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E-LS on The Subject of Temperature: The First Work of a Science-Physics Teacher at Siti Aminah Junior High School Surabaya

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Abstract. The effect of COVID-19 pandemic in Indonesia requires learning that is usually done face-to-face has turned into online learning. For teachers, the implementation of online learning requires engaging media so that learning becomes more various and exciting. This study aims to analyse the validity of the science literacy-based e-book, which will later be called E-LS. The first work of the Science-Physics teacher at Siti Aminah Junior High School Surabaya can train students' scientific literacy skills. This study using a research method with the DDD-E design (Decide, Design, Develop, Evaluate). Based on the data analysis that has been done, we obtained descriptive-quantitatively using the Likert scale percentage score criteria. The results show that the percentage of validity in the aspect of Curriculum Conformity of 91.30 % (very valid). The material aspect is 93.45 % (very valid). The language aspect is 91.67 % (very valid). The media design aspect of 91.91 % (very valid). Scientific literacy aspect of 87.50 % (very valid). Overall the level of validity of the E-LS has an average of 91.17 % (very valid). It can be concluded that the E-LS media (temperature topic) is very suitable for use as a science-physics learning medium to train science literacy for junior high school students.

1. Introduction

The world of education in Indonesia has changed due to the coronavirus (COVID-19) pandemic, which lasted 1.5 years. Learning that used to be face-to-face now has to be done online. In implementing online learning, teachers need skills in making media with an adequate IT base, such as making scientific literacy-based e-book media (E-LS), so that online learning can take place better, interestingly and more various. To improve teachers' ability to design science literacy-based e-book, science-physics teachers participate in training to make science literacy-based e-book independently. In line with the research by Sudarisman that science learning contributes to technological development, science is the fundamental science that underlines technological development [1]. Based on ICASE, students need adequate scientific literacy skills to live productively and obtain the best quality of life as the goal of science education itself [2]. It is also in line with the research results [3], which states that science is fundamental in all aspects of life. Therefore, it is necessary to learn and teach to achieve scientific literacy (science literacy



community) and retain national character. The fact that the 2018 PISA test results obtained from the scientific literacy test of Indonesian students showed that they were ranked 72 out of 78 countries with a scientific literacy score of 396 [4,5]. It showed that the scientific literacy ability of Indonesian students is still low. PISA defines scientific literacy as the capacity to use scientific knowledge, identify questions, and draw conclusions based on facts and data to understand the universe and make decisions about changes due to human activities [6]. One indicator is that an individual with high scientific literacy skills can master the concept and understand its application in everyday life and technology [7].

The teaching and learning process is communication between teachers and students in conveying a message or material delivered by the teacher or a learning resource into a visual and verbal communication symbol. Communication of teachers and students in the delivery of material should be arranged as attractive as possible so that students can be motivated and learning can be meaningful for students. Fitriani et al state that learning-science, meaningfulness can be obtained if the students' scientific literacy skills are promising [8]. Meaningful learning can be carried out if students connect the newly acquired knowledge with previous knowledge [9].

In implementing learning by performing the 2013 curriculum, which leads to 21st-century competencies by utilizing advances in science and technology, a media that supports science and technology-based learning is needed, creating e-book (digital books). The application of e-book in the learning process is one alternative that teachers can use to integrate technology to make learning more exciting and varied [10]. E-Book is an application program that a teacher should develop in the 21st century to provide a fun learning process by prioritizing students' understanding of concepts. E-books have been understood only in the text that can be opened with a PC or gadget.

The development of E-LS is different from the e-book that other researchers have developed. The difference is that features are integrated to train students' scientific literacy in E-LS and provide examples of physics concepts in everyday life related to the concept of temperature for junior high school students. So it can be seen that this study aims to analyze the feasibility level of the E-LS as seen from the level of validity the E-LS on the temperature topic developed by the science teacher at SMP Siti Aminah as a support for online learning during the covid-19 pandemic.

