

## DEVELOPMENT E-BOOK GUIDED INQUIRY MODEL PHYSICS INTEGRATING MULTIMEDIA FOR WAVE PROPAGATION, STATIONERY AND SOUND WAVE LEARNING MATERIALS

Rathika Maffira, Yurnetti<sup>1\*</sup>

<sup>1</sup> Department of Physics, Universitas Negeri Padang, Jl. Prof. Dr. Hamka Air Tawar Padang 25131, Indonesia

Corresponding author. Email: yur\_dian@fmipa.unp.ac.id

### ABSTRACT

*Covid-19 pandemic has changed learning process commonly done directly in school to distance/ online learning. Consequently, it needs media in order to improve students' motivation and critical thinking skill, such as digital book utilizing interactive multimedia using guided inquiry learning model. Purpose of the research was to measure validity and practicality of guided inquiry model of Physics e-book integrating multimedia for wave propagation, stationary wave, and soundwave learning materials in grade XI of Senior High School. It used a research and development method with Plomp model. The instrument to assess validity was a questionnaire consisted of 4 components, in which each components had 6 aspects of assessment. Meanwhile, the instruments to assess practicality were one-to-one evaluation interview and practicality questionnaire. To analyze data, it used persentase analysis. The Analisis used is quantitative techniques. Result of validity analysis conducted by 5 validators (3 lecturers from physics department in State University of Padang and 2 physics teachers from SMAN 1 Harau Regency) shows that it is 90,89%, which means very valid. Beside that, result of practicality analysis conducted by 6 students and 2 teachers shows that it is 95% from students and 83,45% from teachers, which means it is very practical. So, it can be concluded that guided inquiry model of Physics e-book integrating multimedia for wave propagation, stationary wave, and soundwave learning materials in grade XI of Senior High School is valid and practical so that it is proper to use in learning process*

**Keywords :** E-book; Guided Inquiry; Multimedia; Validity; Prakticality.



Pillar of Physics Education is licensed under a Creative Commons Attribution ShareAlike 4.0 International License.

### I. INTRODUCTION

Education is a very important component in facing the challenges of the 21st century. In the century This science and technology develops without limits. These technological advances provide easy access to students in terms of education [1] Education 4.0 can change the utilization of information in a easy in economi, politich, education, etc [2] this is indicated by the availability of various online learning spaces such as e-learning, zoom, google meet, etc. Therefore, supporting human resources are needed, both in terms of spirituality, knowledge, or skills in facing the development of the 21st century. Realizing this, of course, the role of the government is very much needed, one of which is by setting the 2013 curriculum for every level of education.

Educational level is the basic stage that is determined based on the level of development of students, the goals to be achieved and the abilities developed [3]. Indonesia has levels of education, including basic, secondary, and higher education levels, which are at the level of tertiary institutions. SMA is located at the level of education units at the secondary education level with one of the subjects contained in the 2013 curriculum is physics.

The 2013 curriculum emphasizes holistic learning, which can touch on a wider scope which consists of cognitive, effective and psychomotor in students[4]. Students are expected to be able to find or build their own knowledge that will be learned and be able to apply the knowledge that has been obtained. The teacher in learning

has a very important role as a facilitator who will guide students in finding their knowledge. Based on the demands of the 2013 curriculum, students are required to be able to think critically and analytically and be able to utilize technology in every lesson, especially physics subjects. The hope is that with the abilities they have, they can help teachers or students in the learning process during the current covid-19 pandemic.

Pandemic covid-19 has led to major changes to the learning process. The learning process, which was initially carried out at school, is currently being carried out online. The implementation of learning carried out online or online certainly requires different preparation from learning that is carried out as usual in schools. Online learning requires teachers or students to be able to develop their skills and creativity in delivering and finding learning materials. One thing that can be done is by changing learning facilities such as teaching materials that usually use printed teaching materials into technology-based or digital teaching materials. Teaching materials are one of the needs in the learning process carried out in schools [5]. One of these teaching materials is student text books.

Text books absolutely exist as a guide for students in obtaining information. Textbooks are one of the most important sources of information for students, with the availability of quality textbooks, it will certainly support increased interest and student learning outcomes [6]. The benefits of textbooks include, (1) It can speed up the discussion of study materials. (2). Students can study the study material that will be taught earlier. (3) In the textbook, it is also possible to insert exercises that must be done by students with contextual problem-oriented orientation. (4) Questions can be made based on textbooks so that the assessment is more appropriate to students' abilities. (5) With the textbook, the theory conveyed by the teacher that cannot be understood in class, students can learn again from the textbook [7].

