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Development of Interactive Multimedia Based on ISpring Suite Integrated Prompting Question to Facilitate Students' Concept Understanding Ability

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ABSTRACT

The 21st century has been marked by significant advancements in the fields of science and technology. These developments have efficiently addressed many issues in the field of education, in the study of physics. Effective physics learning focuses on students' concept understanding. However, the reality is that students' concept understanding is low, especially in the material of traveling waves and stationary waves. The proposed solution is to develop interactive multimedia based on iSpring suite integrated with prompting questions. The objective of this interactive multimedia is to ascertain its characteristics and validity. The research methodology employed in this study is development research, specifically utilizing the Plomp development model. The initial data was gathered through the utilization of a diagnostic test consisting of four tiers, as well as the study of two interactive multimedia journals. The validity test was administered by a group of five lecturers from the Physics department at FMIPA UNP. The validity analysis results reached 0.85 valid category.

Keywords: *Interactive multimedia, ISpring Suite, Prompting questions, Concept understanding.*

I. INTRODUCTION

The current era, commonly known as the 21st century, is distinguished by swift advancements in knowledge and technology. One of the main features of this century is the increasing interdependence between different disciplines, which encourages cooperation and integration between these fields. Advances in information and communication technology have overcome barriers of distance and time, especially in the context of education. In this era, technological developments have enabled the development of facilities and infrastructure that can help students understand learning concepts better, including in the study of physics.

Physics is the most fundamental science because it deals with the behavior and structure of matter [1]. According to [2], effective learning in physics focuses on the actual facts of physics that learners must master the process and products of physics. Physics products include theories, concepts, laws, and so on. The process includes the application of these products in everyday situations. However, there are increasing challenges to improve the effectiveness and efficiency of physics learning. Many students find it difficult to understand complex and conceptual physics theories, and are less interested in learning physics due to less interesting and participatory learning methods. However, in today's digital era, knowing physics is becoming increasingly important in many fields of work, so learning about physics effectively and efficiently is essential to prepare students for the future.

To improve physics learning in schools, various actions have been taken, such as the development of a more interesting and interactive curriculum, the use of technology, and the creation of relevant teaching materials. This approach is in accordance with Government Regulation No. 32 of 2013, which underscores the significance of employing interactive educational methods that are informative, engaging, stimulating, and afford students the chance to cultivate creativity, initiative, and autonomy in accordance with their unique capacities and interests. Consequently, students are able to acquire a thorough comprehension of the fundamental principles of physics.

The importance of students' understanding of ideas in the achievement of learning, especially in sciences such as physics, is enormous. The comprehension of a subject can be categorized into three levels: understanding, misunderstanding and not understanding the concept. A person is said to understand a concept if the person is able to explain what has been heard and read in his own words. Misconception is a wrong understanding in students' knowledge that can occur repeatedly [3]. Meanwhile, someone is said to not understand the concept if that person is unable to explain what the concept means [4].

A thorough understanding can help students in learning how to apply complex physical concepts in everyday life. However, sometimes students' knowledge of concepts is still insufficient, especially on complex and abstract subjects. One of the subjects in physics studies that experience low understanding of the theory of traveling waves and stationary waves. The pupils' level of concept understanding can be discerned by examining the percentages obtained from the four-tier diagnostic test, as presented in Table 1

Table 1. Percentage of students' concept understanding using the four tier diagnostic test at SMAN 4 Pariaman

Subject Matter	**Category (%)**		
	Percentage of Conceptual Understanding	**Percentage of Misconception**	**Percentage of No Conceptual Understanding**
Traveling Wave	29	60	11
Stationary Wave	30	61	9

According to the data shown in Table 1, the analysis reveals that students' comprehension of the subject matter pertaining to traveling waves and stationary waves is still relatively low and has a high category of misconceptions. A prior study [5] has observed that the inadequate grasp of concepts among students may be attributed to several causes, including a lack of interest on the part of students and a lack of teaching experience among teachers who fail to incorporate engaging and interactive learning aids into their instructional methods. As a response, there needs to be an effort to help facilitate students' concept understanding ability, one of which is through the use of teaching materials. Teaching materials function as a source of information, communication tools and conveyors of information in the field of education [2]. Teaching materials are also used in communication tools between teachers and students. The attainment of effective interaction has been found to be associated with a heightened level of efficiency in the learning process. Learning efficiency can be achieved through interactive teaching materials, and one example is interactive multimedia.

Multimedia in interactive form is an educational tool that integrates text, video, images, graphics, and sound to deliver an engaging and dynamic educational encounter [6]. Interactive here means that users can control, answer or provide text in multimedia content

through digital feedback. With interactive multimedia, students can learn autonomously, which helps to improve the understanding of concepts through a hands-on type of instruction. That is why teachers must have expertise in utilizing technology by using various applications. According to [7], interactive multimedia provides various benefits, including increasing efficiency, motivation, and encouraging active learning, as well as making it easier for students to understand topics that are compatible with student-centered learning strategies. In addition, interactive multimedia has the potential to enhance students' educational experiences during the learning process.

