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Development of 3D ELSA (3D E-Book Based on Scientific Literacy) on Temperature and Heat

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Abstract

ELSA 3D (E-Book 3D Based on Scientific Literacy) is an e-book teaching material that integrates scientific literacy as a medium in the learning process on temperature and heat materials. This type of development research uses the Hannafin and Peck model. The Hannafin and Peck model begins with a needs analysis followed by the design and development stage to create 3D ELSA media which expert lecturers then review. The 3D ELSA that has been reviewed and revised is then validated using a validation sheet to determine the validity of the 3D ELSA media covering several aspects. Then the implementation is carried out by conducting a learning process using 3D ELSA media to test the effectiveness and practicality of 3D ELSA media. Quantitative descriptive analysis was used as the method of analysis. Based on the results of the research that has been done, it can be concluded that the 3D ELSA that has been developed has a validity percentage of 93%, the response of students to the 3D ELSA is 96.3%, and the observation of learning implementation is 96.6%. So that the 3D ELSA is declared to be very valid and suitable to be used as a medium in the learning process on temperature and heat material. In addition, 3D ELSA is included in the medium category with an N-gain of 0.68, so using 3D ELSA as a learning medium is declared effective because it can improve scientific literacy skills.

Keywords: 3D ELSA, Scientific Literacy, Temperature and Heat

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INTRODUCTION

Research related to learning media in the form of e-books in the Google Scholar database from 2018 to 2022, there are 76.800 articles. From these articles, 810 were taken, which were then processed on the VOSviewer data to form the e-book research network map.

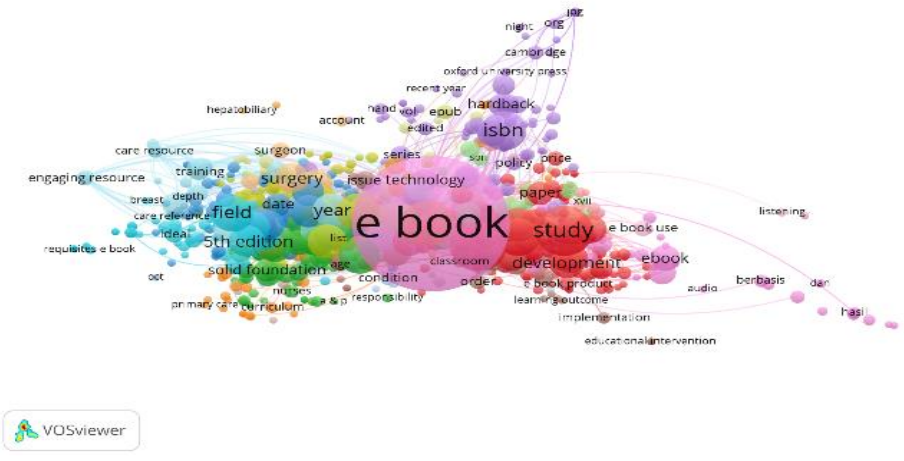

Figure 1. E-book Research Network

Based on the map of the e-book research network, it can be seen that e-book research has been carried out a lot. However, the 3D ELSA developed is different from the previous e-books because ELSA 3D is an e-book in the form of 3D that can improve the scientific literacy of education in Indonesia with scientific literacy skills.

Education is an effort to develop self-potential by acquiring knowledge and skills through learning. A structured education process is needed to improve and develop the applied curriculum to achieve this goal (Kemendikbud, 2016).

The Organization for Economic Cooperation and Development (OECD) surveyed world institutions, namely the Program for International Student Assessment (PISA), to determine the development of interest in reading, mathematics, and science. Indonesia participates in PISA to discover the development of education programs in Indonesia (Rahmawati et al., 2015). The 2018 PISA test focuses on these three areas; of the 79 participating countries, Indonesia has ranked 74th with 371 reading interest results, 379 mathematics, and 396 science (OECD, 2019). Scientific literacy is very much needed to measure students' understanding of science concepts but based on the survey results, students' scientific literacy skills in Indonesia are still deficient (Pratiwi, 2019). According to the Program for International Student Assessment (PISA), scientific literacy competencies that students must describe, evaluate, design investigations, and interpret data from scientific phenomena.