E-book have an orderly presentation, the language used is easy to understand and the information conveyed is more in-depth. Advantages of e-books among others, ease of browsing and reading, saving paper materials, and can be combined with interactive media such as animation, video, and images. The use of animation in physics learning can increase students' attention [8]. It is hoped that with e-books This can trigger students' interest and motivation to think critically in the learning process..

Based on the results of observations in one high school, it is known that teachers during the learning process tend to use textbooks that are already available at school. In other words, textbooks designed by teachers themselves, whether in print or electronic form, are still minimal/limited for use by both teachers and students. The use of learning models in the learning process cannot be carried out properly because the learning process is carried out remotely or online, so teaching materials are needed that can assist in the distance learning process. Judging from this situation (Guided Inquiry).

Guided Inquiry Learning is a stage in the learning process that prioritizes the process of thinking critically and analytically to seek and find a definite answer for the problem in question [9]. Through digital textbooks(e-books) With this guided inquiry model, it is expected to increase the activeness and critical thinking of students. E-book This study was designed on the material of traveling waves, stationary waves and sound waves in class XI semester 2.

The reason the researchers took this material is based on the results of observations in one high school, where the material of traveling waves, stationary and sound is one of the materials that are considered difficult by students of class XI semester 2, and also based on the results of previous research, namely this material is considered difficult to learn. studied by students in class XI semester 2 [10]. Based on the explanation above, the researcher aims to develop and determine the validity and practicality of the E-book Guided Inquiry Model Physics Integrating Interactive Multimedia In Materials of Walking, Stationary and Sound Waves Class XI Semester 2 high school.

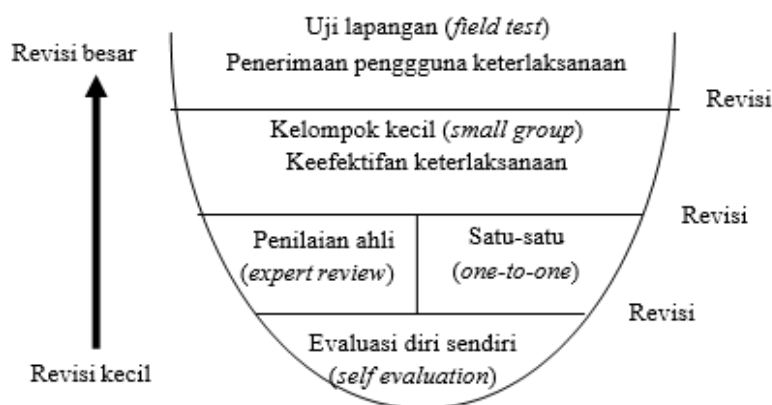
## II. METHOD

The research method used in this study is a development method Research and Development / RnD. This development research is one of the research methods often used to produce a particular product [11]. The model used is the Plomp model which consists of 3 stages, namely for the first stage of the initial investigation (preliminary research), the second stage is the formation of a prototype (prototyping stage) and the third stage is trial and (assessment phase) [12]. The cognitif-based teaching material was designed / development end model of Plomp [13].

The time and place of the research was carried out in the odd semester of the 2021/2022 academic year, with the exact research being SMAN 1 Harau District. The research subjects are physics lecturers, FMIPA UNP, physics teachers and class XII students, while the objects in this study are e-books physics guided inquiry model that

integrates interactive multimedia on the material of traveling waves, stationary and sound class XI semester 2 SMA.

The initial investigation stage is carried out needs analysis, curriculum analysis, literature study and conceptual framework development. As for the formation of the prototype carried out expert review and tested one-to-one evaluation. This research is limited to the test stage one-to-one evaluation to see practicality of the developed textbooks. For each prototype, a formative evaluation test will be carried out, as shown in the following figure:



**Fig. 1.** Tesser's formative evaluation stages

The instrument used in this study is a validity questionnaire to assess the validity of the e-books, next is the interview sheet one-to-one evaluation as well as a practicality questionnaire to see the practicality of e-books developed. The data obtained from the validity and practicality instruments will be analyzed using the following formula:

$$\text{Score} = \frac{\text{Many Score}}{\text{score max}} \quad (1)$$

The decision results on the validity/practicality category obtained after processing the data are presented in Table 2.

