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Development of Student Worksheet with the SETS *(Science, Environment, Technology, and Society)* Approach to Improve Critical Thinking Skills in Reproductive System Materials

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Abstract: This study aims to develop electronic Student Worksheet (known with E-LKPD) with the SETS (*Science, Environment, Technology, and Society*) approach model to improve the critical thinking skills of high school grade XI students on reproductive system material. The SETS approach is used to stimulate critical thinking skills in problem-solving-oriented situations. The development model of this research is the ADDIE (Analysis, Define, Design, Development, Disseminate, Evaluation) development model. The research design uses a pretest-posttest control group design. The subjects of the study were 70 students in class XI of SMA Negeri 1 Depok. The development of E-LKPD was carried out with the help of iSpring. Validation is measured based on expert validation and limited trial results. The results of this study show that E-LKPD is declared very feasible and the results of the response to the use of E-LKPD have perfect criteria. The results of the wide-scale test showed that in the experimental class that applied the SETS approach, there was an increase in critical thinking skills with an average posttest score of 84.8 with the results of the gain score test in moderate criteria. Meanwhile, the control class also experienced an increase in critical thinking with an average posttest score of 77.62 with the results of the gain score test in low criteria.

Keywords: E-LKPD; Critichal Thinking; SETS

Introduction

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results. The 21st century is a century of knowledge marked by a massive transformation from an agrarian society to an industrial society and continuing to a knowledge society (Berlianti et al., 2024). The development of science and technology in the 21st century presents new challenges in the world of education. Students who lack or do not have 21st century skills will face stiff competition. Students must master various 21st-century skills so that they can adapt to technological developments, social, and economic demands. Related to this, changes to the 2013 curriculum at the Ministry of Education and Culture Number 22 of 2016 concerning skills that are indispensable to students, force all parties, especially schools, to prepare students to master several 21st century skills (Mursita et al., 2022). This aims to ensure that students have a meaningful role so that they can answer the demands of the development of the times. The many indicators of success in mastering 21st Century skills are not balanced by the measurement of 21st Century skills in Indonesia in a complex manner,

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one of which is critical thinking skills (Daud, 2024). The 2013 curriculum requires training students' critical thinking skills and integrating technology into learning. Having critical thinking skills, will equip students to face future problems not only in classroom learning (BNSP, 2017). Critical thinking is high-level thinking that is divided into four groups, including problem-solving, decision-making, creative thinking, and critical thinking (Parmin & Savitri, 2020). Critical thinking is a complex process that involves receiving mastery, evaluation and analysis of data as well as considering quantitative and qualitative aspects, as well as making decisions based on the results of evaluation (Wati et al., 2022). However, in reality, the thinking skills of students in Indonesia are still very low, especially in the field of science. This is seen from the results of the Global Creativity Index (GCI) research in 2015 according to (Itaunada & Rachmadiarti, 2023).

Stating that Indonesia is ranked 115th out of 139 countries. Based on the results of observations conducted at SMA 1 Depok Sleman, the researcher saw that the students' critical thinking skills have not been seen because there are still students who are based on the answers in the book, but explained in their thinking have not been seen. To think critically, students have not been honed more deeply to ask questions or explain (Puspitasari, 2020). Stating that if students' critical thinking skills are not visible and left continuously, it will hinder the learning process, which means that the learning goals will not be achieved. If students cannot think critically, then students will be disadvantaged, because having the ability to think critically is very important in the world of education to train the courage to speak, confidence, and have new knowledge (Puspitaningrum et al., 2022). It does not seem that students' critical thinking skills are due to many things, one of which is because educators have not implemented the right learning model so that learning becomes less interesting and students are not able to think critically. Researchers found several problems faced by students, especially in critical thinking skills. It is difficult for students to improve their critical thinking skills because educators still use the old paradigm, namely using conventional methods or lectures during learning. Students only sit, be silent, listen, take notes, and memorize so that KBM (Teaching and Learning Activities) becomes unpleasant and less attractive to students (Syah et a., 2022).

Based on the results of these initial observations, it is known that in general, educators at SMA 1 Depok consider the need for the development of LKPD by the needs and characteristics of students, one of which is based on SETS which is very suitable for use in elementary schools because the SETS learning model focuses on problems from the real world, namely it can be understood, can be explored, and the solution can be solved so that it is effective in increasing activities and critical thinking skills to be more optimal. Therefore, it is necessary to develop a SETS-based LKPD to improve students' critical thinking, where the implementation of learning is by the scientific approach as desired by the 2013 curriculum (Ningsi et al., 2021). Student Worksheet (known with LKPD) is based on SETS which presents structured questions that can help students to remember and understand the material better and help students conclude what they have learned so that after participating in learning activities students do not have difficulties when given the form of structured questions (Mursita et al., 2022).