Table 2. Advantages and disadvantages of pre-existing interactive multimedia

Product	Strengths	Weaknesses
Interactive multimedia can be utilized as a pedagogical tool in the form of educational videos. (source : Ref [8])	1) The lesson video possesses a visually appealing aesthetic 2) Accessible anytime and anywhere. 3) Can combine technological knowledge, pedagogy, and course content in one digital presentation. 4) Can be repeated when necessary to increase the clarity of the material.	1) Limitations of individual response. 2) Requires large bandwidth and internet connection.
Interactive multimedia on web platforms. (source : Ref [9])	1) Can encourage students to be more active and independent in learning. 2) Can overcome different learning styles. 3) Provides universal accessibility and flexibility for individuals to engage in learning regardless of geographical location or time constraints. 4) Teachers can find out the value of students.	1) Access to supporting programs is necessary in order to open web-based interactive multimedia. 2) Can only be accessed using a laptop/computer.

According to the findings presented in Table 2, it is evident that several interactive multimedia applications have been created to address the subject matter of travelling waves and stationary waves. However, it is important to note that interactive multimedia still exhibits certain limitations. Hence, in order to address this issue, it is imperative to develop a more efficient and adaptable interactive multimedia platform utilizing iSpring suite software.

The iSpring Suite is a software tool designed for the creation of interactive multimedia content, integrating various features such as audio, video, and audiovisual elements. The application has been integrated with PowerPoint and works with various supporting tools to make multimedia presentations more attractive, Interactive, and easy to use [10]. Interactive multimedia created with the iSpring suite can be relatively converted into flash and HTML 5 formats [11]. In addition, it should be noted that iSpring Suite 9 has the capability to publish

interactive multimedia in six different formats, including video, learning management system (LMS), CD, iSpring Learn, web, and iSpring Cloud [12]. However, there are instances where the utilization of interactive multimedia may not be optimal in enhancing students' ability to comprehend concepts. One solution is to use prompting questions to increase the effectiveness of interactive multimedia.

In interactive learning, an effective strategy to increase learners' participation and understanding is to use prompting questions. This is in accordance with the view of [13] showing that prompting questions have a function to enable students to find the right answer by combining the use of instructions or hints so that solutions they could not offer before which if applied can be effective and interesting. In interactive multimedia, prompting questions can be presented in different formats such as open-ended questions, multiple choice, or statements that must be analyzed by students. Hence, the objective of this study is to create interactive multimedia utilizing iSpring suite, which will be supplemented with prompting questions. The intention is to facilitate students' concept understanding ability.

II. METHOD

Development research, alternatively referred to as design research, is a form of research that aims to facilitate the advancement and substantiation of a product. The research in question adopts the Plomp model as its development framework. The research approach of the Plomp model consists of two distinct stages: the preliminary research phase and the development phase. The development phase encompasses three distinct processes: the construction of interactive multimedia using iSpring suite, the incorporation of prompting questions, self-evaluation, and expert review.

During the preliminary research stage, a needs analysis was carried out, which involved administering a four-tier diagnostic test to 33 class XII students at SMAN 4 Pariaman in the academic year 2023/2024. The purpose of this test was to assess the level of understanding of concepts related to traveling waves and stationary waves. Additionally, two journals were examined to explore the benefits and drawbacks of interactive multimedia developed by previous researchers.

During the development or prototyping phase, the objective is to create interactive multimedia content with the iSpring suite, which is integrated with prompting questions. The subsequent stage involves the researcher conducting a self-evaluation to enhance the quality of the product or interactive multimedia that has been developed, prior to its submission to the validating instructor. The product's self-evaluation employs the percentage technique, as described in reference [14].

$$\% = \frac{score\ obtained}{total\ score} x100\% \text{.....(1)}$$

The evaluation is conducted by the completion of a questionnaire that includes a validity sheet checklist, utilizing a Likert scale [14].

Tabel 1. *Skala Likert*

Skala *Likert*	Assessment
5	Strongly Agree
4	Agree
3	Undecided
2	Disagree
1	Strongly Disagree

(source : Ref [14])

The data from this analysis is then expressed with the item validity index, namely the Aiken's V index (V).

$$V = \frac{\Sigma s}{n\,(c-1)} \text{.....(2)}$$
$$s = r - l_0 \text{.....(3)}$$

Description:
V = Rater index
l0 = The lowest level of practicality (in this case = 1)
c = The highest level of practicality (in this case = 5)
r = The number given by a rater
n = Number of raters

Aiken's V Index is employed to ascertain the category of the rater agreement index value. An item assessed by 5 raters with 5 standard choices of Aiken's value of V = 0.80 with an error rate of 5% [15]. The validity of the item can be established when the minimum threshold value reaches 0.80.

III. RESULTS AND DISCUSSION

A. Result

A review of the existing body of research, the outcomes of the Preliminary Research phase indicate the utilization of a four-tier diagnostic test established by [16]. The validation of the test questions yielded an average score of 82.8%, falling inside the very good category. Based on the inquiry, it was determined that the percentages of students who possessed a clear understanding, held misconceptions, and lacked understanding of the topic of traveling waves were 29%, 60%, and 11% respectively. In the context of stationary waves, it is observed that 30% of students possess an in-depth understanding of the concept, while 61% hold misconceptions, and the remaining 9% lack understanding altogether. Subsequently, an in-depth analysis shall be conducted on two scholarly publications pertaining to the merits and demerits of interactive multimedia, as authored by preceding academics.