2. Method

E-LS development uses DDD-E (Decide, Design, Develop, Evaluate) research design according to Figure 1. Analysis uses the technique-quantitative descriptive with E-LS content validity instruments in terms of Curriculum Conformity Aspects, Material Aspects, Media Design Aspects and Scientific Literacy Aspects, and for further analysis using quantitative descriptive analysis with Likert scale according to Table 1. The criteria for scoring on the E-LS content validity instrument using a Likert scale are shown in Table 1.

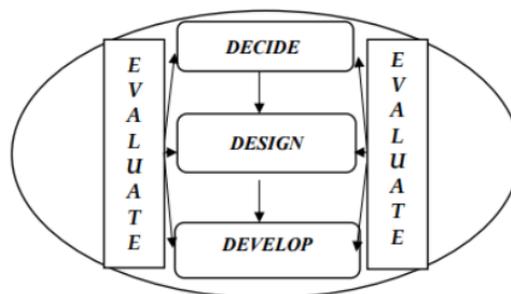


Figure 1. DDD-E research design [11]

Table 1. The criteria of the E-LS content validity instrument [12]

Score	Criteria
4	Very Valid (VV)
3	Valid (V)
2	Invalid (IV)
1	Very Invalid (VIV)

The percentage of student response sheets ²³ is calculated using the formula:

$$\text{Score percentage} = \frac{\Sigma \text{ Score}}{\Sigma \text{ Maximum Score}} \times 100 \% \quad (1)$$

The criteria for the percentage score of the E-LS validity instrument can be seen in Table 2, and the developed E-LS is said to be feasible if the percentage of E-LS validity is $\geq 61\%$.

Table 2. E-LS validity interpretation criteria [12]

Percentage	Information
$0\% < x \leq 20\%$	Very Invalid
$21\% < x \leq 40\%$	Less Valid
$41\% < x \leq 60\%$	Quite Valid
$61\% < x \leq 80\%$	Valid
$81\% < x \leq 100\%$	Very Valid

3. Results and Discussion

3.1 E-LS Product that has been Developed by the Teacher of SMP Siti Aminah Surabaya

The science literacy-based e-book (E-LS) developed by the science teacher at SMP Siti Aminah on temperature is different from the e-book developed by previous researchers. This E-LS contains temperature material and is accompanied by a video associated with scientific literacy indicators. It can motivate and train students' scientific literacy skills, thus making online learning more exciting and various. The following is a display of the E-LS that has been developed by a science teacher at SMP Siti Aminah Surabaya.



Figure 2. Display cover E-LS

Figure 2 show the display cover of E-LS. It represents the physics-science content material, that is, temperature at 7 grade of junior high school. It is validated by the expert judgment that is the resource persons in training on making E-LS from experts in the field of physics learning media. Besides, there are experts on the physics content and experts on developing physics learning based on scientific literacy.

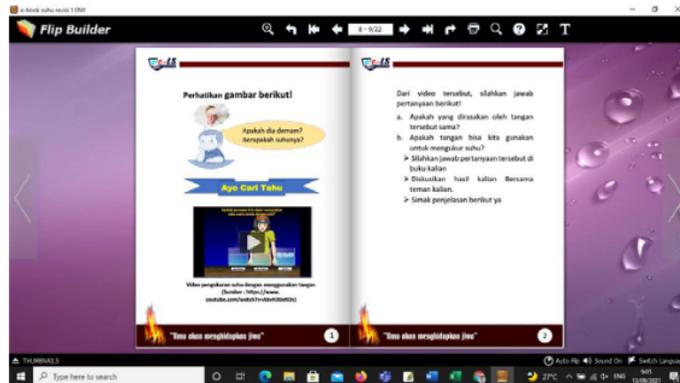


Figure 3. E-LS content display (motivation video)

⁵ There are three competencies of scientific literacy: explaining phenomena scientifically, evaluating and designing scientific inquiry, and interpreting data and evidence scientifically [5,6]. E-LS was developed based on that competencies. Figure 3 shows the E-LS content display for the motivation video. This part stimulates the students to explain phenomena scientifically through contextual phenomena that can be explained scientifically. Figure 4 shows the role of E-LS to serve the competence of evaluating and designing scientific inquiry through practice or experiment activity. Based on the data and evidence obtained in experimental activities, students are trained to interpret data and evidence scientifically.

