



Development of Interactive E-Books containing Virtual Laboratory to Improve Students' Motivation Learning

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Abstract

This study aims to analyze the characteristics, validity, and ability of Interactive E-Book media containing Virtual Laboratory in fostering learning motivation and to find out how the cognitive learning outcomes of students. The design of this research is Research and Development, using modified steps according to Sugiyono. Analysis of potential problems seen from the low motivation to learn of students, which is supported by the lack of innovation in learning media on global warming at SMP N 4 Semarang. In this study, an interactive learning media on global warming material was developed in the form of an E-Book with an application format so that it could be accessed flexibly via mobile phones. The Interactive E-Book was declared very valid with an average validation of 92.94% from media validators and 89.87% from material validators. Then a trial was conducted to determine the readability of the media. The results of the media readability research from students obtained an average of 88.92% with very good criteria. The ability of Interactive E-Books to increase students' learning motivation was measured using a learning motivation questionnaire, there was an increase in the high category. In addition, the increase in learning motivation is also supported by the cognitive learning, average pretest score was 51.78 while the posttest score was 85.56. Based on the description, it is concluded that the Interactive E-Book is valid to be used as a medium in learning activities and is able to improve students' learning motivation.

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INTRODUCTION

Science learning in junior high schools in the 2013 curriculum is carried out in an integrated manner, where the Physics, Biology and Chemistry materials are packaged in one particular theme. Integrated science learning is expected to increase the efficiency and effectiveness of learning. This integration is in order to obtain more meaningful, fun learning with the demands of the 2013 curriculum (Hayati et al., 2019). To find out and explain the natural events of science learning, it takes a strategy that can be applied by teachers to students in the learning process, of course, plays a very important role for successful learning. The level of success of the learning carried out can be determined through the learning process and student learning outcomes (Wipasith, 2015).

Changes as a result of the learning process are shown in various forms, such as changes in attitudes, behavior and changes in other aspects of individuals who carry out learning activities (Rohwati, 2012). Learning accompanied by motivation from students are two things that are interconnected and influential in the learning process (Rohman & Sayyidatul, 2018). The relationship that occurs between learning motivation and learning outcomes is a positive relationship, which means that the higher the learning motivation of students, the higher the learning outcomes obtained.

Motivation is a change in energy in a person which is characterized by the emergence of feelings and reactions to achieve certain goals. According to Hamalik (2004), as quoted by Surahmadi (2016), the success of the process and student achievement is strongly influenced by learning motivation. Umar et al., (2016) in learning science there are several factors that can affect the motivation of students. Factors that are often encountered are the use of learning methods and media applied by teachers to students in the learning process. Learning media are all tools or objects used in teaching and learning activities with the aim of facilitating the delivery of learning information from sources (teachers or other sources) to recipients (students and learning residents) (Rohwati, 2012).

One of the learning media that can be used is E-Book. E-books are an alternative science learning media on smartphones supported by interactive content, so that they can attract the attention of students to be encouraged to learn (Hasbiyati & Khusnah, 2017). With the existence

of an e-book, it should also be balanced with innovation or presentation of a good, attractive, and motivating display for students in operating it so that learning objectives can be achieved (Ghofur & Kustijono, 2015). According to Eskawati & Sanjaya (2012) states that the maximum utilization of learning resources or media will improve the quality of learning.

The results of the initial study at SMP N 4 Semarang, the reference textbooks used were only printed package books from the government. The learning media used to support learning activities are in the form of digital teaching materials or power points which are explained by the teacher with the help of bandicam screen recordings. Based on the researcher's observations, the digital teaching materials and power point used are less attractive because the display presented is almost the same as the printed textbook that has not been developed. This makes students only pay attention to both digital teaching materials and power point explanations uploaded by the teacher on the YouTube page

In addition, the involvement of students is not directly involved in learning so that the activeness of students is also not channeled properly. The teaching materials and media are actually complete, but several aspects need to be developed to make it more interesting. Teaching materials or media do not only contain text and images, but are also equipped with interactive content offerings that are suitable for learning materials and ability test exercises to measure students' understanding of the material being studied. This should be applied so that students are more interested in learning and maximally in achieving learning objectives.