The SETS learning model used in the development of LKPD media is expected to make students look at everything in an integrated way, namely paying attention to the elements contained in SETS, namely science, environment, technology, and society, so that educators can connect the science concepts in the LKPD with the problems that occur in society and the environment around students (Rosa et al., 2022). As stated by Suryani & Rini, (2023) it is stated that SETS learning will essentially guide students to think globally and act locally and globally in solving problems that will be faced in daily life. Problems that exist in society today are brought into the classroom to be solved by using the SETS model learning in an integrated manner in the mutual relationship between elements of science, the environment, society, and technology (Pratama et al., 2024). stated that learning using the SETS model can encourage students critically to look at the scientific problems they find, and students learn how scientific knowledge is obtained, by understanding scientific knowledge better and evaluating scientific knowledge (Harnani et al., 2021), based on the results of previous studies, it is stated that learning with the SETS model can improve scientific literacy related to critical thinking. Based on the background of the problems that have been stated above, it is important to apply the SETS learning model to the development of LKPD which can improve students' critical thinking skills (Amelia et al., 2024). Therefore, based on some of the problems above, the development of SETS-based LKPD media is expected to be effective in improving the critical thinking skills of high school grade IX students, especially in reproductive materials (Rizkika et al., 2022).

Method

Research design and method should be clearly defined. This research is Research and Development (R&D). Borg & Gall, (1983), states that research and development (R&D) is the process used to develop and validate the educational products to be produced. The

use of the term "product" not only includes material objects, such as textbooks, modules, LKPD, and so on but also what is intended to refer to established processes and procedures, such as teaching methods or methods to organize teaching (Wulandari et al., 2023). This research and development will produce a valid and feasible product, and it is more likely to be used as a learning resource in the classroom, if the product has been validated by material experts, media experts, linguists, peer assessments, and received assessments from students (Santosa et al., 2018). The effectiveness of the use of LKPD can be seen from the learning outcomes of students, as well as to measure students' critical thinking skills. The data is in the form of quantitative data obtained through pre-test and post-test (Syainatunnisa et al., 2024).

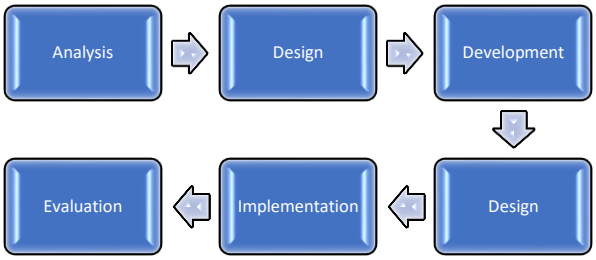

Figure 1. Research Stage

Result and Discussion

At this stage, data collection is carried out in the form of needs analysis and literature review. The needs analysis was carried out by observation and distributing questionnaires to students and educators to obtain initial information on learning activities at SMA Negeri 1 Depok Sleman. Based on the needs analysis, information was obtained that all (100%) educators need LKPD as teaching materials for thematic lessons and all educators agree that LKPD plays an important role in learning so that the material is easy to convey and students are active in learning(Boimau, Tukan, Lawung, & Boelan, 2022). In Learning, educators are used to using LKPD even though the LKPD used is not by the characteristics of students and the desired goals because the LKPD is used in general(Herawati, Ibrahim, & Suratman, 2014). Educators need LKPD that is in line with the characteristics of students and the material is presented in a simple and easy-to-apply manner by educators. The LKPD based on the SETS model developed was declared valid/feasible based on the results of validation by material experts, media experts, and linguists. Furthermore, after developing the initial product, the researcher asked for input and suggestions from experts in their fields, namely material experts, and media experts. The expert validation test serves to assess the suitability of the teaching materials developed with learning needs. This validation is obtained by filling out a questionnaire by validators. The results obtained from the validators are as follows(Wardani & Miftakhi, 2021).

E-LKPD Validation Results

This validation was carried out to assess the feasibility of the E-LKPD product developed. The assessment of the material includes four aspects, namely the feasibility, effectiveness, and practicality of the LKPD. The results can be seen in Table 1.

Table 1. Results of Validation of Material Experts on E-LKPD Products

Assesment of Aspect	Score	Value	Criteria
Aspects of material feasibility and accuracy of material	4	90	Very Good
Aspect of material presentation	4	98	Very Good
Aspects of the relevance of facts to the concept	4	95	Very Good
Language aspects	3	80	Good
Average		90.75	Very Good

The results of the assessment of the four aspects used showed a final average score of 90.75 with a very feasible category. All aspects get a perfect score of 100, except for the language aspect which gets a score of 82. There are suggestions and inputs from material experts, so revisions are needed. Overall, it can be concluded that E-LKPD biology teaching materials with the SETS approach are feasible to be used for learning in terms of material.

Meanwhile, the assessment of media includes two aspects, namely the software engineering aspect and the visual aspect. The results of the assessment can be seen in Table 2.