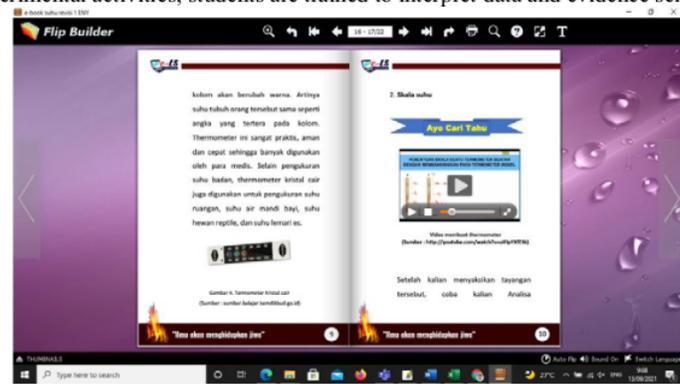


Figure 4. Content display of E-LS (video practicing science literacy)

Based on the data analysis that has been carried out from the validity process, obtained overall validity is shown in Figure 5. The results show that the percentage of validity in the aspect of Curriculum Conformity of 91.30 % (very valid). The material aspect is 93.45 % (very valid). The language aspect is 91.67 % (very valid). The media design aspect of 91.91 % (very valid). Scientific literacy aspect of 87.50 % (very valid). Overall the level of validity of the E-LS has an average of 91.17 % (very valid).

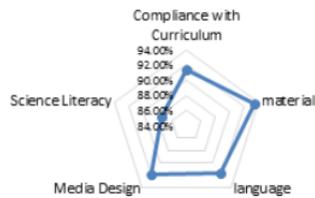


Figure 5. E-LS validity of all aspects

The validity of each aspect is shown in Figure 6 until Figure 8. Figure 6 shows the E-LS validity aspects of conformity with the 2013 Curriculum. The components of curriculum validation are compliance with the 2013 curriculum, content standard, learning process standard, and evaluation standard. Figure 7 shows the material aspect of E-LS Validity. The validity components are basic competence, adequacy, the need for teaching materials, the material substance, and consistency.

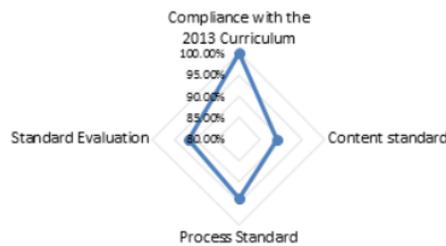


Figure 6. Material aspect E-LS validity of compliance with curriculum



Figure 7. Material aspect E-LS validity

Figure 8 shows the result of E-LS media design aspect validity. The validity of the media design is based on the principle of learning media, the media principle and curriculum, also writing systematics and media design.

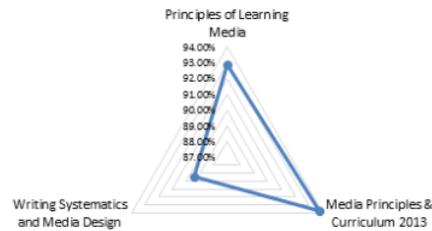


Figure 8. Media aspect E-LS validity

5 Figure 9 shows the result of the E-LS validity for the science literacy aspect. It is based on the competencies of scientific literacy, that is, explaining phenomena scientifically, evaluating and designing scientific inquiry, and interpreting data and evidence scientifically [5,6].