**Table 1.** Validity and practicality categories

| Interval   | Information |
|------------|-------------|
| 0% - 20%   | Very Less   |
| 21% - 40%  | Not Enough  |
| 41% - 60%  | Enough      |
| 61% - 80%  | Tall        |
| 81% - 100% | Very High   |

(Source: Modified [14])

### III. RESULTS AND DISCUSSION

#### A. Preliminary investigation (preliminary research)

Meanwhile, based on a survey conducted on digital textbooks, some data were obtained including 1) Textbooks have not used the guided inquiry learning model for traveling, stationary and sound waves, 2) books have been compiled based on basic competencies and indicators of achieving the required competencies, 3 ) digital textbooks already present pictures that match the material described, 4) textbooks are presented in the form of flip PDFs but are not yet equipped with interactive multimedia. . The survey results can be seen in appendix 1. 4) textbooks are presented in the form of flip PDF but not yet equipped with interactive multimedia. The survey results can be seen in appendix 1. 4) textbooks are presented in the form of flip PDF but not yet equipped with interactive multimedia. . The survey results can be seen in appendix 1.

The results of observations in one high school are known that teachers during the learning process tend to use textbooks that are already available at school. In other words, textbooks designed by teachers themselves, whether in print or electronic form, are still minimal/limited to be used by teachers and students. The learning process during the pandemic is carried out online/offline using Telegram and WhatsApp Groups. The use of learning models in the learning process cannot be carried out properly because the learning process is carried out remotely or online, so teaching materials are needed that can assist in the distance learning process. Judging from this situation, the thing that can be done in order to increase the activeness and critical thinking of students in the learning process is to design textbooks into digital textbooks using a guided inquiry learning model (Guided Inquiry).

Furthermore, an analysis of the curriculum used in the school was carried out, based on the results of observations the curriculum used by the school for now is the 2013 revised 2017 curriculum. Then a literature study was also carried out, namely as follows. (1) Stages of guided inquiry learning (2) e-book consists of several components, namely cover, user guide, competencies to be achieved, activity sheet, evaluation sheet, glossary sheet, answer key and literature. (3) The physics e-book development model used is the Plomp model which consists of three stages including the initial investigation stage, the prototype formation stage and the last one is the assessment stage.

The last stage in the initial investigation is to carry out a conceptual analysis that functions to analyze the concepts in the material of traveling waves, stationary and class XI sounds that will appear in the textbook that will be developed. The results of the analysis will form a concept map on the physics e-book guided inquiry model integrating interactive multimedia for traveling, stationary and sound waves for class XI semester 2.

#### B. Prototype Formation (Prototyping Stage)

The resulting prototype I is an e-book of physics guided inquiry model integrating interactive multimedia on traveling wave material. The design consists of covers, as well as stages of guided inquiry learning, competencies achieved and student activity sheets.

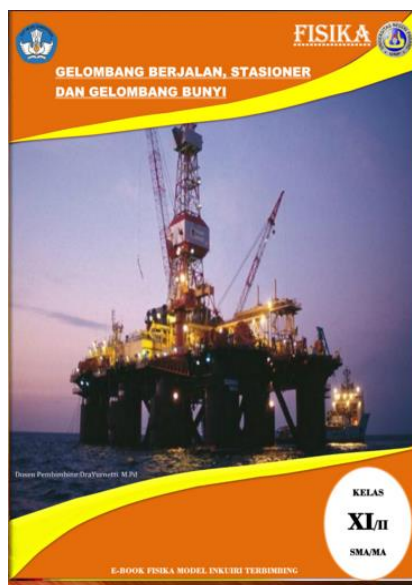


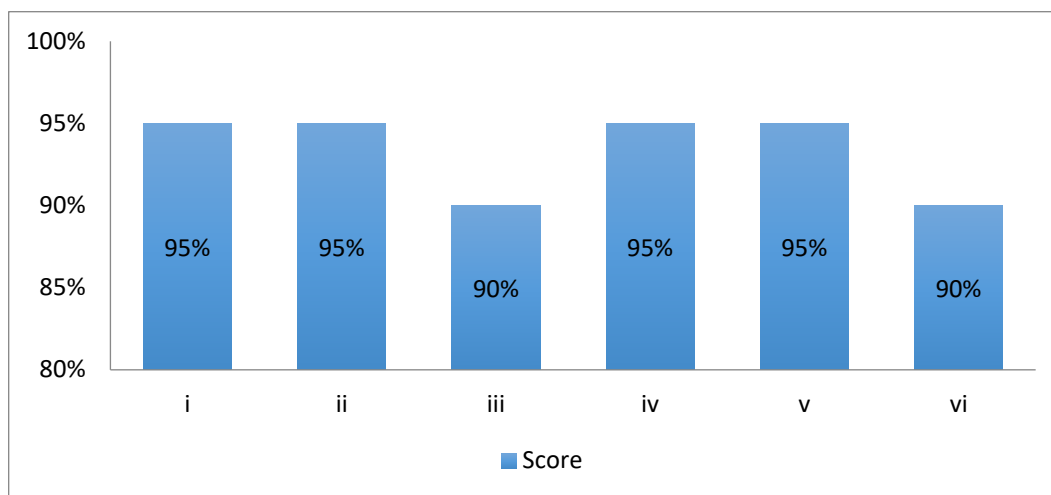
Fig. 2. Cover e-book

The results of the prototype II were obtained from the results of the self-evaluation test. The results of the self-evaluation test are that the ebook does not require revision because the components are complete. Self-evaluation is useful to see the completeness of the guided inquiry model physics e-book integrating multimedia on traveling, stationary and sound waves for class XI in the second semester of high school.

