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THE DEVELOPMENT OF ELECTRONIC WORKSHEETS BASED ON SETS (SCIENCE, ENVIRONMENT, TECHNOLOGY, AND SOCIETY) ON VIRUS TOPIC TO IMPROVE STUDENT CRITICAL THINKING SKILLS

Pengembangan LKPD Elektronik Berbasis SETS (Science, Environment, Technology, and Society) pada Materi Virus untuk Meningkatkan Keterampilan Berpikir Kritis Peserta Didik SMA

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Abstract

The education era challenges institutions to produce generations with 21st-century skills such as critical thinking. SETS learning can enhance these skills by encouraging learners to become active problem solvers. This study aims to produce a SETS-based electronic worksheet to improve critical thinking skills on virus topics that is valid, practical, and effective. This development research uses the ADDIE model. In the study, there were validity, effectiveness, and practicality, as the parameters measured. Quantitative descriptive techniques were used to analyze the data in this research. Based on the scores given by three validators on an electronic worksheet, the average percentage was 3.72 (93.10%) with a very valid category. Based on the assessment of learning outcomes, the post-test achieved a 100% completion score, with an N-gain score of 0.66, placing it in the moderate category. The average completion percentage for each critical thinking indicator was 88.40%, with detail of improvement per indicator of interpretation, analysis, inference, explanation, and self-regulation in order of 40%; 50%; 12%; 22%; and 22%. Based on the responses of 25 students, the average percentage of practicality was 98.88%, which was classified as very practical. Based on the three parameters in this study, the SETS-based electronic worksheets are declared feasible to be applied to tenth-grade high school students and can be alternative teaching materials in schools. Students are expected to be motivated to learn, actively participate in the learning process, and have critical thinking skills.
Keywords: Electronic worksheets, SETS approach, critical thinking skills, virus, high school education.

Abstrak

Era pendidikan menantang lembaga untuk menghasilkan generasi memiliki keterampilan abad ke-21 seperti berpikir kritis. Pembelajaran dengan SETS dapat meningkatkan keterampilan ini dengan mendorong peserta didik menjadi pemecah masalah aktif. Penelitian ini memiliki tujuan, yakni menghasilkan LKPD elektronik berbasis SETS untuk meningkatkan keterampilan berpikir kritis pada materi virus yang valid, praktis, dan efektif. Penelitian pengembangan ini menggunakan model ADDIE. Dalam penelitian terdapat validitas, keefektifan, dan kepraktisan, sebagai parameter yang diukur. Teknik deskriptif kuantitatif digunakan untuk menganalisis data dalam penelitian ini. Berdasarkan nilai dari tiga validator pada LKPD elektronik mendapatkan rata-rata persentase sebesar 3,72 (93,10%) dengan kategori sangat valid. Berdasarkan penilaian hasil belajar keefektifan memperoleh skor ketuntasan post-test sebesar 100% dengan kategori sangat efektif, N-gain score sebesar 0,66 yang termasuk dalam kategori sedang. Rata-rata ketuntasan tiap indikator berpikir kritis sebesar 88,40%, dengan rincian persentase peningkatan per indikator interpretasi, analisis, inferensi, eksplanasi, dan regulasi diri secara berurutan sebesar 40%; 50%; 12%; 22%; dan 22%. Berdasarkan respon 25 peserta didik kepraktisan memperoleh rata-rata persentase sebesar 98,88% yang tergolong dalam kategori sangat praktis. Kesimpulan berdasarkan ketiga parameter dalam penelitian ini, LKPD elektronik berbasis SETS dinyatakan layak diaplikasikan pada kelas X SMA dan dapat menjadi bahan ajar alternatif di sekolah. Peserta didik diharapkan memiliki motivasi belajar, berpartisipasi aktif dalam proses pembelajaran, serta memiliki keterampilan berpikir kritis.
Kata Kunci: *LKPD elektronik, pendekatan SETS, keterampilan berpikir kritis, virus, SMA*

INTRODUCTION

Globalization in education challenges educational institutions to produce a qualified and competitive generation. Learners must have problem-solving skills, be proficient in technology, and be able to select information. In the 21st century, learners are challenged with complex and challenging life situations, requiring various skills to advance and have integrity (Permendikbud, 2014). These demands can be met with competencies in 21st-century skills that every learner needs to improve competitiveness. The required competencies include 4C skills: Critical thinking, Creativity, Communication, and Collaboration (Zubaidah, 2017).