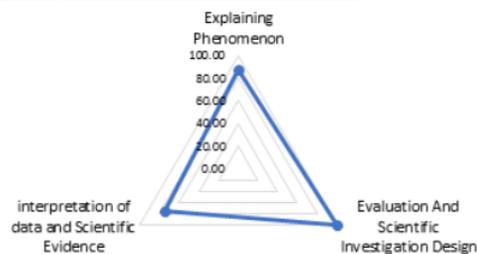


Figure 9. Validity of E-LS aspects of scientific literacy

1 Figure 5 illustrates that the results of the validity of the E-LS developed by the Physics Science teacher of SMP Siti Aminah, which is the first work, have an average validity 91.17 % with very valid criteria. But suppose you look at the E-LS Validity diagram. All aspects can be seen that the validity of the scientific literacy aspect has the lowest validity compared to other aspects. In that case, the teacher as the maker of the E-LS work is not familiar with science literacy competencies which is something new for teachers of SMP Siti Aminah, which incidentally is a private junior high school in Surabaya. Also in the 2013 curriculum for junior high school level does not include scientific literacy skills. In the junior high school curriculum, it is stated that basic competence (KD) for temperature only has understanding, applying and conducting experiments on a concept. Teachers tend to focus on core competence (KI) and KD in the curriculum. As results, teachers are less likely to provide examples of scientific literacy on the temperature topic. For the validity of conformity with the 2013 curriculum, materials, language, and media design have balanced validity.

3.2 The Temperature Concept in E-LS

Temperature is the degree of hotness and coldness of an object. To determine the degree of hotness of an object, requires a device called a thermometer [13]. In the E-LS, it is described that measuring the temperature of an object cannot be done by hand but must use a thermometer to produce accuracy in measuring the object temperature, according to the video contained in the E-LS (Figure 10).

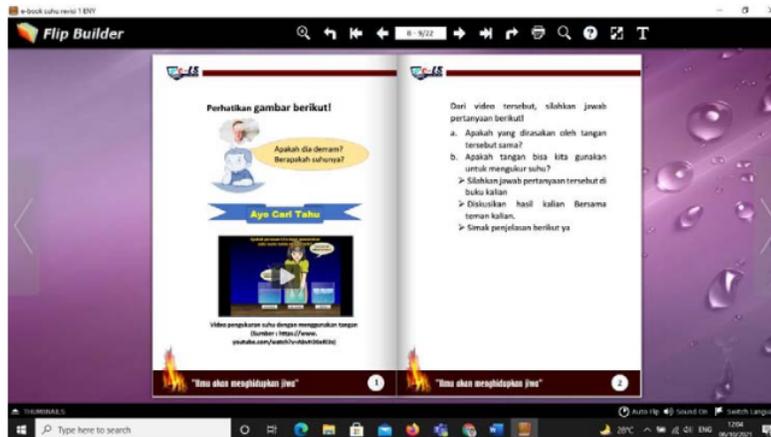


Figure 10. E-LS: Temperature determination cannot be done by hand

In learning, when explaining the concept of temperature, students are invited to think and be literate that measuring the temperature of an object cannot be done by hand but must use a tool called a thermometer.