During the developmental phase, interactive multimedia is designed using iSpring Suite, which incorporates prompting questions. This interactive multimedia has been prepared in accordance with the criteria for creating ICT-based teaching materials [17]. It consists of the following interactive multimedia components:

1) The cover serves as the initial page of interactive multimedia, prominently featuring the title and class information in a visually appealing manner.

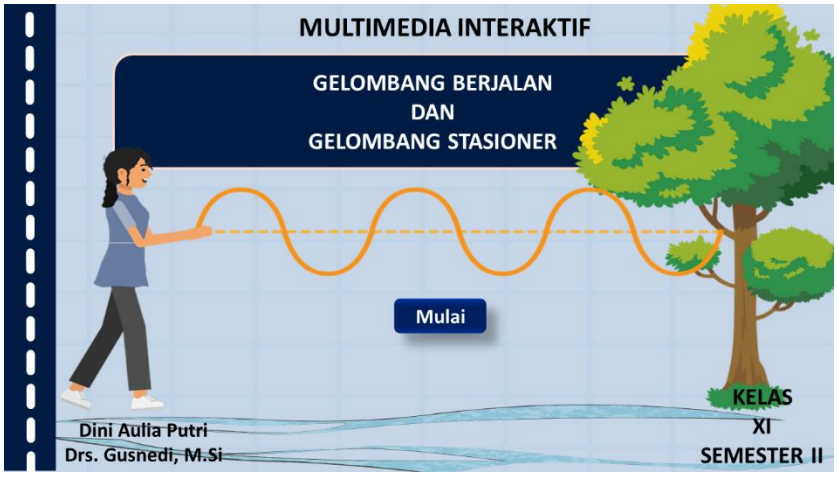


Fig 1. Interactive Multimedia Cover

2) Instructions for Use of interactive multimedia contains steps in using interactive multimedia equipped with sound to help use the interactive multimedia with the following display:

Fig 2. Interactive Multimedia User Manual

3) The concepts of core competencies, basic competencies, competency achievement indicators, and learning objectives are being discussed.