One of the 4C skills, critical thinking, is the process of solving problems by finding the source of the problem and the right solution. In this study, the electronic worksheets developed will contain Facione's (2015) five indicators, namely interpretation, analysis, inference, explanation, and self-regulation. Critical thinking skills are important for students to face future challenges and can be trained in school. However, the critical thinking skills of high school students in Indonesia are still low. Research by Agustine et al. (2020) showed that the critical thinking skills of high school students in Talang Ubi, North Sumatra were low, with only high on interpretation indicators. Sugiarti & Gayatri (2021) found that students' critical thinking skills in biology learning in three high schools in Surabaya only reached 51.85%, which is classified as low.

To improve critical thinking skills, educators need to develop relevant strategies, teaching materials, and learning media. Critical thinking skills are responsive process skills when thinking and analyzing (Khasanah, 2017). The SETS (Science, Environment, Technology, and Society) approach is a learning method that focuses on real events and hones critical thinking skills (Fatchan, 2014). SETS positions students as the main actors in solving problems related to science, environment, technology, and society (Uswatun & Isnawati, 2019).

The SETS approach can be applied in teaching materials such as electronic worksheets, which contain practical learning guides. Electronic worksheets utilize technology and is easily accessible to students (Ariani & Meutiawati, 2020). This can be an opportunity for utilization in developing SETS-based teaching materials in the form of electronic worksheets that are practically accessible to students. This teaching material is needed in biology learning, including virus topics, which are taught to 10th-grade high school students.

The virus topic is taught to grade 10th-grade high school students at the phase E stage, which is classified as an element of understanding biology. The achievement of the biology understanding element in the virus topic requires learners to think critically through skills in making solutions to prevent the spread of viruses by considering the characteristics, replication process, and role of viruses based on issues that occur in society. Learning outcomes in a virus topic can develop learners' skills to think critically because it is close to the problems faced in real life. The critical thinking skills of students that can be improved were indicators of interpretation, analysis, inference, explanation, and self-regulation. Skills that can be described from the virus topic can also be applied in SETS-based learning, which is included in the stages of invitation, exploration, solution, application, and establishment of concept.

In the previous study, the profile of students' critical thinking skills showed an increase after applying the probing-prompting-based SETS model, with a pretest value of 72.5% and a posttest of 82.9%, resulting in a difference of 10.4% (Sylviana et al., 2019). The use of SETS-based Integrated Science modules has proven effective as new teaching material, and its effectiveness is measured through the calculation of N-gain, achieving an increase in cognitive test achievement and critical thinking skills of students worth 0.6, classified as "moderate" (Asmuri et al., 2019). The application of SETS-based worksheets in learning ecosystem topics succeeded in training students' critical thinking skills, achieving a success rate of 88.3% (Pramesthi & Purnomo, 2020). Research by Ilmi (2017) states that SETS-based ecology textbooks received a positive response of 99.61%, indicating that the book is effective for training students' critical thinking skills.

Although many teaching materials have been developed, SETS-based electronic worksheets on virus topics to train critical thinking skills are still limited. Therefore, research is needed to develop and describe SETS-based electronic worksheets on virus topics that are valid, effective, and practical in improving students' critical thinking skills.

METHODS

This research is a type of electronic student worksheet development research using the ADDIE development model. The stages of this research included product development, validation, and limited trials. Development and validation were conducted at the Faculty of Mathematics and Sciences, State University of Surabaya, while the limited trial was conducted at MAN

3 Kediri in May-June 2024. The test subjects were 25 students of class X-K who were heterogeneous based on academic grades and gender.

The analysis stage includes curriculum, learners, tasks, concepts/materials, indicators, and learning objectives to develop electronic worksheets that meet the needs. The initial design stage of the worksheet includes assessment drafting, media selection, design, and consultation. The development stage aims to produce SETS-based electronic worksheets, based on the validity and suggestions of supervisors and examiners. The implementation stage was carried out to determine the effectiveness of the worksheet by implementing it on 25 students for four meetings. The evaluation stage is carried out based on learning outcomes and students' responses to the use of SETS-based electronic worksheets on virus topics to improve critical thinking skills.