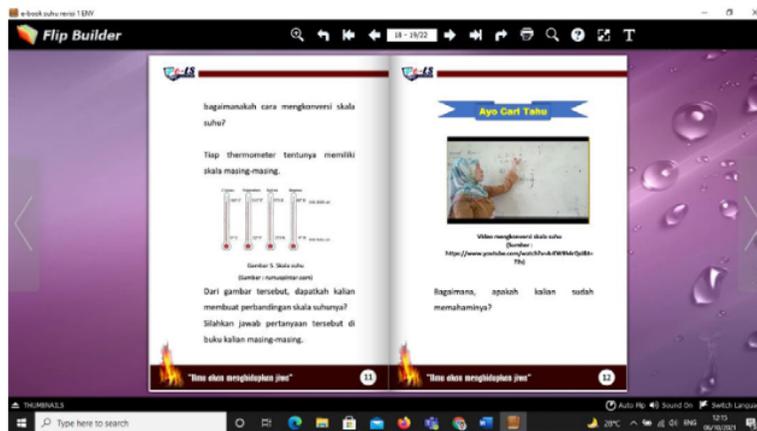


Figure 11. E-LS: Temperature scale conversion

Temperature is a physical quantity that has units. There are several units of temperature, namely: degrees Fahrenheit, degrees Celsius, degrees Reaumur and Kelvin. The temperature unit requires conversion. For example, it can be done using equation [13] from degrees Celsius in the conversion to degrees Fahrenheit. In E-LS, a teacher is given a video explaining how to convert temperature units according to the concepts in physics literature books. It aims to make distance learning students feel like a teacher is explaining to them in class the concept of temperature unit conversion.

The research results on E-LS development are in line with research by Ravenscroft, which states that 21st-century learning is process-oriented learning, solving a problem, and the ability to adapt and work effectively, and effectively in different situations [14]. The purpose of learning in the 21st century in the 2013 curriculum is to prepare students to enter the world of work with a broader scope. The more

comprehensive range of work is caused by high mobility in times like today. It can be taken as a common thread that students must adapt and survive outside their environment. In other words, the goals of 21st-century learning are shifting to be global. The demands of individuals in the 21st century should have hard skills and soft skills to enter the world of work and be ready to compete with other countries. The core subjects and interdisciplinary 21st-century themes are founded by three sets of skills most in-demand in the 21st century said that among the 21st-century skills are (1) learning and innovation skills; (2) information, media, and technology skills; and (3) life and career skills [15].

This research is also in line with the results of a study related to Assessment and Teaching for 21st Century Skills (ATCS), which concludes that four main things are related to 21st-century life skills: ways of thinking, working, work tools, and life skills. Ways of thinking include creativity, critical thinking, problem-solving, decision making and learning. The form of working provides communication and collaboration with others. Tools for work include Information and Communication Technology (ICT) and information literacy. Life skills include living as a citizen, life and career, personal responsibility, and social responsibility [16]. In implementing learning in the 21st-century, 21st-century skills are needed to be trained on students. Twenty first century skills include critical thinking skills.

In the E-LS, there are several examples of how scientific literacy is related to the concept of temperature. The E-LS adopts the concept of scientific literacy, which defines scientific literacy as a person's understanding of science and can apply that science in social life [18]. The scientific literacy indicators used in the E-LS are based on the OECD's scientific literacy indicators, which include (a) explaining phenomena scientifically, (b) evaluating and designing scientific investigations, and (c) interpreting data and evidence scientifically [6,18]. Scientific literacy skills are also in direct contact with higher-order thinking skills (HOTS), which have indicators of analyzing, evaluating, solving problems, thinking logically, creatively, and systematically [19]. Scientific literacy skills, which are also related to higher-order thinking, require someone to apply new information or knowledge and manipulate data to reach possible answers in new situations [20].

Online-based learning has the advantage of reducing paper usage and being more communicative. In this case, e-book, IT media can be used to practice indicators of these science process skills such as observing, classifying, analyzing, predicting, and communicating. In addition, online learning media can be used to develop several elements in critical thinking and literacy skills, such as analyzing, evaluating, applying, generating ideas, and expressing ideas [20-23].

Concerning the results of the E-LS validity, the results of this study are in line with the research conducted by AT Kusumawati, Wasis, IGM Sanjaya, and Abd. Kholiq. Their results found that Elite (E-Book Literacy) for Junior High School Student's Scientific Literacy in Solar System Materials obtained valid results with very valid criteria and suitable for junior high school students [24].

4. Conclusion

Based on the data analysis, the E-LS (science literacy e-book) on the topic of temperature (developed and is the first work of a teacher at SMP Siti Aminah Surabaya) that has very valid criteria. The E-LS media is suitable for being used as an online learning medium and can train students' scientific literacy skills.

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