Journal of Innovative Physics Teaching
Volume 2, Issue 1 June 2024, 23 - 36
ISSN: 3021-8551 (Online)
Doi: https://doi.org/10.24036/jipt/vol2-iss1/32
https://jipt.ppj.unp.ac.id/index.php/jipt

Development of Interactive Learning Media Using the Lectora Application to Enhance Student's Critical and Creative Thinking Skills

Deby Marlina*, Silvi Yulia Sari, Fanny Rahmatina Rahim
Physics Education, Universitas Negeri Padang, Padang, Indonesia.

Article Info

Article history:

Received December 29, 2023
Revised June 19, 2024
Accepted June 23, 2024

Keywords:

Interactive Learning Media
Critical thinking
Creative thinking
Newton Law of Gravity
ADDIE Model

ABSTRACT

The Development of Interactive Learning Media in the 2013 Curriculum is a government effort to ensure that students have 21st-century skills. The goal of the conducted research is to develop valid interactive learning media on the topic of Newton's Law of Gravity. A field study revealed that students' critical and creative thinking skills in Newton's Law of Gravity were still low. Therefore, the existing problem was addressed by producing a product in the form of integrated learning media that fostered critical and creative thinking skills for high school students. The research conducted followed the Research and Development (R&D) approach using the ADDIE model, which was reduced to the Implementation stage. Three Physics lecturers from the Faculty of Mathematics and Natural Sciences Education at State University of Padang (UNP) were involved in this research as validators, along with six Physics teachers from Padang City as practitioners. Validity test sheets were used as the data collection instrument in this research. During the data analysis phase, instrument validation and product validation were performed using the V Aiken Model Technique. The research results showed that the validated development instrument for the product category was valid. The average validity test score for the product was 0.79, which falls into the valid category. Therefore, it can be concluded that the interactive learning media developed in this study is considered valid.

***Correspondence:**
Deby Marlina, Physics Education, Universitas Negeri Padang, Padang, Indonesia.
email : debymarlina0300@gmail.com

INTRODUCTION

Education is the most important part that serves as a measure of a nation's progress. Therefore, in order to produce high-quality future leaders of the nation, the quality of education in a country is highly prioritized. The quality of education and human resources can be enhanced by utilizing technology effectively and appropriately. The presence of the fourth industrial revolution and advancements in science and technology (S&T) pose new

challenges in the field of education that cannot be avoided (Diyen et al., 2021). The utilization of technology allows learners to study anytime, anywhere, using various technology devices connected through the internet. The development of digital technology in education is not limited to e-books but also includes videos and animations. This technological advancement facilitates teachers in delivering subject matter, including physics. With the help of videos and animations, abstract concepts in physics can be presented more clearly and easily understood by students (Ningrum et al., 2023). Therefore, with the current technological advancements, various learning resources are available for students to access (Wannapiroon et al., 2021). The availability of various instructional materials and learning resources can create a relationship between students and teachers, aiming to achieve effective learning, which requires supportive learning media (Husnah, 2019).

Learning media holds a significant position in instructional planning. The process of instructional planning begins with formulating specific instructional objectives as a development of general instructional objectives. To achieve learning objectives, the use of appropriate learning tools that align with students' characteristics is necessary (Rahim et al., 2019). Interactive media combines various forms of text presented in both audio and visual formats, capable of conveying material in a general overview. One of the objectives of interactive media is to provide visually appealing and engaging examples of what evaluation processes are and how they are applied in realistic scenarios (Gardner et al., 2020). The rapid development of technology provides opportunities for educators to develop Interactive Learning Media (Septia et al., 2018). The advancement of media and information technology has had an impact on education, both in positive and negative aspects of its usage. This is because accessing media information and technology is easy and accessible to various groups, including teachers, students, and parents (Rosynanda et al., 2021). The presence of interactive learning media diversifies the learning experience, especially in physics education, which is closely related to everyday life. The media used should be able to stimulate students' curiosity throughout the learning process to prevent it from becoming monotonous. Therefore, interactive learning media that incorporates videos can make it easier for students to observe real-life physics phenomena.

Physics learning requires students to analyze the concepts of the learning material and solve given problems in the learning process. The main characteristics of higher-order thinking are critical thinking and creative thinking abilities (Accarya, 2016). Critical thinking is not a new concept in education. One of the indicators of successful learning is critical thinking. Critical thinking in education is a cognitive process that enables students to distinguish, analyze, and evaluate relevant information, allowing them to ask questions and tackle significant problems for independent thinking (Gunawan et al., 2017). Critical thinking skills are known as higher-order thinking skills that help individuals connect knowledge, information from various sources, and experiences to gain a broader perspective and deeper understanding (Jamilah, 2021). When students engage in critical thinking using scientific concepts, they develop critical thinking skills. However, there is no empirical evidence to support and develop these skills. Therefore, it is important for students to enhance their critical and creative thinking skills. Creative thinking arises from students' habits of generating new ideas based on logical considerations to participate in the teaching and learning process (Ekasari et al., 2016). Creative thinking always involves brilliant ideas, resulting in the ability to generate new ideas that can be utilized in a process (Trianggono & Yuanita, 2018). Every individual has creative potential and a unique set of creative habits. Good stimuli should be able to bring out creative thinking potential. Therefore, classroom learning activities require active student engagement to adequately develop their creative thinking (Riduwan, 2019).