Looking at the supporting conditions for learning, the results of cognitive learning are obtained daily test scores, there are more than 50% of class VII students who get scores below the KKM, which is 73. This can be influenced by students' learning motivation towards science learning which still needs to be improved. From the results of online interviews with students of SMP N 4 Semarang, almost 50% of the 32 students consider science subjects to be less attractive so they are less enthusiastic about participating in learning or completing assignments to exceed the time limit set by the teacher, especially during the pandemic. It is felt that students are quite bored with the online system and there is minimal opportunity for students to be more active. In addition, the lack of enthusiasm for learning can be seen from

attendance in virtual classes between 40% -70% of 32 students and there is no interactive learning media about global warming material in digital form at the school.

Based on the description of the background, it is necessary to develop learning media to foster students' learning motivation so that the process and learning outcomes aimed at can be improved. In this study, a learning media in the form of an e-book was developed with an interactive display in the form of an application. The application will have to go through the installation process first before being used, both on Android which can later be accessed anywhere and anytime. The developed learning media is named Interactive E-Book, with the aim of increase students' learning motivation. Characteristics of Interactive E-Books display multimedia content in the form of text, images, animations, videos with information features, instructions for use, materials, games and songs, as well as evaluation questions that can be obtained directly from the results. In addition, this application is also equipped with experiments through virtual laboratories so that learning becomes more active and attracts the attention of students to conduct further investigations related to the material being studied, as well as equipped with student worksheets.

METHOD

The sample in this study was taken by purposive sampling technique, namely students of class VII B SMP N 4 Semarang. The research design used in this research is research and development, with a modified research and development model by Sugiyono. The modification is done by reducing two steps, namely the second product trial and the second product revision. These two steps were not carried out due to time constraints and conditions that were still in the condition of the COVID-19 pandemic. Sugiyono's research and development model used in this study includes: (1) potential and problems, (2) data collection, (3) product design, (4) design validation, (5) design revision, (6) product trial, (7) product revision, (8) final product.

Descriptive analysis of the validity of the Interactive E-Book media containing Virtual Laboratory was carried out by researchers based on the assessments and suggestions given by the media and materials expert validators. The

scoring score obtained is then analyzed using the formula:

$$P = \frac{f}{N} \times 100\% \quad (1)$$

Information:

P: Percentage of score obtained

f: Total score obtained

N: Total maximum score

(Sudijono, 2009)

The results of the percentage scores obtained are then converted into the validation assessment criteria in Table 1.

Table 1. Validity Assessment Criteria

Percentage	Criteria
81,25% < score ≤ 100%	Very Valid
62,50% < score ≤ 81,25%	Valid
43,75% < score ≤ 62,50%	Sufficiently Valid
25,00% < score ≤ 43,75%	Less Valid

(Arikunto, 2012)

RESULT AND DISCUSSION

Characteristics of Interactive Media E-Book containing Virtual Laboratory Global Warming Materials

The characteristics of the Interactive E-Book media are known based on the results of the Interactive E-Book development and readability questionnaire. Media development has been adapted to Core Competencies, Basic Competencies, Learning Indicators, and Learning Objectives for the Global Warming material for Semester 2 Class VII SMP in the 2013 curriculum. The media consists of (1) information, (2) apperception, (3) material, (4) virtual lab, (5) games, (6) quizzes, and (7) hints.

Information

The information menu contained in the Interactive E-Book is presented in three components, namely Core Competencies (KI), Basic Competencies (KD) and Learning Objectives. With the information menu, it is intended that students can focus more on learning both during class hours and outside class hours in accordance with learning objectives. Based on the results of the assessment by the validator in the media, the average percentage of the assessment of competency information is 100% in the very good category and the learning objectives are 75% in the good category. Based on the readability questionnaire by students regarding interesting activities in the

Interactive E-Book that will be carried out, the percentage obtained is 85% with very good criteria.

Apperception

Apperception in the Interactive E-Book is presented by relating daily life events in the form of questions. It aims to make students more interested in learning and foster student curiosity in understanding the material at hand. This section shows that the Interactive E-Book media has the characteristics of contextual learning in it. Based on the results of the assessment by the validator regarding apperception, the average percentage result is 100% with a very good category. Based on the readability questionnaire by students regarding the interesting pictures/animations in the Interactive E-Book, a percentage of 92.5% was obtained in the very good category.