In the third prototype stage, a formative evaluation consists of (Expert Review) and one-on-one trial (one to one evaluation) to get the level of validity and practicality of the physics e-book. The results of the validity test are obtained:

#### 1) Content Component

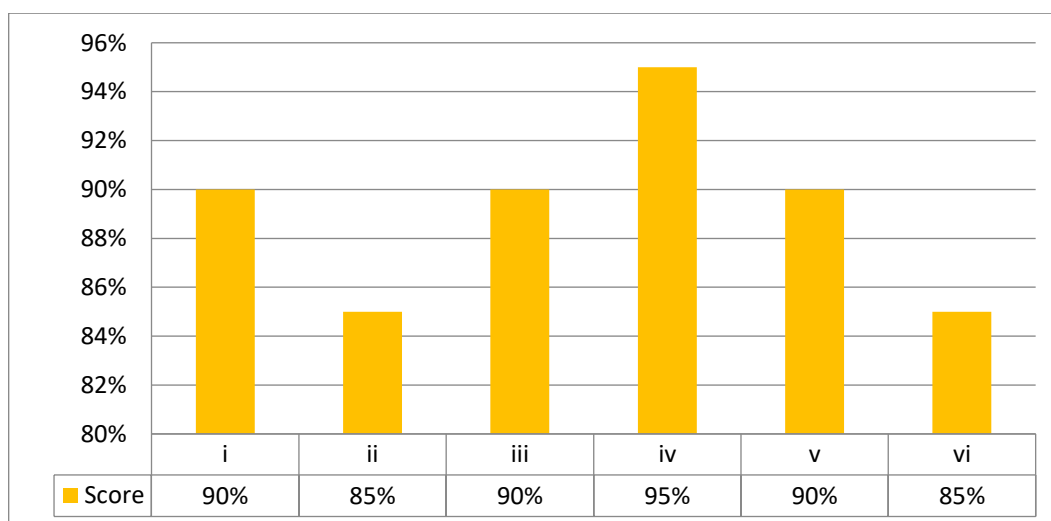
The assessment of the content components includes conformity with Basic Competencies, conformity of content with students' abilities, scope of questions contained in the content e-books, the suitability of the substance of the material with the characteristics of the material, content e-books can add insight for students, and the suitability of the served in it.



**Fig. 3 . Content Component Validity Analysis**

#### 2) Language Component

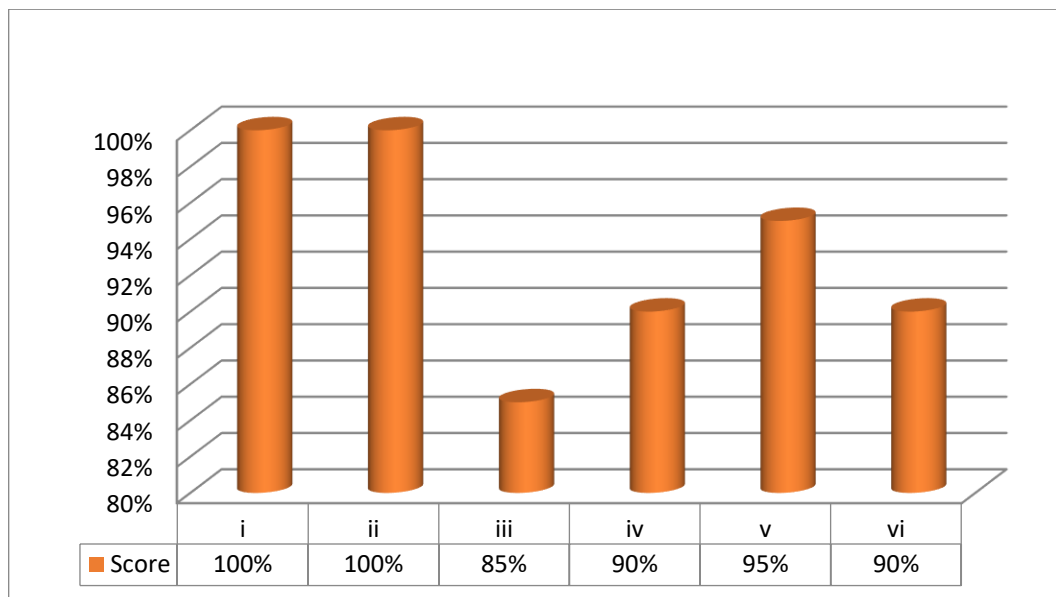
Assessment on the linguistic component includes the shape and size of the letters used, the clarity of the information provided, the language used in accordance with the rules of using the correct language, the clarity of the language used, the ease of understanding the language used, and the use of consistent symbol.