In the learning process, scientific literacy competencies are still not applied (Safitri, 2016). Students' understanding of a concept and analyzing scientific phenomena will be easier if an exciting learning process is provided (Adam & Suprapto, 2019). In the learning process, students must be introduced to and apply scientific literacy to have scientific literacy skills to face the ASEAN Community (Khoiriah & Kholiq, 2020).

Teaching materials are influential in increasing students' scientific literacy skills; exciting teaching materials containing scientific phenomena are often encountered and in line with scientific literacy competencies (Hardjo, Permatasari, & Permana, 2018). In line with research (Pravitasari et al., 2015), using media developed in the learning process can improve scientific literacy skills.

In the learning process, media is a very appropriate choice for the times. Technology is developing and progressing rapidly; in education, a medium has been created, namely an electronic book (e-book). E-books are information media on computers and mobiles used in learning (Amalia & Kustijono, 2019). The development of e-books using 3D PageFlip software has several advantages because it can integrate images, animations, audio, and videos that explain scientific phenomena to create an e-book that is more interesting and can improve scientific literacy that readers can also customize according to their wishes.

Based on these problems, it is necessary to develop a 3D ELSA (E-Book 3D based on scientific literacy) using 3D PageFlip Professional software that is packaged creatively and innovatively and has an attractive appearance that integrates images, audio, and video that explain scientific phenomena to facilitate the learning process. his study aims to describe the feasibility (validity, effectiveness, and practicality) of 3D ELSA as a learning medium that can improve scientific literacy skills and student learning outcomes on temperature and heat materials.

METHOD

This type of development research uses the Hannafin and Peck model. The Hannafin and Peck model begins with a needs analysis followed by the design and development stage to create 3D ELSA media which two media expert lecturers then review. The 3D ELSA that has been reviewed and revised is then validated using a validation sheet to determine the validity of the 3D ELSA media covering several aspects. Then the implementation is carried out by conducting a learning process using 3D ELSA media to test the effectiveness and practicality of 3D ELSA media (Tegeh, Jampel, & Pudjawan, 2014).

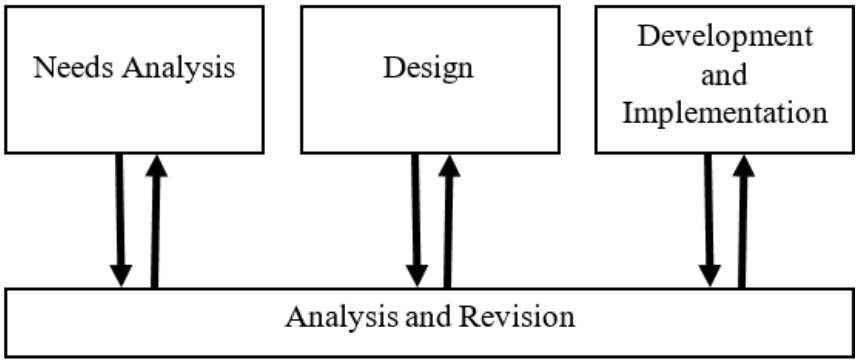

Figure 2. Stage of Hannafin and Peck Model

The validity test aims to determine the validity of the 3D ELSA; the score given on the validation instrument is by the media validity scale.

Table 1. Validation scale scores on media

Score	Description
5	Very Good
4	Good
3	Enough
2	Not Enough
1	Very Less

(Riduwan, Skala Pengukuran Variabel-Variabel Penelitian, 2015)

After obtaining the overall score, then the validity percentage is calculated by:

$P(\%) = \frac{\text{total score obtained}}{\text{criteria score}}$ x 100% (Arifin, 2010)

After obtaining the number of percentages, then analyzed using quantitative descriptive analysis techniques to determine the feasibility of 3D ELSA.