Table 2. Media Expert Validation Results for E-LKPD Products

Assesment Aspect	Score	Value	Criteria
Software engineering aspects	3.9	97.5	Very Good
Visual communication aspects	3.9	97.5	Very Good
Average		97.5	Very Good

The results of the assessment of the two aspects used showed an average score of 98.75 with a very decent category. The software engineering aspect gets a score of 100 while the visual communication aspect gets a score of 97.5. In the media aspect, validators do not provide specific suggestions and inputs. Overall, it can

be concluded that E-LKPD with the SETS approach is feasible to be used for learning in terms of media.

Limited Trial Results

Before being used, E-LKPD with the SETS approach was tested on a limited basis to students in class XII MIPA MA Al-Barokah who were not the target subjects of the research. A limited trial was conducted to see the practicality of E-LKPD with the SETS approach from student assessment. The assessment was carried out by distributing questionnaires containing statements based on learning aspects, language aspects, and technical aspects. In this trial, 20 respondents filled out a questionnaire and were selected by random sampling. The results of students' responses to E-LKPD can be seen in Table 3.

Table 3. Student Responses to E-LKPD

Assesment Aspect	Scale	Value	Criteria
Learning aspects	3.15	77.8	Practical
Language aspects	3;07	76;8	Practical
Technical aspects	3.18	79;5	Practical
Average		81;9	Practical

The assessment of the three aspects used shows a final average score of 81,9 in the practical category. The highest score was obtained in the technical aspect while the lowest score was in the language aspect. Overall, it can be concluded that students as users of teaching materials have a positive response to E-LKPD with the SETS approach.

Wide-scale trials are implementations of products that have previously been feasible and tested in the field. The implementation is carried out in real conditions of biology learning activities on reproductive system material and aims to test its effectiveness on critical thinking skills and health literacy.

The implementation of the E-LKPD product with the SETS approach developed in this study uses a pseudo-nonequivalent experiment (pretest-posttest) control group design. The subjects of the broad trial were students of SMAN 1 Depok class XI MIPA which amounted to 70 students, each divided into treatment groups (experiments) of 35 students and comparators (controls) of 35 students.

The experimental group is students in the class who receive learning of reproductive system material using E-LKPD with the SETS approach, while the control group is students in the class who receive learning of reproductive system material using PowerPoint and LKPD in printed form and using the discovery learning model. The extensive trial data collected includes the results of working on pretest questions, posttest questions, health literacy questionnaires, and observation sheets on the implementation of the RPP.

In the effectiveness test, the development of Borg & Gall was carried out, namely by involving all students of class IX MIPA 1 as an experimental class and class XI MIPA 2 as a control class. An N-Gain Test is carried out first to see the level of effectiveness of the product. Normalized gain (N-Gain) is a data analysis test that aims to determine the effectiveness of using SETS-based LKPD. The results of the analysis of N-Gain were obtained based on the results of the pretest and posttest as well as the standard deviation carried out in this study.

Table 4. Experimental and Control Class Averages

Class	Pre-test Average	Post-test Average	N-Gain Score	Criteria
Experiment	68.69	84.80	0.50	Medium
Control	67.82	77.62	0.29	Low

The N-Gain value obtained in the experimental class of 0.50 is included in the Medium category, while the N-Gain value in the control class obtained a value of 0.29 is included in the Low category. Normality Test After meeting the requirements, hypothesis testing is carried out. From the results of the analysis of the normality test of the data above, it can be concluded that the data is distributed Normal because of the value of Sig>0.05. Homogeneity Test After conducting the normality test, the homogeneity test is continued. The homogeneity test was used to find out whether the respondent group came from the same population or not. The results of the data homogeneity test can be concluded that the sample data comes from a homogeneous population because the Sig value is 0.574 >0.05.

Based on the results of research, theory, and relevant research, it can be concluded that the development of SETS-based LKPD can improve students' critical thinking skills. This is evidenced by the difference in critical thinking skills of students who use SET-based LKPD with those who do not use SET-based LKPD at SMAN 1 Depok Sleman, Yogyakarta. The difference that occurred to students as respondents from this study was that there was a significant increase in students' critical thinking skills to be even better after using the SETS-based LKPD. Thus, based on the results of this study, it can be an alternative for educators to improve students' critical thinking skills through the use of SETS-based LKPD.

Conclusion

Based on the results of the research and development of E-LKPD with the SETS approach on reproductive system materials that have been carried out, it can be concluded that: (1) E-LKPD with the SETS

approach on reproductive system material is suitable for use in high school biology learning Class XI based on assessments from material experts, media experts, and biology teachers as practitioners; (2) E-LKPD with the SETS approach on practical reproductive system material is used in high school biology learning Class XI based on responses from high school class XI students. E-LKPD with the SETS approach on reproductive system material is effectively used to improve critical thinking skills and health literacy of grade XI high school students in a meaningful way.

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The authors declare no conflicts of interest.

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