**Fig 4 . the Analysis of the Validity of the Language Components**

### 3) Components of Serving

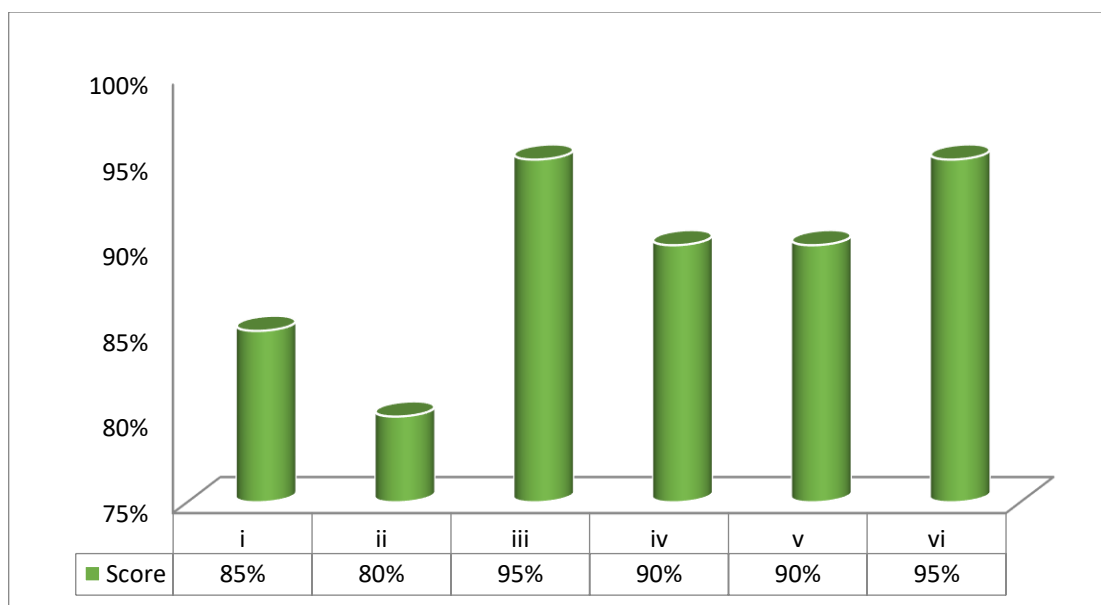
Assessment on the presentation component includes conformity with indicators, conformity with learning objectives, questions that have been prepared have led to learning objectives, clarity of the questions presented, systematic from books, and books have been compiled based on the steps of the model used.



**Fig. 5 .** the Analysis of the Validity of the Presentation Components

### 4) Graphic Component

The assessment on the graphic component includes the type of font used, the size of the font used, the appearance of the image e-books, the clarity of the images presented, the illustrations used have been seen with clear and display e-books have been able to attract learning interest from students.



**Fig. 6.** The Analysis of the Validity of the Presentation Components

Based on the figure, the average for the validity of the inquiry model physics e-book is obtained Supervised integration of multimedia on traveling, stationary and sound waves for class XI in the second semester of high school is 90,89%. The average validation results can be seen in the following table 2:

