



DEVELOPMENT OF E-LKS (ELECTRONIC STUDENT WORKSHEETS) CONTAIN HOTS (*HIGHER ORDER THINKING SKILLS*) STUDENTS IN SCIENCE LEARNING

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Received: March, 11th 2022

Revised: September, 3th 2023

Accepted: October, 22th 2023

ABSTRACT

Worksheets are one of the learning tools that play an important role in students' thinking processes. The thinking process in achieving 21st-century skills is that students can have higher-order thinking skills (HOTS). The objectives of this research are: (1) How do teachers and students respond to the development of E-LKS, which includes students' HOTS in science learning? and (2) How do we increase students' HOTS in using E-LKS in science learning? The research subjects were students of class VIII SMPN 4 Sumenep. This study uses the Research and Development approach and Thiagarajan's four-dimensional research and development model. Our E-LKS validity data was obtained from the content validity index (CVI) analysis. Teacher and student response data were obtained by using response questionnaire analysis. Data on increasing HOTS using E-LKS used pretest and posttest techniques with n-gain analysis. The results showed that the validity of the E-LKS on light materials and optical instruments class VIII was declared valid with a CVI score of 1.00 (very high validity) in terms of material and language aspects as well as media aspects. The results of teacher and student responses are in the positive category. The teacher's response to the E-LKS contains HOTS, which is 96.97%, while the student response to the E-LKS contains HOTS, which is 92.72% with the "achieved" category. In increasing HOTS, students who use the E-LKS are included in the effective category based on the analysis results, with an n-gain score of 0.72. This shows that the E-LKS is easy to understand and effectively used by students and teachers during distance learning.

Keywords: E-LKS, HOTS

INTRODUCTION

The coronavirus disease (COVID-19) pandemic impacts the learning process in schools (Churiyah & Sakdiyyah, 2020). The Ministry of Education and Culture does not allow schools to conduct face-to-face learning during the pandemic. The government provided a policy as a solution to regulate the learning process during the pandemic through the circular letter of the Ministry of Education and Culture No. 4 of 2020 that learning in Indonesia is carried out online, which means using internet access. Online learning is Distance

Learning, which is carried out without meeting face to face but using a platform that can help the learning process using the Internet (Handarini & Wulandari, 2020).

The availability of teaching materials in the science learning process will support students' success in distance learning. According to (Pannen, 2001), teaching materials are materials or subject matter arranged systematically by teachers or students in the learning process (Prastowo, 2011). Teaching materials used in the learning process include LKS (Student Worksheet), modules, textbooks, and handouts (Setyawan & Wijayanti, 2020).

According to the Ministry of Research, Technology and Higher Education (2016), distance learning resources are ICT-based teaching materials (Information and Communication Technology). This opinion follows 21st-century skills, which can be learned through the integration of ICT (Kemendikbud, 2016). Teaching materials that can be developed to facilitate Distance Learning include electronic teaching materials, one of which is the Electronic Student Worksheet (E-LKS) (Fitriasari & Yuliani, 2021).

E-LKS is a student worksheet that is delivered and processed using the internet to assist students in doing student work and practice questions effectively for a certain period (Lathifah et al., 2021). Student worksheets are one of the learning tools that play an important role in students' thinking processes (Indriyani, 2019). The thinking process is a process of recalling students' knowledge so that they can be reused in receiving information, processing, and concluding material (Noprinda & Soleh, 2019). LKS can assist students in obtaining information about material concepts through summaries, assignments or work steps, and evaluations (Prastowo, 2011).

Based on the results of teacher interviews and analysis of PAS questions for Class VIII A SMPN 4 Sumenep, the teacher finds it challenging to present assignments to students, such as making summaries and student work assignments. Hence, teachers need teaching materials that can make it easier for teachers to give assignments and electronic teaching materials that can make it easier for students when working on assignments, namely E-LKS, to help students in the distance learning process. Analysis of the percentage of HOTS PAS questions for class VIII A SMPN 4 Sumenep is still low at 33%. So, there is a need for teaching materials that can contain HOTS elements in order to train students' thinking. The thinking process adapts to the achievement of 21st-century skills. Namely, students can have higher-order thinking skills (HOTS) (Trilling & Hood, 1999). Students' higher-

order thinking skills will develop if they face unknown problems, challenging questions, or doubts (Sani, 2019).

Based on the problems described previously, it is necessary to develop an E-LKS containing HOTS that can guide students during distance learning. To meet these needs, this study aims to determine the response of teachers and students to the effectiveness of the developed E-LKS. E-LKS is a tool that can help students with their thinking process. The E-LKS containing HOTS can help students solve problems, gain understanding, and find something new.

RESEARCH METHOD

The type of research used in this research is the R&D (Research and Development) method of ten, referred to as research and development. Research and development model by the 4D model (four D) proposed by (Thiagarajan, 1974). This research was conducted in February-July 2021. The research took place at SMPN 4 Sumenep. The research sample consisted of class VIII –A students and science teachers.