The parameters used in this study were validity, effectiveness, and practicality. Data analysis was carried out descriptively qualitative and quantitative based on validation results, learning outcomes, and student responses. Analysis of validation results based on validation instrument that assesses the feasibility of electronic worksheets based on presentation, content, and language. Scores were given by two biology lecturers and one biology teacher using a Likert scale of 1-4. As space to write suggestions to provide in the validation instrument with written suggestions. The validation results are in the form of feasibility scores, which are calculated descriptively and quantitatively with the formula, as follows:

$$\text{Average} = \frac{\Sigma\, score\ for\ each\ criterion\ of\ all\ validators}{\Sigma\, validator} \times 100\% \quad \text{.....(1)}$$

Electronic worksheet validation scores were interpreted based on the criteria in Table 1. Electronic worksheets are said to be valid if the score is between 2.51-4.00.

Table 1. Criteria for Interpreting Validity Scores (Riduwan, 2013)

Score	Interpretation Criteria
1.00-1.50	Less valid
1.51-2.50	Quite valid
2.51-3.50	Valid
3.51-4.00	Very valid

Analysis of learning outcomes to determine the effectiveness of electronic worksheets were effective. The pre-test was given before, and the post-test after using electronic worksheets to measure the improvement of learning outcomes and students' critical thinking skills:

$$\text{Score pre-test/post-test} = \frac{\Sigma\, the\ score\ obtained}{\Sigma\, maximal\ score} \times 100\% \quad \text{.....(2)}$$

Students' achievement is considered complete if the pre-test and post-test scores are $\geq$ 75. The learning outcomes of students can be calculated using the formula, as follows:

$$\text{Learning outcome completeness (\%)} = \frac{\Sigma\, completed\ student}{\Sigma\, number\ of\ student} \times 100\% \quad \text{...(3)}$$

The completeness of learning outcomes is recognized if the completeness score is > 61%, then interpreted in the completeness criteria according to the table. The improvement of learning outcomes can be known through the calculation of the N-gain score. The N-gain-score calculation uses the formula as follows:

$$(g) = \frac{(score\ posttest) - (scorepretest)}{(score\ maksimal) - (scorepretest)} \quad \text{.....(4)}$$

After the calculation of the N-gain score obtained, it is categorized into high, medium, or low improvement. The N-gain categories are contained in Table 2.

Table 2. Category of N-gain Score (Riduwan, 2018)

N-gain Score	Category
(g) > 0.7	High
0.3 > (g) 0,7	Medium
(g) < 0,3	Low

Analysis of the results of students' responses to determine the practicality of electronic worksheets is practice. Students filled out a questionnaire containing questions about electronic worksheets, with "Yes" or "No" answers. The students' responses were then interpreted based on the Guttman scale. The results of the participants' responses were calculated using the formula, as follows:

$$\text{Student response (\%)} = \frac{\Sigma\, students\ who\ answer\ "Yes"}{\Sigma\, number\ of\ students} \times 100\% \quad \text{.....(5)}$$

Student responses from the questionnaire were interpreted based on the criteria in Table 3. The response is considered practical if the response value is $\geq$ 61%.

Table 3. Learner Response Interpretation Criteria Based on Likert Scale (Sugiyono, 2015)

Percentage	Interpretation Criteria
0%-20%	Impractical
21%-40%	Less practical
41%-60%	Moderately practical
61%-80%	Practical
81%-100%	Very practical

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RESULT AND DISCUSSION

This research produces Science, Environment, Technology, and Society (SETS)-based electronic Worksheets to improve critical thinking skills on virus topic. This electronic worksheet includes brief material, images, and stages of SETS-based learning activities, including invitation, exploration, solution, application, and concept establishment. The improved critical thinking skills include interpretation, analysis, inference, explanation, and self-regulation. This research aims to produce electronic worksheets that were valid, effective, and practical. Validity was determined by validation from two biology lecturers and a biology teacher. Effectiveness was assessed from the improvement of students' learning outcomes based on pre-test and post-test data. Practicality was measured by students' positive responses to the electronic worksheet.