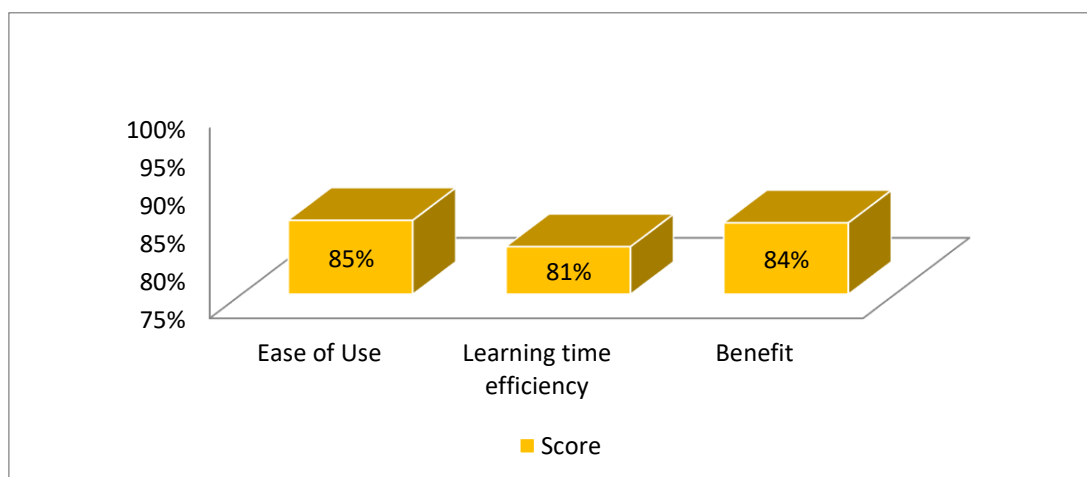
**Table 2 .** The average of the results of the validity of

| No      | the components assessed | Score | Category  |
|---------|-------------------------|-------|-----------|
| 1       | Contents                | 93,3  | Very high |
| 2       | Language                | 88,17 | Very high |
| 3       | Presentation            | 93,3  | Very high |
| 4       | Graphics                | 88,17 | Very high |
| Average |                         | 90,89 | Very high |

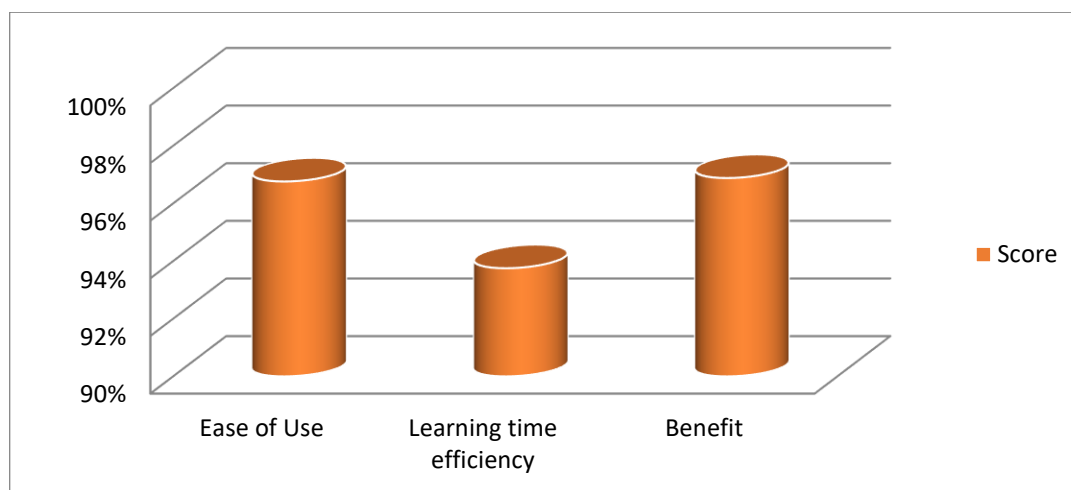
After the product in the form of an e-book physics guided inquiry model integrating multimedia is validated by the validator, the next step is to do a small class trial or one to one evaluation using an interview sheet conducted to 6 class XII students at SMAN 1 Harau District then also a practical test was conducted on two physics teachers and 6 students of SMAN 1 Harau District.

The results of the practicality questionnaire from 2 physics teachers at SMAN 1 Harau District obtained an average practicality of e-books physics guided inquiry model integrating multimedia on the material of traveling waves, stationary and sound class XI semester 2 SMA is 83.45% with a very high category.

The results of a practical questionnaire from 2 physics teachers at SMAN 1 Harau District for each aspect can be presented in the form of the following diagram

**Fig. 8.** Graph of Teacher Practical Results

The results of the practicality questionnaire from 6 students of SMAN 1 Harau District can be presented in graphic form as follows:

**Fig. 9.** Graph of Students' Practicality Results

In addition to using a practicality questionnaire, the researchers also conducted test one to one evaluation through interview sheets distributed to students. After seeing the results of the interview sheets filled in by the students, the researcher can conclude that the guided inquiry model physics e-book integrating multimedia in the material of traveling waves, stationary and sound class XI Semester 2 senior high school can increase the interest and motivation of students in the learning process.