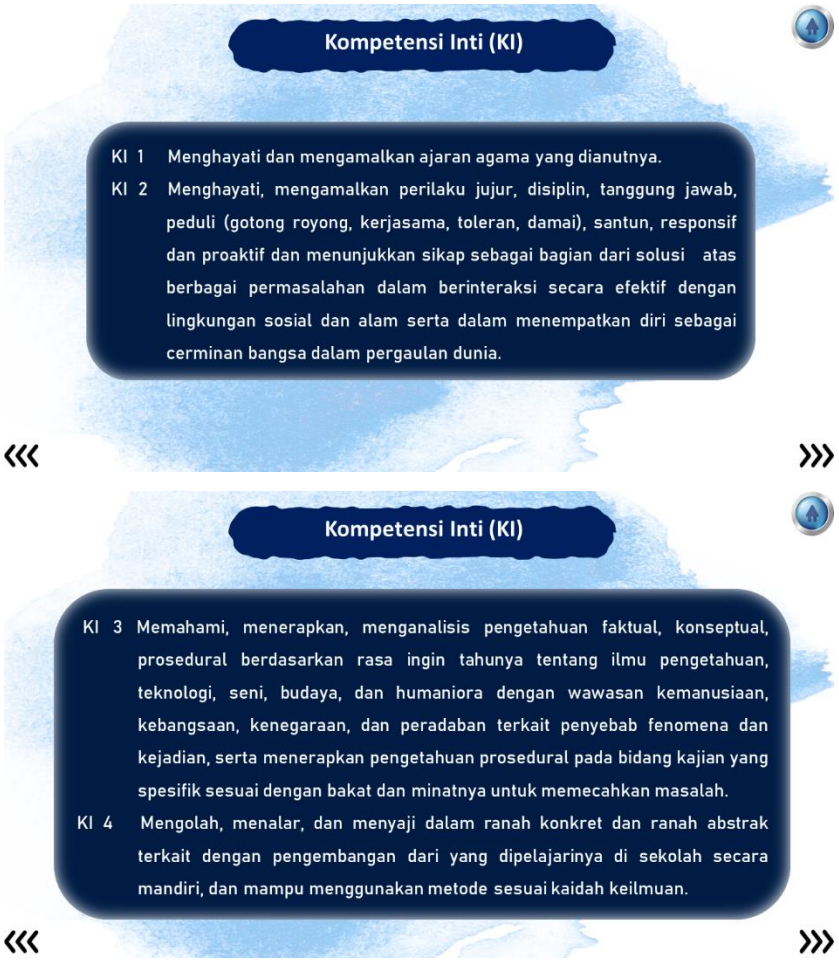


Fig 3. Core Competency

Fig 4. Basic Competencies

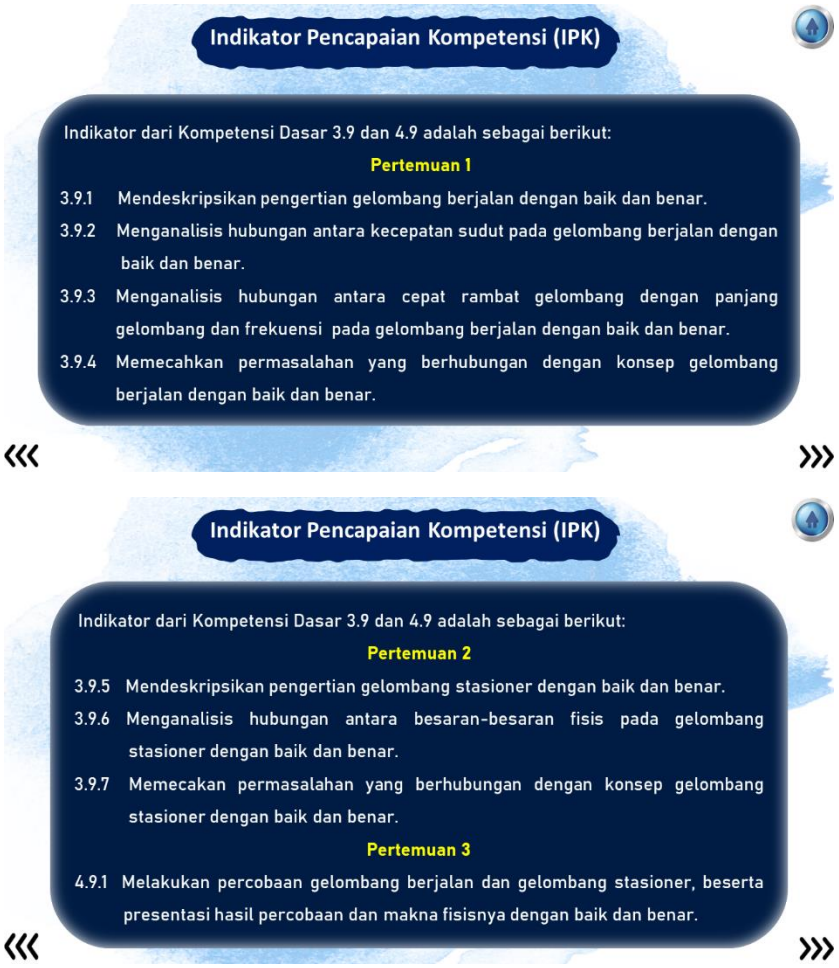
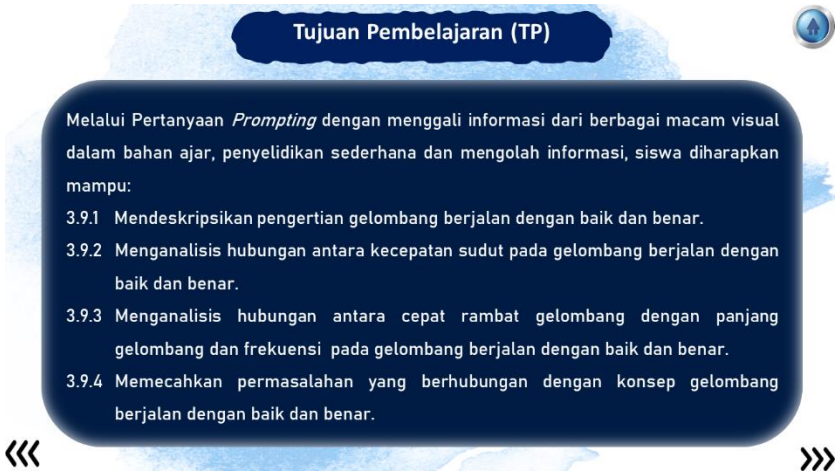


Fig 1. Competency Achievement Indicator



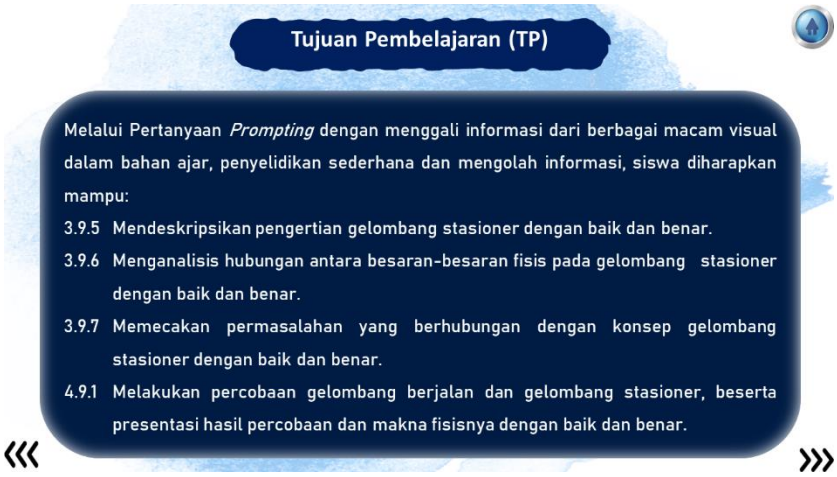


Fig 2. Learning Objectives

4) Supporting information is additional information that supports students' understanding of the subject matter, such as examples, illustrations, or graphs.