Table 2. Validation criteria on media

Presentase	Criteria
81% - 100%	Very Valid
61% - 800%	Valid
41% - 60%	Quite Valid
21% - 40%	Not Valid
0% - 20%	Invalid

(Riduwan, Skala Pengukuran Variabel-Variabel Penelitian, 2015)

To determine the level of progress in student learning outcomes, pre-test and post-test scores based on scientific literacy are needed, which are then included in the formula:

$N\ gain = \frac{\text{Posttest score} - \text{Pretest score}}{\text{Ideal score} - \text{Pretest score}}$

The n-gain value obtained is interpreted in the criteria for dividing the n-gain score in the following table:

Table 3. Standards for distribution of n-gain scores

Value N gain	Catagory
$g > 0,7$	High
$0,3 < g < 0,7$	Currently
$g < 0,3$	Low

(Hake, 1999)

RESULTS AND DISCUSSION

ELSA 3D is an e-book teaching material on temperature and heat material as a medium in the learning process. 3D ELSA in the learning process can make it easier to understand a concept and improve students scientific literacy.

The design of the ELSA 3D cover page that was developed can be seen in Figure 3. ELSA 3D has integrated scientific literacy to improve students' scientific literacy in understanding temperature material. The display of scientific literacy is packaged so attractively in Figure 4.

Figure 3. 3D ELSA Cover Page

Figure 4. Science Literacy Integrated Page

ELSA 3D using 3D PageFlip Professional software can insert clickable images so that the image display becomes more prominent and transparent, making it easier for students to understand the idea. In addition, it can also insert video content that is packaged more attractively with a three-dimensional concept and can be rotated 360^{o} to motivate students more (Sanuaka et al., 2017). This is in line with research (Salamiyah & Kholiq, 2020) that aims to train thinking skills to solve problems faced by students. In addition (Gaol et al., 2019) stated that e-book content that provides video and can be adapted to the needs of the material content can make it easier to convey information.The following is an attractively packaged video display.

Figure 5. Video Playback Display

Two expert lecturers carried out the validity of the 3D ELSA media on the validation assessment sheet covering aspects of suitability as a learning media, conformity with competence, scientific literacy, material clarity, media work processes, and media display. Before the validation, the 3D ELSA was studied first and received some input in the form of a 3D ELSA design to emphasize scientific literacy (Karnia et al., 2022).

Several suggestions and inputs were obtained during the validator's evaluation of the 3D ELSA media. The suggestions and information received are used as improvement materials to produce a higher quality 3D ELSA and can help the learning process (Patmawati & Kholiq, 2021). The following is the result of 3D ELSA validity.