This study's research and development procedure consisted of the four-D model development stage, which included (1) Define: There are several stages, namely early-late analysis, student analysis, task analysis, concept analysis, and formulation of learning objectives. (2) Design: There are several activities, namely the preparation of tests, the selection of media, and the selection of formats. (3) Development: There are two stages, namely validation of material and media experts and limited development trials to see student and teacher responses to products developed on a small scale.

The research instrument used in this study was a validation sheet consisting of material and media validation, a response questionnaire consisting of teacher responses and student responses, and a test containing HOTS on the E-LKS. E-LKS product validation data was obtained from three expert validators' Content Validity

Index (CVI) analysis. The professional background of the first validator is a lecturer at the Faculty of Teacher Training and Education, Wiraraja University; the second validator is a physics teacher at Yas'a High School, and the third validator is a physics teacher at SMAN 2 Sumenep. Teacher and student response data were obtained using response questionnaire analysis. Data on increasing HOTS in using E-LKS using pretest and posttest techniques with n-gain analysis with a limited number of students, namely five.

Determination of the percentage of teacher and student answers for each statement/question item in the questionnaire used the following formula:

$$P = \frac{f}{n} \times 100 \dots \dots \dots (3.1)$$

Information:

P = Percentage of Answers

f = Answer Frequency

n = Many Respondents

The criteria set to state that teachers or students have a positive response are at least 50% of the total respondents giving a positive response to at least 70% of the number of question items or statements in each aspect (Ilyas et al., 2015)

Pretest and posttest values were calculated using the N-gain formula. The calculation of N-gain, according to Hake (1999:1), uses the following formula:

$$(g) = \frac{\text{skor posttest} - \text{skor pretest}}{100 - \text{skor pretest}} \dots \dots \dots (3.2)$$

(Oktavia et al., 2019)

RESULTS AND DISCUSSION

Data from research and development of E-LKS containing student HOTS in science learning are presented as follows.

Define stage

At the Define stage, it aims to determine the needs in the learning process activities through various information to be used as material in planning the development of an E-LKS teaching material containing HOTS. The data at this stage is obtained from the first; the Preliminary Analysis is carried out by interviewing teachers regarding teaching

materials and students' HOTS and analyzing the Final School Examination questions in semester 1 to determine the percentage of difficulty level in terms of cognitive level. Electronic-based teaching materials during the pandemic in the learning process are needed so that the development of E-LKS is needed to help students make it easier to work on assignments. Second, student analysis is carried out by examining the characteristics of students based on the development of E-LKS teaching materials. Third, task analysis is carried out by describing the content of teaching materials as an outline that includes core competencies and basic competencies in developing E-LKS containing students' HOTS. This study chose the light and optical instruments material for class VIII, semester 2. Fourth, concept analysis was carried out through curriculum analysis and analysis of science books, which became the handbook for even-semester students of class VIII-A SMPN 4 Sumenep. Fifth, learning objectives are formulated to determine indicators of learning achievement based on material analysis and curriculum analysis.

Design Stage

The Design Phase of the E-LKS (Electronic Student Worksheet) containing students' HOTS in science learning is carried out with the following steps: (1) Preparation of tests and preparation of learning indicators that motivate students' abilities. The HOTS question grids are arranged based on students' cognitive abilities based on the analysis of the 1st semester Final School Examination questions. (2) Selection of Media, the suitable media to convey material using E-LKS, namely Liveworksheet. Liveworksheet-assisted e-LKS makes distance learning interactive, effective, and innovative. (3) Format selection is carried out by formulating KD in science learning, which is monitored by applying light and optical instruments for class VIII semester 2. Basic competencies are divided into two sub-chapters with indicators in each sub-chapter, namely the properties of light and

simple optical instruments and the structure of materials. Teaching, E-LKS is designed

based on the structure or elements of LKS according to (Prastowo, 2011), namely:

Table 4.1. Elements of E-LKS Format

No.	Design/structure of E-LKS	Description
1.	Outer cover	The main cover page contains, among others, the title of the E-LKS, material, class, compiler, university logo, and year of publication.
2.	Cover in	the second cover page contains the student's identity and the title of E-LKS
3.	Learning Instructions	Contains instructions for using E-LKS during the distance learning process
4.	Basic Competencies.	It contains basic competencies that are adapted from the learning material.
5.	Concept map	It contains a summary of the material to be taught in the E-LKS in the form of a concept map.
6.	Learning Indicators.	Contains indicators of learning achievement in each sub-chapter.
7.	Let's Know!	Contains a summary of the material to add students' insight into the work assignments carried out by providing videos on applications in students' daily lives that are following the material
8.	Let's Work!	It contains student work assignments so students can think more logically and creatively. The scope of HOTS in this structure includes creative thinking and problem-solving.
9.	. Let's Practice!	It contains analytical questions to determine students' cognitive understanding in increasing students' HOTS on student work assignments that have been carried out. HOTS coverage in this structure includes critical thinking and decision-making

Development stage

The E-LKS development stage contains HOTS to make the learning process innovative and creative; it can also help students train their' higher-order thinking. The E-LKS development stage contains HOTS to make the learning process innovative and creative; it can also help students train their' higher-order thinking. At this stage, the researcher

developed the E-LKS that interestingly contained HOTS and could be used by students during distance learning. To determine the validity of the product, it is necessary to have product validation, which consists of material validation, namely material and language, as well as media validation. Both validations are validated by a validator or expert validation.