Based on the research that has been done at SMAN 1 Harau District that is starting from the initial investigation (*Preliminary Research*) by means of observations to schools to analyze needs. Based on the results of observations found in schools that learning is currently carried out with online and offline systems, for online learning using telegrams and WhatsApp groups as learning tools, while for books used in the learning process teachers still depend on printed books provided by the school. Based on the needs analysis carried out, it is necessary to have new innovations that can facilitate learning activities and support the interests and motivation of students in the learning process. One alternative that can be done is to develop electronic textbooks or *e-book* guided inquiry physics model integrates multimedia on the material of propagation waves, stationary and sound class XI semester 2 SMA.

*E-book* guided inquiry physics model in the view of structure referring to Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 8 of 2016 which states that the textbook consists of: 1) The beginning of the book in the textbook must fulfill the title page, publishing page, foreword page, table of contents page, picture list page, and page numbering, 2) The contents of the book in the textbook must meet the material aspects, linguistic aspects, presentation aspects material, and graphic aspects, and 3) The final part of the book in the text book must fulfill information about bookkeepers, glossary, bibliography. Special characteristics digital book this is the existence of multimedia in the form of videos and virtual labs that can increase the motivation and interest of students in addition to digital books or digital books *e-book*. It also uses a guided inquiry model with an orientation syntax, formulating problems, formulating hypotheses, collecting data, testing data, and drawing conclusions that can provoke students' critical thinking. Coverage of material on the book this digital is propagation wave, stationary and sound waves.

Based on the results of the revision of the validator's suggestions Guided Inquiry Model Physics e-book already has a proper description as a text book. The structure and order of presentation have been adjusted to the proper structure of the text book. Guided inquiry physics e-book integrating multimedia has an average level of validation for the content component 93.3%, for the linguistic component is 89.17%, for the serving component 93.3%, and for the graphic component is 89.17%. In the four components that were assessed, the presentation component and content component had the same average value and the language and graphic components also had the same average value. *E-book*. The physics of guided inquiry models integrating multimedia have been improved as well as suggestions and inputs given by validator, both in terms of content, presentation, and addition of information and questions that can encourage critical thinking and increase students' learning motivation.

The second result that has been achieved in this research is Judging from the results of practicality carried out by 2 teachers and 6 students, the researcher took the subject of 6 students based on the state of learning that was carried out fully online. The teacher suggests bringing in limited students by grouping them based on the ability level of the students. As for the results practicality of physics digital book Theory propagation, stationary and sound waves that integrate multimedia has a high level of practicality very good according to teacher and student. Practicality is the level of ease experienced by educators in teaching student by using a product or teaching material. Based on data analysis from the practicality of the teacher, the average practicality is obtained 84.72% for the convenience aspect usage, 81.25% for the aspect of time efficiency, and 84.38% for the benefit aspect, where the time efficiency aspect has a lower value than the other two aspects. The analysis of practicality data by the teacher is obtained on average 96.76% for ease of use, 93.75% for time efficiency and 96.88% for the ease of use aspect.

Based on the results of the practicality test, it can be seen that physics e-book guided inquiry model integrating multimedia on traveling, stationary and sound waves in class XI in the 2nd semester of high school have average easy to use in the physics learning process. The language used, the content of the material, and the learning activities in physics e-book easy to understand by students in learning, as well as books digital teaching can be used at anytime with needs. *E-book* guided inquiry physics model integrating multimedia This is useful in developing students' knowledge and relating it to everyday life. Besides the book digital teaching also useful in transferring students' physics knowledge into technology. Book display and presentation digital teaching interesting, interesting color composition so that it triggers the enthusiasm of students to read.

Based on the discussion that has been described previously, the *e-book* guided inquiry physics model integrating multimedia on moving, stationary wave material and the sound of class XI semester 2 high school suitable for use as a learning resource in schools. Teachers can use books teach electronics. This is to make it easier and save time in the learning process because *e-book* guided inquiry physics model integrating multimedia it already has a level of practicality very good. *E-book* guided inquiry physics model integrating multimedia can be used as an alternative source of learning for teachers to improve students' abilities in improve critical thinking.



The result of data analysis shows that the guided inquiry model of physics e-book which four of the first ease in accessing it, the second it's usefulness in learning, the third it's attractiveness in the learning process and the last is it's high level of efficiency [14].

According to previous research, the use of physics e-books that integrate interactive multimedia is very practical, interesting and easy to use [15]. E-book guided inquiry physics model integrating multimedia can be used by students during the learning process because it has a high level of practicality very high according to students. Students can relate physics material with video and simulation so that it can increase students' interest in learning.