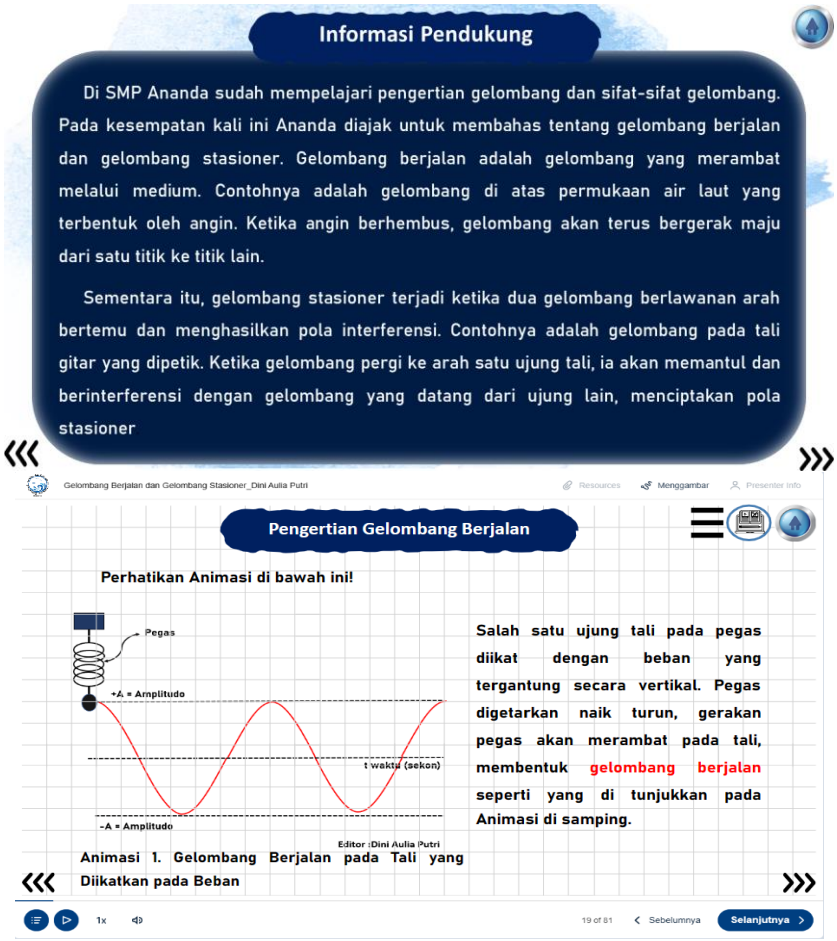


Fig 3. Example of Illustration on Interactive Multimedia

5) The exercises provided consist of interrogative prompts that students can utilize to assess their comprehension of the subject matter.

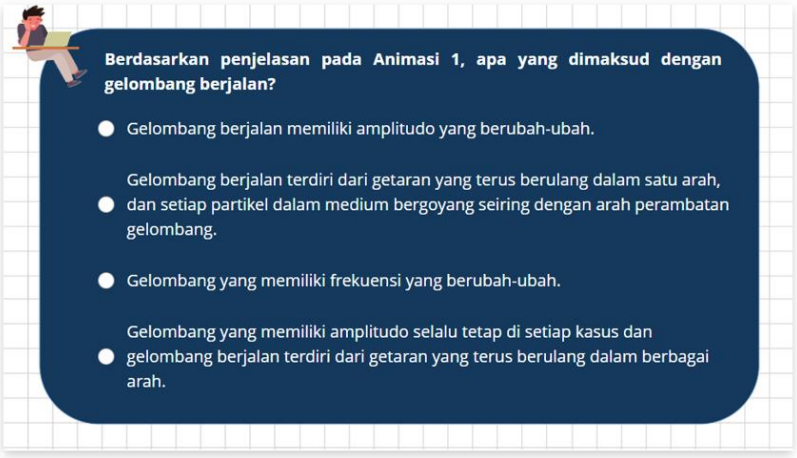


Fig 4. Practice Questions on Interactive Multimedia

6) The evaluation portion serves the purpose of assessing pupils' comprehension of the content that has been instructed.

Fig 5. Evaluation on Interactive Multimedia

7) Reference Sources is a list of sources used in the preparation of teaching materials.