SETS-Based Electronic Worksheet Development Results

The developed electronic worksheet also contains supporting features, namely *Isu Virus*, *Kenal Virus*, *Lawan Virus*, *Aksi Virus*, and *Konseptualisasi Virus*. These features can be described in Table 4.

Table 4. Profile and Supporting Features of Electronic Worksheets

No	Features	Description
1.		Cover page of SETS-based electronic worksheet on virus topic to improve students' critical thinking skills.
2.		News about a disease symptom is presented as a means for learners to improve their skills in interpreting the meaning of information from community life issues.
3.		Reading materials are provided as learning materials for learners to develop analysis skills.
4.		Questions are posed for peer-to-peer discussion as a means for learners to hone inference skills to prevent the spread of the virus.
5.		Assignments are given as a platform for learners to master the skill of explaining the steps to prevent the spread of viruses.
6.		Discussion forums between learners are organized with feedback from the teacher to strengthen understanding of concepts.

Each SETS approach has five activity steps used. The first step was the invitation stage which contains news about a disease. This news was presented as a means for learners to practice interpretation skills, which is to explore the meaning of information from community life issues. This invitation stage guides learners to connect aspects of science with society through reading and understanding the meaning of news texts about diseases that occur in society. In line with research conducted by Agustine (2020) at the invitation stage, students can be directed to link the components of science and society based on problems that occur around them as an introduction to topics at the beginning of learning. In the exploration stage, learners were given readings as learning materials to develop interpretation and analysis skills, namely to get more in-depth information about viruses. This exploration stage helps learners link aspects of science with the environment, where they learn about the replication and role of coronavirus in the environment. The solution stage is a stage that guides learners to connect aspects of science and society by presenting questions for discussion with friends as a means to hone inference skills in an effort to prevent the spread of the virus. The next stage is the application stage, where learners conduct a campaign to master the skill of explanation regarding the steps to prevent the spread of the virus to the community in the form of infographics through their social media. Activities in this application stage train students to connect aspects of science, environment, and society. The last stage is the establishment concept stage, where students reconstruct their knowledge about the four aspects of SETS that have been carried out in the previous stages by concluding through the linkage of the four existing SETS elements, and they also get feedback from the teacher to strengthen the knowledge that has been obtained. According to research by Itaunada & Rachmawati (2023), the stabilization stage can guide students in linking the four SETS components to address problems occurring in society.

Validity of SETS-Based Electronic Worksheet

Table 5. Result of Validity of Electronic Worksheets

No	Rated Aspect	Score			Average
		V1	V2	V3	
Language Components					
1.	Following the development of learners				
	Appropriate level of thinking	4	4	4	4
	Appropriate level of	4	4	4	4

No	Rated Aspect	Score			Average
		V1	V2	V3	
	emotional				
2.	Motivating Ability				
	Motivating language	3	4	4	3.67
	Communicative	4	4	4	4
	Encourages critical thinking	3	3	4	3.33
3.	Agility				
	Precise sentence	4	4	4	4
	Standardized terms	3	3	3	3
4.	Conformity to Indonesian language rules				
	Grammar is correct.	4	3	4	3.67
	Spelling is correct.	3	4	4	3.67
Average validity of language component					**3.70**
Presentation Component					
1.	Presentation Technique				
	Systematic	4	4	4	4
	Topic-appropriate cover	4	4	4	4
	Attractive display	3	4	4	3.67
2.	Supporting Material Presentation				
	Image accordingly	4	4	4	4
	Numbering, naming, and tables were appropriate.	3	4	4	3.67
3.	Presentation of Learning				
	Interactive and participative	3	3	3	3
	SETS-based	4	3	4	3.67
4.	Comprehensiveness of Presentation				
	Instructions for use	4	3	4	3.67
	Concept map	4	3	4	3.67
Average validity of presentation component					**3.71**
Content Appropriateness Component					
1.	Activities according to learning objectives				
	In accordance with learning objectives	4	3	4	3.67
	Appropriate level of critical thinking	3	3	4	3.33
	Time allocation is appropriate.	3	4	3	3.33
2.	Accuracy of Electronic Worksheet Activities				
	Easy to understand	3	4	4	3.67
	By biological science	4	4	4	4
3.	Up-to-date and contextual				
	Refers to the environment	4	3	4	3.67
	In accordance with the development of science	4	4	4	4
4.	Characteristics of SETS Activities				
	Invitation	3	4	4	3.67
	Exploration	4	3	4	3.67
	Solution	4	4	4	4
	Application	3	3	4	3.33
	Establishment of concept	4	4	4	4
5.	Improving Critical Thinking Skills				
	Interpretation	3	4	4	3.67
	Analysis	4	3	4	3.67
	Inference	4	4	4	4
	Explanation	4	4	4	4
	Self Regulation	3	4	4	3.67
Average validity of content component					3.73
Average score of validity of electronic worksheets					3.72