The actual condition in the field indicates that students' critical and creative thinking skills are still relatively low. One of the factors is based on the national examination scores for high school students in 2019, which showed that the critical and creative thinking skills of students in Padang City were generally low and even experienced a decline each year. However, according to the demands of the current curriculum, specifically the revised 2013 curriculum, students should possess higher-order thinking skills. Critical and creative thinking abilities are among the indicators associated with higher-order thinking skills. Physics teachers who were interviewed revealed that students' critical and creative thinking skills were relatively low. This was evident when students were faced with Higher-Order Thinking Skills (HOTS)-based questions, where many students expressed difficulties when attempting to solve those problems. One contributing factor is the below-average thinking abilities of students and their lack of understanding of the topics explained by teachers during the learning process. Based on observations of physics learning materials, it was noticed that students considered kinematics to be a difficult topic. The students' difficulties in understanding critical and creative thinking skills in the context of kinematics may be due to the teaching methods employed by teachers, which primarily rely on verbal explanations (in the form of review methods). This observation suggests that, in general, kinematics is only explained verbally, leading to students struggling to comprehend the material. Additionally, data obtained from questionnaires revealed that 83% of students preferred learning materials with the assistance of visual media. This observation indicated that the largest percentage was related to the learning style aspect. It implies that learning requires the availability of appropriate audiovisual learning materials or media to match students' preferred learning style.

In addition, observations of students' learning styles found that 95% of students preferred engaging learning media, and 83% of students stated that interactive media was highly needed in the learning proces, so that is audiovisual learning style can be supported by the presence of interactive learning media that provides interaction between the media and its users. Furthermore, observations regarding the use of learning media in schools in Padang City found that the media used were still non-interactive. The majority of learning media used were PowerPoint presentations. These PowerPoint presentations were mostly created directly by teachers, while some were obtained from the internet or utilized internet platforms such as YouTube. An analysis of the learning media created by teachers generally contained written information related to the presented material, and some included images and videos taken from the internet. The instructional design used was visually appealing, but the level of interactivity in the learning media was still lacking. Therefore, the PowerPoint-based media used only allowed students to observe the presented material without generating interaction between the user and the media used.

In addition, the animations provided in the media were not suitable for the demands of the presented material. The animations in the media mainly supported the features of the media itself, rather than enhancing students' understanding. Most teachers were not familiar with the various features available in learning media, which hindered the learning process. Furthermore, the formulas presented were in their final form, without any discovery of concepts related to the presented material. This limited students to merely accepting what was presented in the media without the ability to discover concepts related to the material. The questions displayed in the PowerPoint media did not reflect indicators of critical and creative thinking skills. The material and questions presented were mainly of low-level thinking and medium-level thinking, so when students attempted to solve the questions, there was no thinking challenge to find solutions. Based on the actual situation, the solution to these problems is to develop learning media that can enhance students' thinking abilities. Therefore, as students tend to understand the material better through the use of audio,

video, animation, and images, they will be more interested in and able to comprehend physics topics through interactive media in the learning process.

Many previous studies have been conducted on the use of interactive learning media. Research conducted by (Mardianti et al., 2023) showed that more than 70% of students were interested in the development of interactive media for learning physics and gaining a deeper understanding of Kirchhoff's Law through Google Sites. The study by (Diyen et al., 2021) demonstrated that the validation results from expert teams regarding interactive learning media with social networking content obtained an average score of 4.96. The average score was categorized as excellent. Khodizah et al. (2019) conducted a study showing that the game Ludo could be used as a practical and easy-to-use learning media to teach circular motion with a score of 82.67% (categorized as very interesting). Furthermore, Irwanto et al. (2022) conducted a study showing that the feasibility of learning media based on Macromedia Flash 8 was highly suitable for use as a learning media in simulation and digital communication subjects in vocational schools, with a score of 3.89 (categorized as highly suitable).

Finally, Dewi et al., (2022) conducted a study on cartoon art learning media, which showed an average validation score of 90% (categorized as highly valid). Previous studies developed interactive learning media using cartoon art and Powtoon. This current study differs from previous research, as the media developed in this study is in the form of interactive learning media using an application. The application used in developing this interactive media is Lectora Inspire. Lectora Inspire has a more advanced interface than Microsoft Office, which has been widely used. Based on this, Lectora can be utilized to assist in developing digital content for teaching materials and tests in the form of dynamic learning media (Firman et al., 2021). The research is conducted to develop a valid product, following the ADDIE steps. In the analysis phase, instructional materials in the form of interactive media are developed for learning objectives, enabling the definition of a problem to be further addressed.

METHODS

The research conducted is categorized as development research. The research method used is research and development (R&D). Research and development examine theories, concepts, or models to create new products or develop existing ones. This research and development process is conducted in accordance with scientific principles, where each stage of the research must be carefully employed. Research and development can be conducted in various fields, including education.