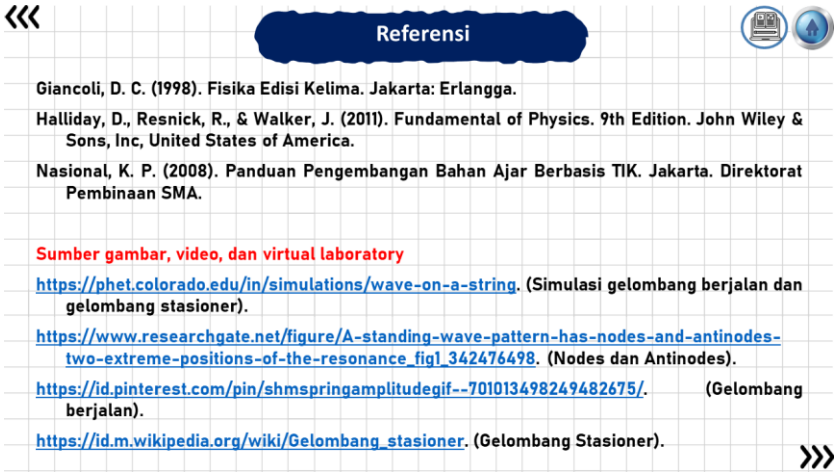


Fig 6. Reference

Self Evaluation

During the self-evaluating phase, research engage in the process of verifying and ensuring the integrity of the interactive multimedia materials. Subsequently, research proceed to rectify any early flaws that may have surfaced. Following this, the proceed to rectify any early flaws that may have surfaced. Following this, the materials are subjected to a comprehensive examination by a team of academics during the expert review stage. The self-evaluation indicators' respective results are depicted in Figure 11.

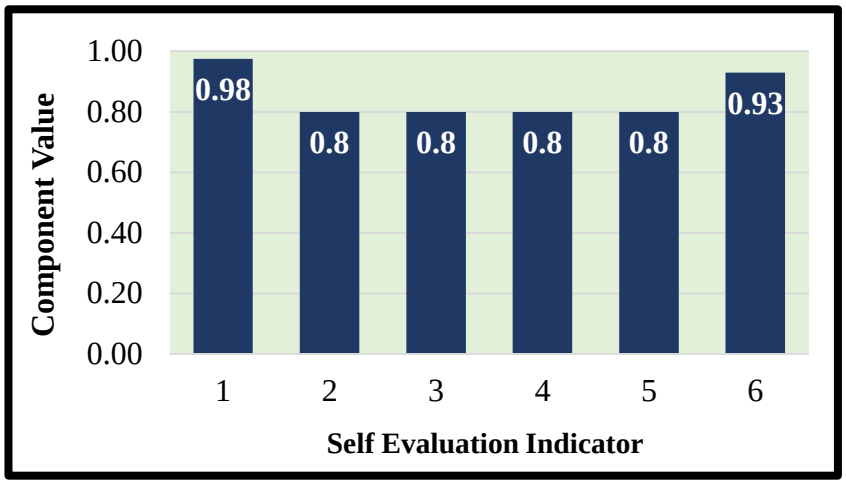


Fig 11. Graph of Self Evaluation Indicator

According to Figure 11, the self-evaluation indicator falls within the range of 0.80 to 0.98. The mean value of the six components of the self-evaluation indicator is 0.85 within the valid category.

Expert Review

During this phase, the validation of interactive multimedia is conducted by specialists through the utilization of validation assessment instruments that have been specifically designed for IT-based instructional materials. Subsequently, the validation process of the interactive multimedia is undertaken by an assessment team of five esteemed professionals who hold positions as Physics instructors at FMIPA UNP.

The developed assessment instrument is subsequently employed to validate the interactive multimedia created by researchers. The multimedia assessment instrument comprises four assessment indicators, namely: (1) material substance, (2) learning design, (3) visual communication display, and (4) software utilization [18].

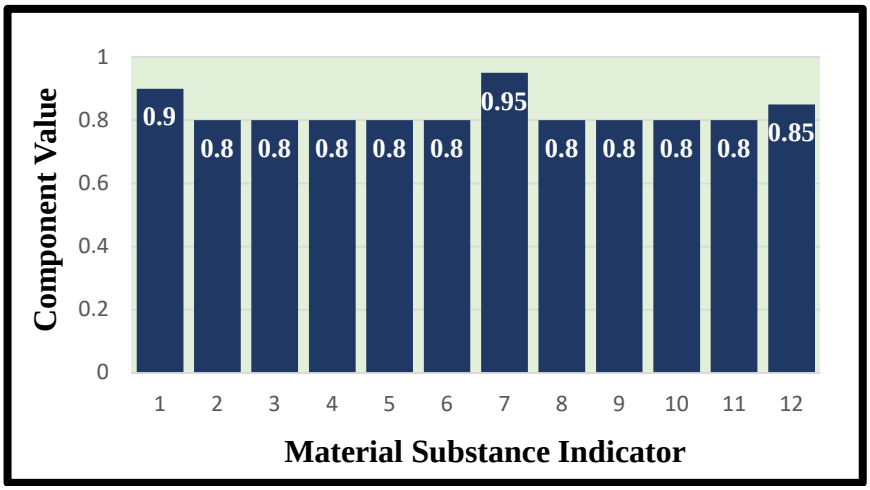


Fig 12. Graph of Material Substance Indicator

According to Figure 12, the material substance component comprises 12 indicators with values ranging from 0.8 to 0.95. The mean value of the twelve constituents of the material substance indication is 0.83 within the valid category.

