = Animal-Like Protists, V = Role of Protists in Life

Based on the **Table 2** above, it explains the effectiveness of the expectations obtained from students' critical thinking skills with six indicators based on (Facione, 1990). There are five electronics student worksheets with different sub-concepts but contains indicators of Facione's critical thinking skills. The critical thinking skills of the four students at the small group test stage had a "very good" category on the skills of doing interpretation, analysis, and inference, and a "good" category on the skills of conducting evaluation, explanation, and self-regulation.

The developed electronic student worksheet is a form of effort to improve students' critical thinking skills. Electronic student worksheet is one of the learning tools that can train students to develop skills according to the demands of 21st century education (Lessy et al., 2021; Maulana & Sopandi, 2022). The purpose of the student worksheet being developed is to create learning media that improve students' higher-order thinking skills (Rachmasari et al., 2019).

The effectiveness of the expectations of the electronic student worksheet as a result of the development is determined based on the results of the students' critical thinking skills in working on the tasks of the electronic student worksheet at the small group test stage. The protists concept electronic student worksheet developed raises students' critical thinking skills with good categories (covering evaluation, explanation, and self-regulation) and very good categories (covering interpretation, analysis, and inference). The electronics student worksheet developed were based on the critical thinking skills of Facione (1990), this research was also carried out by previous researchers but with a different concept Nabila (2019) & Sa'diyah (2019) which shows that each critical thinking skill gets a different score and category, different for each skill.

One way that can be done to improve critical thinking skills is to use electronic student worksheet, because students can play an active role and take control of solving problems in the learning system. Ridhana et al. (2021) states that using appropriate learning strategies and learning resources can develop students' critical thinking skills in the learning process.

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Students can be actively involved in critical thinking, one of which is the alternative of providing student worksheets because students can express their ideas and opinions when critiquing problems (Astuti et al., 2017).

Astuti et al. (2018) explained that the student worksheet is teaching material that is packaged in such a way that students can learn the material, and become more active in solving problems in problem-solving activities. So that the problem-solving activities contained in the student worksheet will have an impact on improving their way of thinking, including critical thinking (Is'ad & Sukarmin, 2022). Student worksheets that contain critical thinking skills are needed so that students have cognitive skills in dealing with everyday life (Hidayati et al., 2020).

Students are said to already have critical thinking skills, when students are able to understand a concept, foster curiosity, have process skills, and are able to solve problems. If students are able to understand a concept, then apply the concept and then solve the problem, then indirectly students already have critical thinking skills (Dewi et al., 2017). The existence of learning facilities such as student worksheets will make student learning activities more structured, systematic, and directed (Balela et al., 2021).

Aspects of critical thinking skills including interpretation, analysis, evaluation, inference, explanation, and self-regulation that are assessed, have been represented by at least one sub-skill on each task in the electronic student worksheet. Jamaluddin (2019) results for measuring students' critical thinking skills are seen from the scores/values obtained by students in doing the student worksheet tasks critical thinking skills, so that the effectiveness of learning can produce a useful teaching and learning process.

The results showed that evaluation skills experienced an increase in critical thinking skills. This is in accordance with the number of electronic student worksheet, in the study of the electronic student worksheet that were developed there were five electronic student worksheet. Thus, the improvement in critical thinking skills is seen in the evaluation skills, which have increased from the good category to the very good category to the electronic student worksheet V, thus indicating an increase. Evaluation skills distinguish strong and relevant arguments from weak and irrelevant arguments (Rosidah & Fitrihidajati, 2020). Inference skills as well as evaluation skills also experience an increase in critical thinking skills. Inference skills make logical conclusions from the information presented (Kistiono et al., 2017).

The developed protists concept electronic student worksheet has several advantages, including that all electronic student worksheet already cover Facione's six critical thinking skills, but do not meet all critical thinking sub-skills, but have been represented by at least one sub-skill in each assignments in the electronic student worksheet. Nabella et al. (2020) states that effective means that the product developed must bring results or effects after the goal.

The electronic student worksheet developed is an interactive student worksheet with an attractive appearance, is more practical and can increase student interest. In the electronic student worksheet the results of the development not only display material and assignments but are equipped with learning links, learning videos, and pictures that can strengthen understanding and increase students' learning motivation. The electronic student worksheet is easy to use because it is online, so it can be used in learning anywhere and anytime and in a more efficient time and place.

CONCLUSION

Research on the quality of electronic student worksheets on the protists concept to improve critical thinking skills has been carried out. The results showed that critical thinking skills through the provision of electronic student worksheets on the protists concept were in the good category on the indicators of evaluation, explanation and self-regulation and in the very good category on the indicators of interpretation, analysis and inference. This is because the developed electronic worksheets are equipped with learning links, learning videos, and pictures so that they have an attractive appearance, are more practical and can strengthen students' critical thinking skills. Thus, electronic student workhseet on the protist concept can improve critical thinking skills at the high school level and can be used as an alternative learning to train students' critical thinking skills.

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