Material

The material in the Interactive E-Book is presented in an interesting way in the form of interactive animations that explain the material on global warming. In the material menu, each sub-chapter is given an introduction regarding what material will be studied in the sub-chapter, so that students are more focused and focused in learning. The characteristics of the presentation of the material obtained an average percentage of 91.67% by the validator with very good criteria. Based on the readability questionnaire by students, the systematics of the material presented obtained a percentage of 87.5% with very good criteria. In addition, the color combination of text, animation or images and a harmonious background gets a percentage rating of 90% with very good criteria as well.

Virtual Lab

The Virtual Lab menu in the Interactive E-Book is presented with access, in the form of links to virtual experiments through PhET simulation along with student worksheets in the form of live worksheets. By using a live worksheet, students can directly input the results of observations from virtual experiments in PhET simulation via their respective mobile phones. Based on the results of the assessment by the validator regarding virtual experiments on media, a percentage of 100% was obtained with very good criteria. Based on the readability questionnaire by students regarding virtual experiments that make it easier for students to

understand the material, the percentage obtained is 85% with very good criteria.

(5) Games

In Interactive E-Book media, it is presented in several games, namely drag and drop and fill the blank. The game aims to train students' understanding after studying global warming material using this learning media. In addition, there is also a "Let's Sing" feature to help make it easier for students to memorize and understand the process of the greenhouse effect. This feature displays the music "Abang Tukang Bakso" with lyrics that have been changed according to the material. Based on the results of the assessment by the validator regarding the game on the media obtained a percentage of 100% with a very good category. Based on the readability questionnaire by students regarding the presentation of questions packaged in the form of games, the percentage obtained was 87.5% with a very good category. In addition, the songs that are presented in a fun way can help in thinking to get an assessment percentage of 87.5% in the very good category.

Quiz

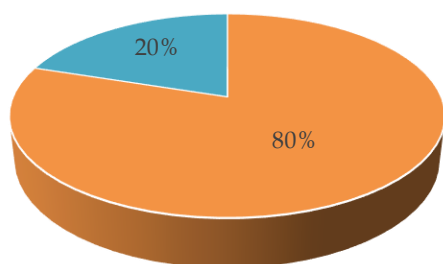
In Interactive E-Book media are presented in the form of multiple-choice questions as many as 10 items according to the material that has been studied. Students can find out the results of the quiz after answering all the questions. The quiz menu is intended to provide an evaluation to students regarding the extent of understanding they get after doing learning activities with this learning media. Based on the results of the assessment by the validator regarding the quiz on the media obtained a percentage of 100% with a very good category. Based on the students' readability questionnaire regarding the presentation of practice questions, it was obtained a percentage assessment of 87.5% with a very good category.

Hint

The instructions contained in the Interactive E-Book media are intended to provide direction to users, namely students to be able to operate learning media properly so that learning objectives can be achieved optimally. In the menu instructions, there are improvements to the material validator's input in the form of writing size so that it can be enlarged to make it clearer and the instructions given are displayed in more detail so that they are easily understood by users. Based on the readability questionnaire by students regarding the easy operation of the

Interactive E-Book, the percentage obtained is 90% with a very good category.

Interactive E-Book media also carried out a readability test. This media readability assessment was carried out after testing the product developed by students, to determine the readability of the media as a consideration in helping to describe the characteristics of the Interactive E-Book media. The results obtained were from 10 students, 8 students gave an assessment of the very good criteria and 2 students gave an assessment of the good criteria. The percentage of the interactive E-Book media readability assessment by students is presented in Figure 1.



■ Very good ■ Good ■ Quite good ■ Less good

Figure 1. Percentage Diagram of Media Readability Assessment

Based on the analysis of the media readability assessment, it can be said that students also gave an assessment of the criteria of good and very good. This supports the characteristics of Interactive E-Book media that can help motivate students and understand the material being studied.

Data from the Validation of Media Interactive E-Books containing Virtual Laboratory

Assessment of Interactive E-Book media by media validators is adjusted to good media indicators by Walker & Hess (1984) as quoted by Arsyad (2011), covering several aspects, namely (1) instructional, (2) quality, and (3) completeness. In addition, an assessment indicator is also used regarding the ability of learning media in growing students' learning motivation. Based on the assessment criteria, Interactive E-Book media is good to use if it is declared valid when it gets a score of more than 62.50% and less than 81.25%. Meanwhile, if the Interactive E-Book media scores more than 81.25% and less than 100%, it can be said that the media is very valid. The results of the percentage

of interactive E-Book media validation by media validators can be seen in Table 2.