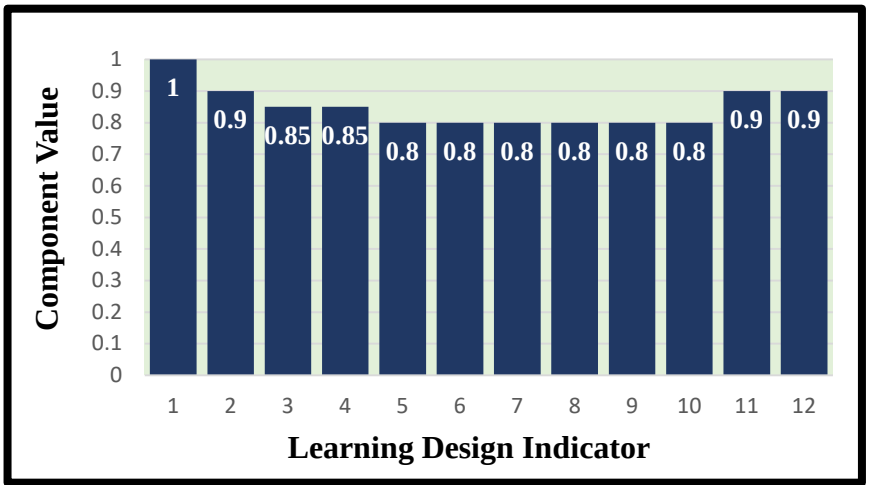


Fig 11. Graph of Learning Design Validation Results

In Figure 13, the learning design component has twelve indicators, each falling within the range of 0.80 to 1. The mean value of the twelve components of material indicators is 0.85, indicating statistical validity.

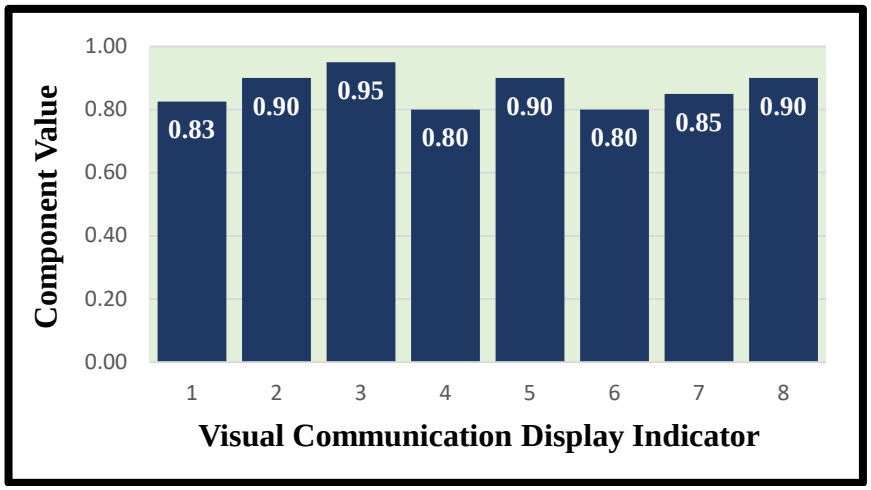


Fig 12. Graph of Visual Communication Display Validation Results

By the data presented in Figure 14, the visual communication display component has eight indications, each of which falls within the range of 0.8 to 0.95 out of a total of eight indicators. The mean value of the eight material indicator components is 0.87 within a qualifying category.

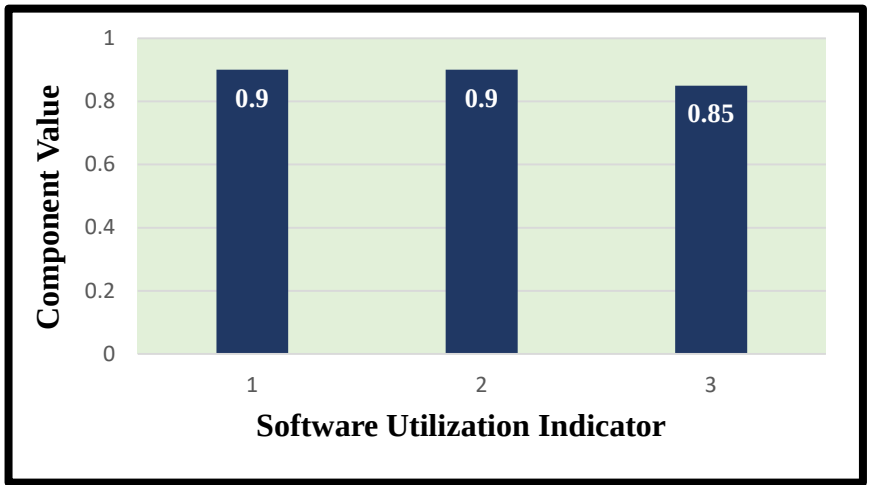


Fig 13. Graph of Software Utilization Validation Results

As seen in Figure 15, it is evident that the indicator value for software usage falls within the range of 0.85 to 0.90 across three indications. The mean value of the eight components comprising the material indication is 0.88 within the valid category.

In order to study the evaluation of the four aforementioned components, the average validity value of each interactive multimedia component is shown in Figure 16.