The validation results from three validators showed that the SETS-based electronic worksheet obtained an average score of 3.72, or 93.10%, classified as very valid. SETS-based electronic worksheets to improve critical thinking skills were considered feasible because they have met the requirements in the aspects of language, presentation, and content. This worksheet is considered feasible to use and must meet the requirements in the aspects of language, presentation, and content (Sulviana, 2016).

The language component received an average score of 3.70 or 92.59%, classified as very valid. There were eight sub-aspects that show the electronic worksheet was in accordance with the development of students, motivating, communicative, and uses proper grammar and spelling. The use of language in worksheets must be standardized and communicative, and the sentences used were simple, clear, and easy to understand (Sulviana, 2016). The lowest score in the language component was the use of terms, with a score of 3, which was still classified as valid. The selection of appropriate terms in the preparation of worksheets, students can improve their understanding of the content and avoid misinterpretation (Syam, 2017).

The presentation component received an average score of 3.71, or 92.59%, classified as very valid. There were eight sub-aspects that show the electronic worksheets were systematic, interesting, and used the SETS approach. The use of electronic worksheet images according to the material being taught can also support an attractive appearance, making it easier for students to capture material understanding (Indrawati, 2023). The lowest score in the presentation component was interactive and participatory worksheet, with a score of 3 which was still classified as valid. Electronic worksheets were interactive and easily accessible online, thus creating an innovative learning environment (Fitriani et al., 2021).

The content component received an average score of 3.73, or 93.63%, classified as very valid. All 17 sub-aspects show that the electronic worksheets were in accordance with the learning objectives, critical thinking level, and virus topic, as well as the students' environment. The formulation of learning objectives must be in line with the current curriculum (Syam, 2017). Research shows that the use of SETS-based teaching materials effectively improves students' critical thinking skills. SETS characteristics have been presented in electronic worksheets, each of which can improve critical thinking skills according to the appropriate indicators. In accordance with the research of Sylviana et

al. (2019), the use of SETS-based teaching materials proved effective in improving students' critical thinking skills. Research by Pramesthi & Purnomo (2020) also shows that the SETS approach has a significant impact on critical thinking skills.

Overall, the SETS-based electronic worksheets received an average validity score of 3.73, classified as very valid, meeting the feasibility of language, presentation, and content. These worksheets were ready to be tested on 25 students of class X-K MAN 3 Kediri to obtain effectiveness and practicality data.

Effectiveness of SETS-Based Electronic Worksheets

The effectiveness of SETS-based electronic worksheets can be seen through the increase in N-gain score from pre-test and post-test. The pre-test and post-test instrument contain items that were in accordance with the indicators of improved critical thinking skills, including interpretation, analysis, inference, evaluation, and self-regulation. The data of pre-test and post-test results are described in Table 6.

Table 6. Student Learning Outcomes Before and After Using Electronic Worksheets (Pre-test and Post-test)

Students No-	Pre-test		Post-test		N-Gain
	Score	Completeness	Score	Completeness	
1	30	No	80	Yes	0.7
2	60	No	80	Yes	0.5
3	50	No	80	Yes	0.6
4	60	No	100	Yes	1
5	70	No	100	Yes	1
6	50	No	80	Yes	0.6
7	100	Yes	100	Yes	0
8	50	No	80	Yes	0.6
9	60	No	80	Yes	0.5
10	50	No	80	Yes	0.6
11	30	No	100	Yes	1
12	20	No	100	Yes	1
13	80	No	90	Yes	0.5
14	50	No	80	Yes	0.6
15	60	No	80	Yes	0.5
16	40	No	100	Yes	1
17	70	No	100	Yes	1
18	90	Yes	100	Yes	1
19	90	Yes	100	Yes	1
20	100	Yes	100	Yes	0
21	60	No	80	Yes	0.5
22	60	No	80	Yes	0.5
23	50	No	80	Yes	0.6
24	50	No	80	Yes	0.6
25	50	No	80	Yes	0.6
Completeness	20%		100%		0,66