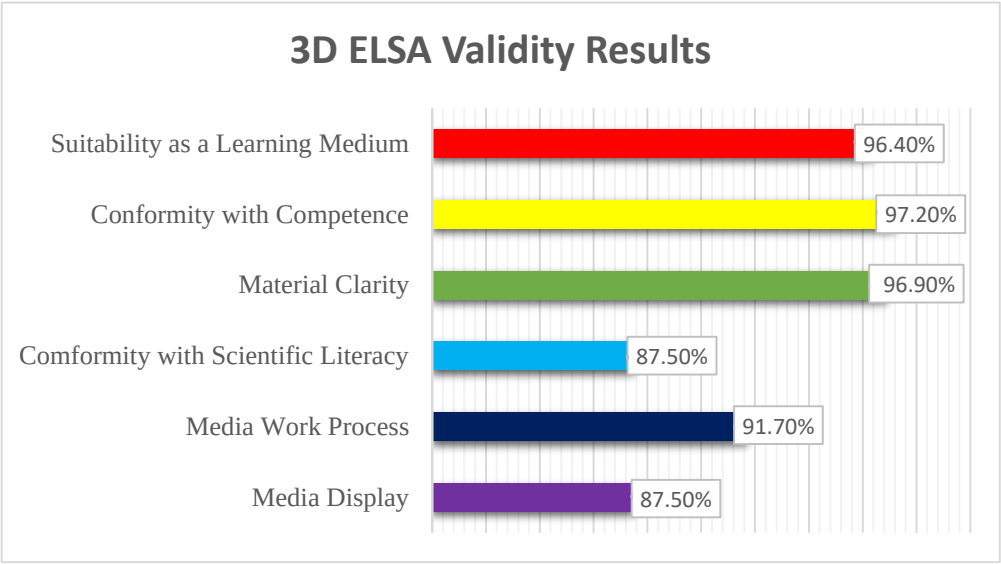

Figure 6. 3D ELSA Validity Results

Figure 6 shows that the 3D ELSA has validity on aspects of suitability as a learning media 96.4%, aspects of conformity with competence 97.2%, aspects of material clarity 96.9%, aspects of accordance with scientific literacy 87.5%, aspects of media work processes 91.7%, and media display element 87.5% so that the average validity of the 3D ELSA is 93% with very valid criteria.

In the 3D ELSA effectiveness test, researchers took data in class X IPA MA Nurul Huda Sedati on 30 students. Students are given pre-test questions based on scientific literacy to determine initial knowledge of temperature and heat material. Furthermore, treatment is provided in the form of learning using 3D ELSA, and students are allowed to operate 3D ELSA. To identify an increase in the knowledge gained by students, post-test questions were

given with the same criteria as the previous questions. The following are the results of the data obtained

Table 4. Analysis of research data

Component	Class X IPA	
	Pre-test	**Post-test**
Number of Students	30	30
Highest Score	60	100
Lowest Score	10	50
Average	39,67	80,67
N-gain	0,68	
Category	Currently	

The research was conducted in class X IPA MA Nurul Huda Sedati on 30 students. From this study, the average value of the pre-test was 39.67, while the average value of the post-test was 80.67, so the N-gain is 0.68 with moderate criteria.

The effectiveness test was also carried out through a questionnaire to students about the aspects of usefulness, convenience, and student satisfaction with the 3D ELSA media used in the learning process (Andaresta & Rachmadiarti, 2021). The following are the results of the student questionnaires.

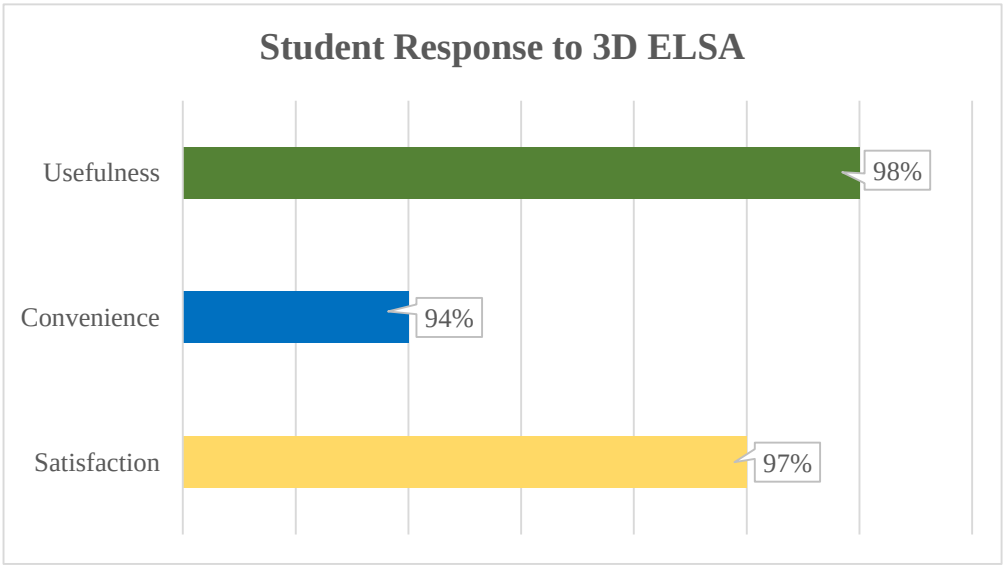

Figure 7. Results of Student Responses to 3D ELSA

Responses to the 3D ELSA media were given to students through a questionnaire containing various questions on each aspect. The results of the response obtained by ELSA 3D on the usefulness aspect of 98%, the convenience aspect of 94%, and the satisfaction aspect of 97%. So that the average student response to 3D ELSA is 96.3% and can be categorized as very effective.