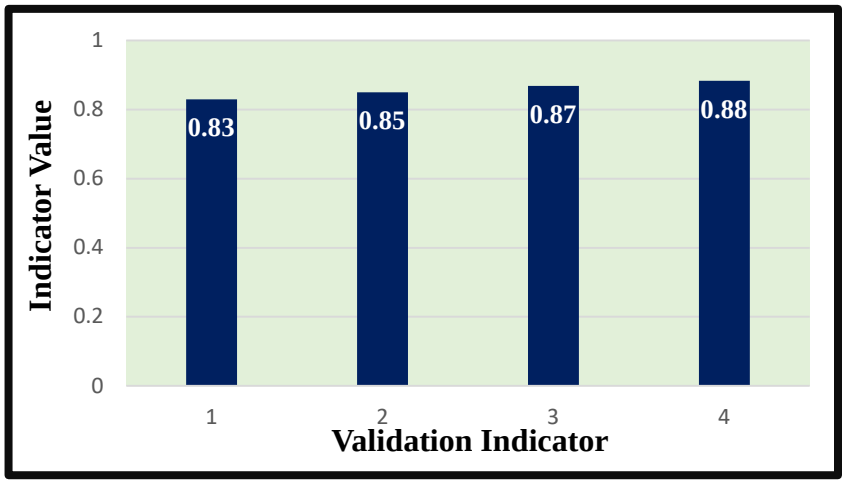


Fig 16. Graph of Interactive Multimedia Validation Indicators

As can be seen from Figure 16, it is evident that the validity test yields average values for each component. Specifically, the content of the material component has a value of 0.83, the learning design component has a value of 0.85, the visual communication display component has a value of 0.87, and the software usage component has a value of 0.88. Based on the aforementioned number, it can be said that the validity component exhibits a valid classification, while the practicality indication shows an average value of 0.85.

B. Discussion

The findings from an initial investigation employing a four-tier diagnostic assessment indicate that students possess a restricted comprehension of the topic of moving waves and stationary waves, accompanied by the presence of misconceptions. This underscores the necessity of implementing a more adept and effective teaching methodology in order to facilitate students' concept understanding ability. The insufficient comprehension of concepts among students may arise from a lack of interest on the part of students and ineffective instructional approaches that do not combine stimulating and interactive learning resources [5]. One potential approach to address this issue is the creation of learning materials in the form of interactive multimedia, utilizing iSpring suite technology. The materials would incorporate prompting questions that are interwoven within the content, specifically focusing on the concepts of traveling waves and stationary waves.

Within the context of the interactive multimedia design and Prototype Phase, it is observed that there exist two distinct stages, specifically referred to as self-evaluation and expert review. The self-evaluation findings indicate that the interactive multimedia, developed using the iSpring suite, falls under the valid category. This categorization is based on the assessment of the completeness of the ICT-based teaching material components, including the presence of a display and the use of valid language. Moreover, the outcomes of the expert review stage fall inside the legitimate category. The process of product validation is conducted by professionals. Interactive multimedia products encompass four key indicators, which include: 1) material substance indicators, 2) learning design, 3) display and navigation, and 4) software utilization.

One primary determinant is the content of the material. The validation of the substance of the material involves the identification of a valid category. The findings suggest that the content present in interactive multimedia aligns with the established criteria for books. This aligns with other scholarly investigations that assert the necessity for the substance or

educational materials to be developed in adherence to predetermined criteria and to be effectively evaluated [19].

The second indicator is about an aspect of learning design. This section integrates interactive multimedia aspects with the inclusion of prompted questions in the form of a two-tier diagnostic test. The results of the evaluation of learning design indicators are classified as valid.

The validation results for the third indicator, specifically the assessment of visual communication, have been categorized as valid. The utilization of button navigation and instructions in interactive multimedia exhibits a high degree of effectiveness. The findings align with prior scholarly investigations that assert the significance of incorporating clear visualizations and user-friendly navigation in the development of interactive multimedia for optimal effectiveness [20].

The fourth indicator pertains to the utilization of software. The development of this interactive multimedia content is accessible in various formats, including HTML 5, exe, web, and can be transformed into an android application. The outcomes of this phase of validation fall within the valid classification.

The validation outcomes of the four indicators pertaining to interactive multimedia as a whole entity are categorized as valid, hence enabling their utilization as effective instructional resources that facilitate students' concept understanding ability.

IV. CONCLUSION

The development of interactive multimedia using iSpring Suite and integrated prompting questions aims to facilitate students' concept understanding skills. This approach is in accordance with the structure of IT-based teaching materials [17]. This structure includes various components such as title, instructions for use, core competencies, basic competencies, indicators of competency achievement, learning objectives, supporting information, exercises, evaluation, and reference sources. The prompting question employs a two-tier diagnostic test in order to facilitate students' concept understanding ability. The validation results of this product showed a validity value of 0.85 with a valid category. This product shows validity quality related to material substance, instructional design, visual communication presentation, and software usage.

The authors propose conducting additional research to assess the practicality and usefulness of interactive multimedia that incorporates iSpring suite integrated prompting questions. This research would focus specifically on the topics of moving waves and stationary waves in the context of class XI SMA/MA.

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