Table 2. Percentage of Interactive E-Book Validation Results by Media Experts

Media Experts	Institute	Percentage (%)	Criteria
ME-1	Integrated Science Lecturer FMIPA UNNES	100	Very valid
ME-2	Physics Lecturer FMIPA UNNES	82,69	Very valid
ME-3	ICT teacher at SMP N 4 Semarang	96,15	Very valid

The results of the assessment carried out by 3 media validators in Table 2. show that the Interactive E-Book media material on Global Warming includes very valid assessment criteria. This means that the Interactive E-Book media Global Warming material is good for use in teaching and learning activities and can help foster students' learning motivation, with the percentage values obtained are 100%, 82.69%, and 96.15%.

Interactive E-Book Material Validation Result Data containing Virtual Laboratory

Assessment of Interactive E-Book media by material validators is adjusted to good media indicators by Walker & Hess (1984) as quoted by Arsyad (2011), covering several aspects, namely (1) accuracy, (2) importance, (3) completeness, (4) balance, and (5) suitability for students. In addition, an assessment indicator is also used regarding the ability of learning media in fostering students' learning motivation. Based on the assessment criteria, Interactive E-Book media is good to use if it is declared valid when it gets a score of more than 62.50% and less than 81.25%. Meanwhile, if the Interactive E-Book media scores more than 81.25% and less than 100%, it can be said that the media is very valid. The percentage results of interactive E-Book media validation by material validators can be seen in Table 3.



Table 3. Percentage of Interactive E-Book Validation Results by Material Experts

Material Experts	Institute	Percentage (%)	Criteria
ME-1	Lecturer of Physics FMIPA UNNES	92,85	Very valid
ME-2	Lecturer of Physics FMIPA UIN Walisongo	80,35	Valid
ME-3	Science teacher at SMP N 4 Semarang	96,42	Very valid



The results of the assessments that have been carried out by 3 material validators in Table 3. show that the Interactive E-Book media on Global Warming material includes very valid assessment criteria. This means that the Interactive E-Book media Global Warming material is good for use in teaching and learning activities and can help foster students' learning motivation, with the percentage values obtained are 92.85%, 80.35%, and 96.42%



Based on the suggestions given by the validator, improvements were made to the Interactive E-Book media. The input and suggestions given are in the form of improving the appearance of the media and terms in the material that require a more complete explanation in several sections of the media. Design recapitulation on the Interactive E-Book media before and after repairs can be seen in Table 4.



Table 4. Design Recapitulation Before and After Improvement

No.	Before	After
1.	<p>Feedback:</p> 	<p>Improvement:</p>  <p>Improvements have been made</p>

The font size is too small for some pages. by changing the font size to make it more visible.

2.	<p>Feedback:</p>  <p>Instructions for operating the media are more detailed.</p>	<p>Improvement:</p>  <p>Improvements have been made by making more detailed operating instructions.</p>
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3.	<p>Feedback:</p>  <p>Need to be more equipped with navigation buttons when opening the material, making it easier to go to certain pages.</p>	<p>Improvement:</p>  <p>Improvements have been made by adding navigation buttons to make it easier to go to certain pages.</p>
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4.	<p>Feedback:</p>  <p>The intro section "click anywhere to</p>	<p>Improvement:</p>  <p>Improvements have been made</p>
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continue" is better if replaced "touch screen to continue.

to the use of more appropriate sentences.

5. Feedback:



Sources/references are written as citations and typos are corrected.

6. Feedback:

Add table of contents and bibliography.

Improvement:



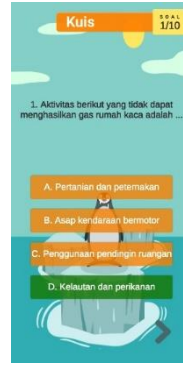
Citation has been added to each statement in the material.

Improvement:



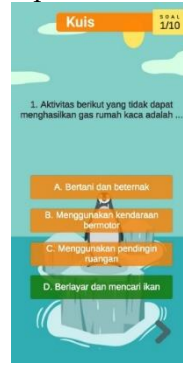
The table of contents and bibliography have been added.

7. Feedback:



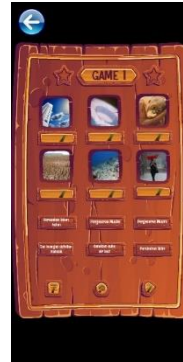
The choice of words on the quiz menu is more concerned.