Description:
Completed score ≥ 75
N-gain:
0,00 < g < 0,30: Low
0.30 < g < 0.70: Medium
0,70 < g < 1,00: High

Table 7 shows the pre-test and post-test results of students using SETS-based electronic worksheets. The pre-test showed 5 students were complete and 20 students were not complete, while the post-test showed all 25 students were complete. The percentage of student completeness increased from 20% in the pre-test to 100% in the post-test, with an average N-gain of 0.66, medium category. The pre-test results showed 25% completeness because 20 students scored below 75.

The cause of low pre-test results was the attractiveness of subjects related to learning methods, teaching materials, and learning media that were centered only on the teacher so that students were not active (Farahani et al., 2023). In addition to these causes, not a few students only memorize the material because they were not used to learning to practice problem-solving in everyday life. This causes students to have difficulty in answering questions on the post-test (Zikra, 2016).

Table 6. also shows the results of the post-test, showing that the percentage of completeness was 100%. Based on the results, there was an increase in students' learning outcomes after learning by operating the given electronic worksheet. If students have critical thinking skills, their cognitive learning outcomes will improve (Saparuddin, 2021). This is because the use of electronic worksheets will make students actively involved in learning (Indriani & Hartono, 2021).

Analysis of pre-test and post-test results using the N-gain score formula with an average N-gain score of 0.66. This value was classified in the moderate category. Similar research conducted by Asmuri (2019) also provides results that the SETS approach can improve critical thinking skills with an N-gain score of 0.6 which is included in the moderate category.

In addition to the completeness of the pre-test and post-test results described in Table 6, the improvement in learning outcomes was also seen through the percentage results of each critical thinking indicator described in Figure 1.

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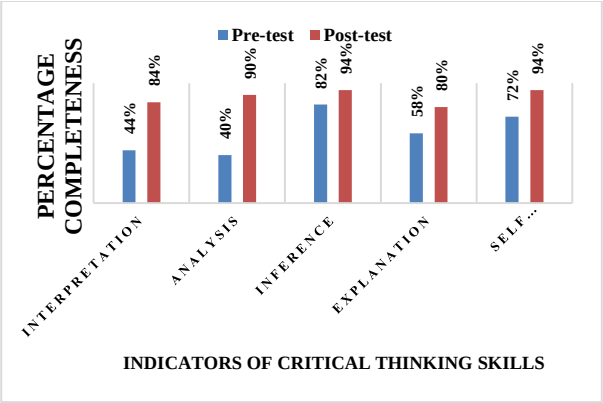

Figure 1. Recapitulation of Learning Outcomes on Each Critical Thinking Skills Indicator

Figure 1. displays a recapitulation of the completeness of student learning outcomes in each critical thinking indicator. The pre-test results on the interpretation indicator obtained a percentage of completeness of 44%, while the percentage of completeness of the analysis indicator in the post-test rose to 84%. Interpretation skills that have increased learning outcomes by 40% may be due to SETS-based electronic worksheets presenting news of virus issues that were problems of students' daily lives so that students can reveal information obtained easily. The possibility of lower students' interpretation skills shown in the pre-test results was caused by learning that was not contextual-based. Learning rarely puts students in real situations, so that learning is less meaningful (Alonemarera, 2023). The post-test results show an increase in interpretation skills after learning using SETS-based electronic worksheets that apply learning that was directly related to real situations. SETS-based teaching materials can help learners see the relevance and practical application of information that can strengthen their ability to interpret information in different contexts (Putri & Syafriani, 2022).