In the 3D ELSA practicality test, the researcher gave an observation sheet on the implementation of 3D ELSA-assisted learning to the MA Physics Teacher Nurul Huda Sedati as an observer when the researcher took data in class. The results of the observation of the implementation of learning can be seen in the following figure:

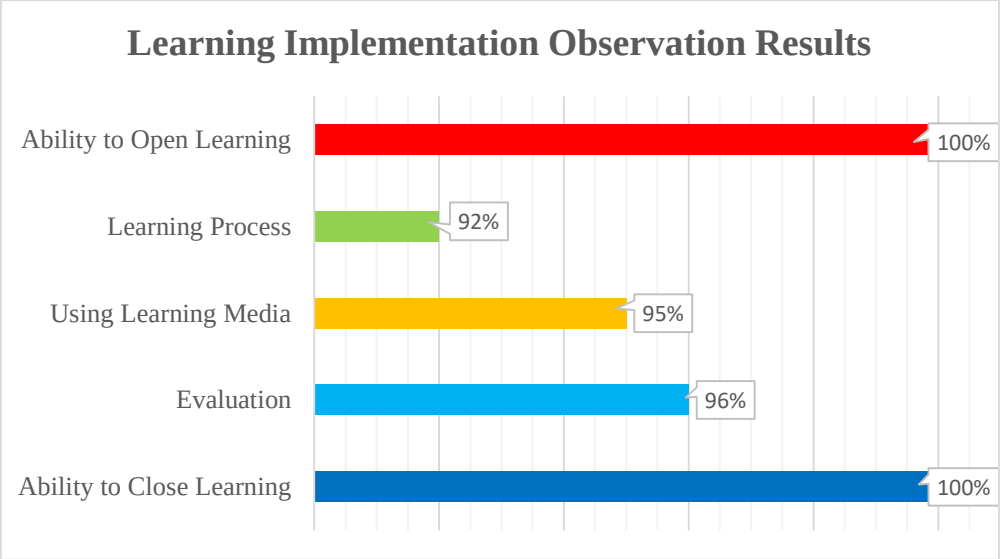

Figure 8. Results of Observation of Learning Implementation

Figure 8. is the result of observing the implementation of learning in each aspect. In the part of the ability to open learning 100%, aspects of the learning process 92%, aspects of using learning media 95%, aspects of evaluation 96%, and aspects of the ability to close learning 100%. So the average for observing the implementation of learning is 96.6%, with the 3D ELSA category very suitable for use in the learning process.

ELSA 3D is an e-book equipped with Ayo Berliterasi. It contains a video of phenomena related to existing problems so that they can direct students to find an answer and evaluate and interpret existing phenomena to increase scientific literacy skills. This is in line with research (Kusumawati et al., 2020), where students' scientific literacy skills can improve if attractively packaged images and videos are presented.

The results of the 3D ELSA research are in line with research results (Ngurahrai et al., 2019; Sari et al., 2019; Wulandari et al., 2019) where the learning process using electronic media can improve learning outcomes. (Agustin & Widodo, 2019) Also stated is that interactive e-books can improve students' scientific literacy skills. In addition (Kholiq, 2020) states that using e-books as learning media is a very appropriate way because it can attract students' interest and improve scientific literacy.

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that the 3D ELSA has a validity percentage of 93%, the response of students to the 3D ELSA is 96.3%, and the observation of learning implementation is 96.6%. So that the 3D ELSA is declared to be very valid and suitable to be used as a medium in the learning process on temperature and heat material. In addition, 3D ELSA is included in the medium category with an N-gain of 0.68, so using 3D ELSA as a learning medium is declared effective because it can improve scientific literacy skills.

RECOMMENDATION

ELSA 3D is an e-book teaching material that integrates scientific literacy as a media to use in the learning process. This e-book developed in the form of a 3D ELSA only contains material on temperature and heat and can be used in direct learning in class or online. 3D ELSA in the learning process can improve scientific literacy skills.

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