Improvement:



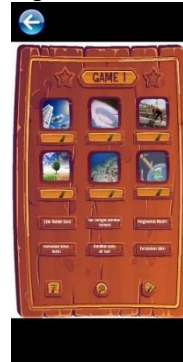
Improvements have been made by changing some words to be more precise and appropriate.

8. Feedback:



It is necessary to improve the use of images that are more specific and there are words in the questions and answer choices in the game menu that are not quite right.

Improvement:



Improvements have been made to the use of specific images and words that are more precise and appropriate.

9. Feedback:




The explanation of the definition needs to be improved.

Improvement:



Improvements have been made by completing the definition of parts of the

		material that are still ambiguous.
10. Feedback:		Improvement:
	Definition added.	Improvements have been made by adding terms in the material so that more complete information is arranged.

Interactive E-Book containing Virtual Laboratory in Fostering Students' Learning Motivation

The increase in students' learning motivation after carrying out learning activities using Interactive E-Book media can be seen using a learning motivation questionnaire. Learning motivation questionnaires were given at the beginning and at the end in order to find out an increase in students' learning motivation. Table 5. regarding the percentage of each category of student learning motivation.

Table 5. Percentage of Learning Motivation Category

Beginning	End
Height = $\frac{2}{30} \times 100\% = 6,67\%$	Height = $\frac{26}{30} \times 100\% = 86,67\%$
Medium = $\frac{25}{30} \times 100\% = 83,33\%$	Medium = $\frac{4}{30} \times 100\% = 13,33\%$
Low = $\frac{3}{30} \times 100\% = 10\%$	Low = $\frac{0}{30} \times 100\% = 0\%$

Based on Table 5. the criteria for assessing students' learning motivation were obtained by categorizing them into low, medium, and high classes. Before using the Interactive E-Book media, students were in the category of low learning motivation by 10%, medium by 83.33%, and high by 6.67%. After using Interactive E-Book media, students' learning motivation has increased in the high category by 86.67%,

medium by 13.33%, and low by 0%. This shows that learning using Interactive E-Book media can foster student learning motivation, supported by analysis of learning motivation assessment criteria from low, medium, and high categories.

In this study, data collection activities were also carried out to determine the cognitive learning outcomes of students. The learning outcomes of students obtained can later be used to strengthen the use of media developed in the learning process to foster student learning motivation. The instruments used are pretest, posttest, student worksheets, and learning motivation questionnaires.

The results of the pretest data analysis of the students' cognitive learning outcomes obtained an average value of 51.78. Based on these results, treatment was given in the form of implementing learning activities using Interactive E-Book media in the class. The results of the posttest showed that the average score obtained by the students was higher than the pretest, which was 85.56. The increase in students' cognitive learning outcomes can be seen in Table 6.

Table 6. N-Gain Cognitive Learning Outcomes

Data	Learning Outcome		N-Gain
	Pretest	Posttest	
Lowest Value	40	73,33	0,71 (High)
Top Rated	80	100	
Average	51,78	85,56	

The N-Gain value in Table 6. shows that the increase in the high category is 0.71. This category is in accordance with Wiyanto (2008) showing that the N-Gain is 0.3 g 0.7 in the high category.

Based on the results of research that has been carried out, Interactive E-Book media has a good ability to help foster students' learning motivation, so it is good to be used as a science learning medium for even semester VII class students on global warming material. The advantages of this media in fostering learning motivation are the application of interactive methods so that there is interaction between the media and users, which is also combined with the characteristics of learning motivation, active learning, fun, and contextual. The results of this study are in line with the research of Najihah & Sanjaya (2014), that Interactive E-books have a better impact on achievement and motivation to learn science material. This is because the interactivity in the media involves physically

and mentally students when using the media, so that learning motivation can also increase.

CONCLUSION

Based on the results of the study it can be concluded that: 1. Interactive E-Book is an interactive learning media in the form of a digital application with the characteristics of learning motivation, fun learning, active learning, and contextual learning that includes a menu of information, apperception, materials, virtual labs, games, quizzes, and instructions. 2. The validity of the Interactive E-Book media is stated to be very valid with an average percentage of 92.94% by media validators and 89.87% by material validators, so it is good for use in learning activities. 3. The use of Interactive E-Book media can foster students' learning motivation with an increase in the high category.

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