In the analysis indicator, the acquisition of the percentage of completeness of learning outcomes in the pre-test was 40%, while in the post-test it increased with a percentage of completeness of 90%. The results of the increase in the analysis indicator were the highest increase among other critical thinking indicators, which was 50%. Students' analysis skills from pre-test data were low, possibly because students have not been trained in learning that involves digging for information in collecting data or facts as a potential solution to complex problems (Pane & Fadilah, 2024). Meanwhile, when students have been given analysis questions and pictures on the post-test questions, students could answer correctly. This was due to the practice questions that have been done during learning using SETS-based electronic worksheets. Learning activities train analysis skills by presenting brief material, then students dig up information from various sources to further analyze everything related to viruses. Extracting various information can require learners to understand the complexity and variation in data or arguments; it also involves assessing and selecting information accurately and synthesizing information so that learners can get used to using analytical skills to develop their understanding (Pane & Fadilah, 2024).

The pre-test results on the inference indicator obtained a percentage of completeness of 82%, while the percentage of completeness of the inference indicator in the post-test rose to 94%. This indicator was one of the indicators that has the highest percentage of completeness. The post-test question has a connection with learning activities with SETS-based electronic worksheets. In this activity, students can conclude solutions to prevent the spread of viruses as a suggestion for educational efforts in the community so that students' inference skills increase. Although the completeness of the post-test inference indicator was high, the increase from the difference between the pre-test and post-test inference indicators was the lowest of the other critical thinking indicators, which was 12%. Although the lowest increase, the inference skills of students based on the pre-test results were included in the complete category. This completeness indicates that students already have high inference skills. Learners' skills in concluding involve the skills of analyzing information, selecting evidence, and making logical connections between ideas so that students have been trained in inference critical thinking skills appropriately (Putri & Syafriani, 2022).

The percentage of completeness on the explanation indicator in the pre-test was 58%, while the percentage of completeness of the explanation indicator in the post-test increased to 80%. Students' explanatory skills from the pre-test data are still low, possibly because students have not been trained in learning that provides opportunities for students to practice expressing opinions, presenting learning outcomes, and getting feedback from the teacher (Khoirunnisa & Dwikoranto, 2021). In the post-test question, learners can explain and present the reasons why a solution can prevent the spread of the virus as a suggestion for educational efforts in the community. Deep understanding through active learning methods, practice expressing opinions, and constructive feedback can improve students' explanation skills (Putri et al., 2021). Although the completeness of the post-test self-regulation indicator was high, the increase from the

difference between the pre-test and post-test self-regulation indicators was not too high, which was 22%. Although the increase was not too high, the inference skills of students based on the pre-test results were almost complete. This shows that students already have sufficient self-regulation skills because learning involves students in a problem in society. Learners' skills in placing themselves in a positive role towards the surrounding circumstances make opportunities for students to have critical thinking skills of self-regulation indicators (Oktaviani, 2017).

Overall, based on Table 7 post-test completeness of 100% and the acquisition of an N-gain score of 0.66, which was classified in the moderate category. Based on Figure 1. post-test learning outcomes in each critical thinking indicator get an average of 88.40%, so the electronic worksheets developed were declared effective in terms of student learning outcomes.

Practicality of Electronic Worksheets

The practicality of SETS-based electronic worksheets on virus topic to improve critical thinking skills was an assessment of the ease of operation of electronic worksheets determined based on student responses. Learners' responses to learning activities during the use of electronic worksheets were obtained after distributing the learner response questionnaire instrument. Filling in the questionnaire instrument of students' responses was carried out by 25 students of class X-K MAN 3 Kediri. In the response questionnaire instrument, students fill in between the answers "Yes" or "No". The criteria assessed include three aspects, namely aspects of language, presentation, and content.