Table 4.2 Material Validation Results

Items	Expert 1	Expert 2	Expert 3	Number of approvals	I-CVI
1	1	1	1	3	1
2	1	1	1	3	1
3	1	1	1	3	1
4	1	1	1	3	1
5	1	1	1	3	1
6	1	1	1	3	1
7	1	1	1	3	1
8	1	1	1	3	1
9	1	1	1	3	1
10	1	1	1	3	1
11	1	1	1	3	1
12	1	1	1	3	1
13	1	1	1	3	1
14	1	1	1	3	1
15	1	1	1	3	1
16	1	1	1	3	1
17	1	1	1	3	1
18	1	1	1	3	1
19	1	1	1	3	1
Σ	19	19	19	Mean I-CVI	1
Relevant proportion	1,00	1,00	1,00		

The results of material expert validation show Mean I-CVI, item-level content validity index on average = 1,00, then the average proportion is considered

relevant from the first validator = 1.00, the second validator = 1.00, and the third validator = 1,00. This means the E-LKS

product containing student HOTS has a "very high validity."

Furthermore, media validation is used to determine the validity of the media

aspect of the three validators in their field of expertise. The results are presented in Table 4.3.

Table 4.3 Media Validation Results

Items	Expert 1	Expert 2	Expert 3	Number of approvals	I-CVI
1	1	1	1	3	1
2	1	1	1	3	1
3	1	1	1	3	1
4	1	1	1	3	1
5	1	1	1	3	1
6	1	1	1	3	1
7	1	1	1	3	1
8	1	1	1	3	1
9	1	1	1	3	1
10	1	1	1	3	1
Σ	10	10	10	Mean I-CVI	1
Relevant proportion	1	1	1		

The results of media expert validation show Mean I-CVI, item-level content validity index on average = 1.00, then the average proportion is considered relevant from the first validator = 1.00, the second validator = 1.00, and the third validator = 1.00. This means that the E-LKS product containing student HOTS has "very high validity" regarding the media aspect.

Data validated and revised in product trials is presented as a response questionnaire. The first is a teacher response questionnaire used to determine the percentage of teacher responses to the developed E-LKS. The presentation of the response can be seen in Table 4.4

Table 4.4 Teacher Response

No	Teacher Response	Description/ Presentation
1	Items to -1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Positive/ 100%
2	Items to -11	Positive / 66,67%

Based on the teacher's response questionnaire analysis on the E-LKS containing HOTS in the trial, the average positive teacher response was 96.97%, and the average negative teacher response was 3.03%. Thus, the teacher's response questionnaire meets the criteria of "achieved." Second, the response is the response of class VIII-A students with a limited number of 5 students. Data is presented in Table 4.5

Table 4.5 Student Response

No	Student Response	Description/ Presentation
1	Items to -1, 2, 3, 5, 6,	Positive/ 100%

7, 9, 10, 11
2 Items to - 4, 8
Positive/ 60%

Based on the analysis of the student response questionnaire on the E-LKS containing HOTS in the trial, the average positive response of students was 92.72%, and the average negative response of students was 7.28%. Thus, the student response questionnaire meets the criteria of "achieved."

It was increasing students' HOTS through pretest and posttest tests. The pretest was conducted by students answering the HOTS questions without the E-LKS, while the students did the posttest by answering the same questions with the E-LKS. The difference in treatment will affect the results of students' understanding through HOTS questions and the effectiveness of E-LKS in the distance learning process. The data is presented in Table 4.6

Table 4.6. The results of the analysis of the effectiveness of the E-LKS treatment on the HOTS

Try to	Mean		N gain	Description
	Pretest	Posttest		
1 (Properties of light)	54	87	0,72	High effectiveness
2 (Simple optical instrument)	62,5	95	0,87	High effectiveness

The analysis shows increased student test results when working on HOTS questions given through different treatments. The average N-gain score in experiment 1 is 0.72 in the "high effectiveness" category, and the average N-

gain score in experiment 2 is 0.87 in the "high effectiveness" category. The results of the high-category analysis show that the treatment of the E-LKS containing HOTS can help students working on HOTS questions.

CONCLUSION

This study concludes that the results of the teacher's and students' responses get a positive response; the teacher's response gets an average positive response with a category score of 96.97%, while the student response gets an average positive response with a score of 92.72% the category is achieved. The increase in students' HOTS through the existence of E-LKS is proven in the results of the pretest and posttest. Student activities were carried out with two experiments with increasing results. The first experiment got an average score of 0.72 in the high effectiveness category, while the second got an average score of 0.87 in the high effectiveness category. This proves that the E-LKS contains HOTS developed on light materials and optical devices to get a positive response and are effectively used during distance learning.

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Trilling, B., & Hood, P. (1999). *Learning, Technology, and Education Reform in the Knowledge Age or "We 're Wired,*

Webbed, and Windowed, Now What?" At the Turning Point of the Knowledge Age, Where was the party? It happened quietly, without fanfare or fireworks. In 1991, U.S. educational technology.