#### IV. CONCLUSION

This guided inquiry physics e-book integrates multimedia needs to be tested more widely so that the scope and quality of this product can be met because the research have only reached the practicality stage and have not yet reached the effectiveness stage. The validity of the guided inquiry model physics e-book integrating multimedia is in the very high category with an average of 90.89%. Practicality e-books physics is in the very practical category with the average value obtained is 83.45% by teachers and 95.80% for students, so the guided inquiry model physics e-book integrates practical multimedia used as a textbook on traveling wave material, stationary and sound class XI semester 2 senior high school

#### REFERENCES

- [1] R. D. & R. E. Prayogi, "Kecakapan Abad-21: Kompetensi Digital Pendidikan Masa Depan," *J. Manaj. Pendidik.*, vol. Vol 14, No, 2019.
- [2] T. Agustina and A. Putra, "PHYSICS E-BOOK DESIGN FOR HIGH SCHOOL STUDENTS USING FLIP PDF PROFESSIONAL BASED ON EDUPARK HOT WATERBOOM SOLOK SELATAN," vol. 13, no. 4, pp. 511–519, 2020.
- [3] departemen pendidikan, *UU no 20 tahun 2003*.
- [4] N. R. Alias and N. A. Rahman, "DEVELOPMENT OF PASCAL PRINCIPLE ACTIVITIES USING THE STEM APPROACH AND UNDERGRADUATE PHYSICS STUDENTS' PERCEPTION TOWARDS THE ACTIVITIES Nawwar Raihan Alias, Nurulhuda Abd Rahman \*," vol. 14, no. 1, pp. 475–478, 2021.
- [5] R. Sumarmin, "ANALISIS KEBUTUHAN PENGEMBANGAN BAHAN AJAR IPA TERPADU BERMUATAN LITERASI ERA DIGITAL UNTUK PEMBELAJARAN SISWA Asrizal, Festiyed, Ramadhan Sumarmin," vol. 1, pp. 1–8, 2017.
- [6] T. E. Yuliyanti, A. Rusilowati, J. Fisika, F. Matematika, and I. Pengetahuan, "Unnes Physics Education Journal ANALISIS BUKU AJAR FISIKA SMA KELAS XI BERDASARKAN MUATAN LITERASI SAINS DI KABUPATEN TEGAL," *UPEJ*, vol. 3, no. 2, 2014, [Online]. Available: <http://journal.unnes.ac.id/sju/index.php/upej>.
- [7] A. Wulandari, "VALIDITY OF PHYSICS MOBILE LEARNING MEDIA EDUPARK OF BAYANGSANI SOUTH COAST FLUID ON FLUID MATERIAL FOR HIGH SCHOOL STUDENTS USING THE ANDROID STUDIO," vol. 13, no. 4, pp. 475–483, 2020.
- [8] Festiyed, "Makalah disampaikan dalam seminar tahunan (Semirata) BKS-MIPA wilayah Barat dari 13-14 Mei 2008 di Universitas Bengkulu Dosen Jurusan Fisika FMIPA Universitas Negeri Padang 1," pp. 1–12.
- [9] A. B. Pakuradin, I. R. Mustapa, and N. S. Y. Abdullah, "THE DEVELOPMENT AND PERCEPTION OF THE USE OF VIRTUAL REALITY LEARNING KITS FOR ELECTROMAGNETIC INDUCTION," vol. 14, no. 1, pp. 25–28, 2021.
- [10] A. Istiyowati, S. Kusairi, and S. K. Handayanto, "ANALISIS PEMBELAJARAN DAN KESULITAN SISWA SMA KELAS XI TERHADAP PENGUASAAN KONSEP FISIKA Analysis," *Pros. Semin. Nas. Iii Tahun 2017*, 2017.
- [11] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta, 2014.
- [12] N. N. Plomp T, *Education Design Research*. Enschede Netherland: National Institute for Curriculum Development (SLO), 2013.
- [13] T. F. Delvia, F. Mufti, and M. Bustari, "DESIGN AND VALIDITY OF PHYSICS TEACHING MATERIALS BASED ON COGNITIVE CONFLICT INTEGRATED VIRTUAL LABORATORY IN ATOMIC NUCLEUS," *Pillar Phys. Educ.*, vol. 14, no. 1, pp. 5–14, 2021, doi: <http://dx.doi.org/10.24036/10354171074>.
- [14] Daryanto, *Menyusun Modul Bahan Ajar Untuk Persiapan Guru Dalam Mengajar*. Yogyakarta: Gava

- Media, 2013.
- [15] Sadraini and Hamdi, “Praktikalitas dari Pengembangan E-book Edupark Fisika dengan Pendekatan Saintifik Berdasarkan Destinasi Rumah Gadang Program Studi Magister Pendidikan Fisika , UNP Dosen Program Studi Magister Pendidikan Fisika , UNP,” *J. Penelit. dan Pembelajaran Fis.*, vol. 7, no. 1, pp. 94–100, 2021.