Table 7. Results of Learners' Response to the Use of Electronic Worksheets

No	Aspect	Percentage (%)
Language		
1.	This electronic worksheet uses the Indonesian language well.	100
2.	The grammar used in the electronic worksheet supports the ease of understanding the flow of the material described.	96
3.	The sentences, questions, and instructions/commands in the electronic worksheets are easy to understand and do not cause multiple interpretations.	96
4.	The terms used in the electronic worksheet are easy to understand.	100
The average percentage language aspect		98
Presentation		
5.	The cover design of this electronic worksheet is attractive.	100
6.	The cover of the electronic worksheet reflects the content of the material it contains.	100
7.	The design theme on each topic of the electronic worksheet is interesting.	100
8.	The instructions for using the electronic worksheet are easy to understand.	100
9.	The presentation of each feature and image in the electronic worksheet is attractive.	100
10.	The size of the letters/numbers in the electronic worksheet is not too small so that it is easy to read.	84
11.	The use of this electronic worksheet is simple and accessible.	100
12.	This electronic worksheet interests you to learn it.	100
The average percentage presentation aspect		**98**
Content		
13.	SETS-based electronic worksheets help you understand virus topic.	100
14.	This SETS-based worksheet motivates you to learn through the learning activities in it.	100
15.	This SETS-based worksheet encourages you to practice critical thinking in learning activities,	100
16.	The SETS-based electronic worksheet supports active and fun learning.	100
17.	This SETS-based worksheet trains cooperation between group members.	100
18.	The activities in the electronic worksheet involve cases/problems as stimulation.	96
19.	The activities in the electronic worksheets train learners to analyze the meaning of information.	100
20.	The activities in the electronic worksheet involve learners in analyzing problems and information.	100
21.	The activities in the SETS-based worksheet involve students to obtain reliable information from various sources.	100
22.	The activities in the electronic worksheet train learners to determine the conclusion and solution of a problem.	100
23.	The activities in the electronic worksheet train learners to present their work.	100
24.	This worksheet electronic with a learning approach help you easily gain new knowledge and is it fun.	100
25.	This electronic worksheet is interesting and can be done easily.	100
Average percentage content aspect		99.69
Average percentage		98.88

The results of positive responses from students to the SETS-based electronic worksheets in Table 7 show that the worksheet was very practical to use, with an average percentage of 98.88%. This worksheet was operated

through the *Live Worksheet* website, which was interactive and easily accessible online, creating an innovative learning environment (Fitriani et al., 2021). Of the 25 questionnaire questions, 21 questions received a positive response of 100%, 3 questions by 96%, and 1 question by 84%.

On the question of font size, 4 learners answered "No" because of the difficulty of reading on mobile phones, but still able to follow the learning well. Choosing the right font size affects readability and understanding of the topic (Suswastini et al., 2022). Regarding grammar and ease of understanding, 1 learner answered "No" but could understand after being explained by the teacher, in line with Nurhayati et al. (2015), who emphasized the importance of structured language. The question about activities in the worksheet, 1 learner answered "No", although the worksheet presents disease news for interpretation of information in society. The use of electronic worksheets increases active participation, reasoning ability, and daily problem-solving skills (Widyanti, 2021).

Learners' responses were reinforced by positive comments in the questionnaire regarding uniqueness, neat layout, and comfortable colors. According to Nurhayati et al. (2015), the quality of worksheets is influenced by attractive delivery techniques. Overall, the electronic worksheets were highly valid and can be used with 25 learners, showing positive responses in the aspects of language, presentation, and content. This worksheet is interesting, easily accessible, and supports learning about viruses and critical thinking skills with gadgets (Nurhayati et al., 2015).

Overall, the results showed that the electronic worksheets were highly valid theoretically and empirically. This teaching material was implemented on a limited basis for 25 students and shows that the response of students was positive during learning activities using SETS-based electronic worksheets based on language, presentation, and content aspects. This was conveyed by students when learning with teaching materials in the form of electronic worksheets, which were very interesting with supporting features and can be accessed easily through the gadget they have so that students can learn virus topics and train their critical thinking skills by operating SETS-based electronic worksheets.

CLOSING

Conclusion

Based on research on the development of SETS-based electronic worksheets (Science, Environment, Technology, and Society) on virus topics, it can be concluded that the worksheets have been produced as teaching materials that can improve the critical thinking skills of high school students. This worksheet was considered very valid with a score of 3.72 and a percentage of 93.10% based on expert validation. Its effectiveness was proven to be very high, with the completeness of student learning outcomes reaching 100% and the average completeness of each indicator of 88.40%, as well as a moderate increase with an N-gain score of 0.66. The practicality of this worksheet was also very practical, with a percentage of learner responses of 98.88%.

Suggestion

Similar research needs to develop electronic worksheets by adding timers at each stage to match the time allocation and ensuring a stable internet connection and adequate devices for students. Worksheets should also include images, videos, and interactive features to facilitate independent access. In addition, the size of the writing must be considered so that it is comfortable to use and facilitates understanding of the topic.

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