The model used in this research is one of the development models proposed by ADDIE. The ADDIE model is used to illustrate a systematic approach to instructional development. The researcher chose the ADDIE research model because the product being developed is learning media, not software engineering, making the ADDIE method suitable for the product development process (Purnamasari, 2019). This research development model uses the ADDIE model, which stands for Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was developed by Dick and Carey (1996) for designing learning systems. The resulting product from research and development must undergo feasibility testing before its finalization.

The research is conducted to develop a valid product, following the ADDIE steps, which include analysis, design, development, and implementation stages as follows: 1) Analysis, in the analysis phase, the development of instructional materials in the form of interactive media is conducted to define a problem for further investigation, 2) Design, in the design phase, the framework of the interactive learning media to be developed is designed,

creating a blueprint to address the problems identified in the analysis phase, 3) Development, This stage is also known as the product realization stage. In this stage, the development of interactive learning media is carried out according to the established design, 4) Implementation, This stage aims to implement the design of instructional materials in the form of interactive learning media that have been developed in a real classroom situation.

The validation instrument used is in the form of a) questionnaire, aquestionnaire is a tool used to collect and record data or information by providing a set of questions to respondents, such as students and teachers, to elicit responses based on user requirements, b) Interview, Interviews are conducted to gather responses, comments, and suggestions from teachers and students, c) Observation, observations are carried out to understand the responses of teachers and students during the use of interactive learning media in the learning process. Data is collected by observing the types of learning media used in schools, which are then analyzed to draw conclusions about the issues.

Then, the categories of needs analysis are obtained by calculating the scores obtained from each positive and negative respondent. The score for each indicator is obtained using the following equation:

$$P = \frac{\sum x}{\sum xi} x100\% = \cdots$$

(Arikunto, 2010)

Explanation:

P = Percentage

x = score obtained for each indicator

xi = number of respondents

Here are presented the analyses of each need analysis conducted according to Table1.

Tabel 1. Needs Analysis Category

Percentage (%)	Category
0 – 20	Very Low
21 – 40	Low
41 – 60	Moderate
61 – 80	High
81 – 100	Very High

(Riduwan, 2019)

Based on the category of needs analysis in the table, the analysis results can be classified into the categories of very low, low, moderate, high, and very high. Therefore, specific problems can be identified clearly through the calculation of needs analysis results using the questionnaire and can be described using these categories.

Next, the validity assessment questionnaire was constructed based on a Likert scale, as shown in Table 2.

Table 2. Likert Scale

Score	**Category**	**Achievement Percentage (%)**
1	Strongly disagree	0%-20%
2	Disagree	21%-40%
3	Neutral	41%-60%
4	Agree	61%-80%
5	Strongly agree	81%-100%

(Modification Riduwan, 2019)

The data obtained is analyzed using the validity index proposed by Aiken. The data from the validity test is analyzed using the Aiken's V item validity index, which is formulated as follows:

$$V = \frac{\sum s}{n(c-1)}$$
$$s = r - l_0$$

Explanation:

V = Agreement index of raters
l_0 = Lowest validity rating score (in this case = 1)
c = Highest validity rating score (in this case = 5)
r = Rating given by an evaluator.
n = Total number of raters

After obtaining the agreement index of raters, the decision categories are determined based on Aiken's V index as shown in Table 3.

Table 3. Decision Based on Aiken's V Index

Interval	Category
≤ 0,4	LessValid
0,4 < V ≤ 0,8	Valid
0,8 < V	Highly Valid

(Retnawati, 2016)

The last practicality of interactive learning media is obtained from the feedback sheets of high school physics teachers. The weighting is based on the Likert Scale with the following criteria: (4) very good, (3) good, (2) fair, and (1) poor.

The calculation of the final score is expressed as a percentage using the following formula:

$$\textbf{Practicality Score} = \frac{\textbf{Archieved Score}}{\textbf{Maximum Score}} \textbf{ X 100\%}$$

The practicality of the instructional media is determined by the final scores obtained, which can be seen in Table 4.

Table 4. Learning Media Practicality Categories

Interval	Category
0-20	Very Impractical
21-40	Impractical
41-60	Less Impractical
61-80	Impractical
81-100	Very Practical

(Retnawati, 2016)

RESULTS AND DISCUSSION

Results

The research conducted through several stages of the ADDIE model. The results obtained from the research for each stage are as follows.

Analysis Stage

In this stage, the results of the assessment of schools regarding the existing learning media in Padang City are still low in various aspects, one of which is the lack of interactivity in the current learning media. These results were obtained through questionnaires, observations, and supported by the arguments of teachers during interviews. The analysis of the material revealed that students have less interest in understanding the subject because of its complex and abstract formulas. As a result, students face difficulties in learning the subject, especially with the lack of interactive learning media.

Design Stage

In the design stage, a storyboard for the interactive learning media was created to address the identified issues from the analysis stage. The design can be seen in Figure 1.

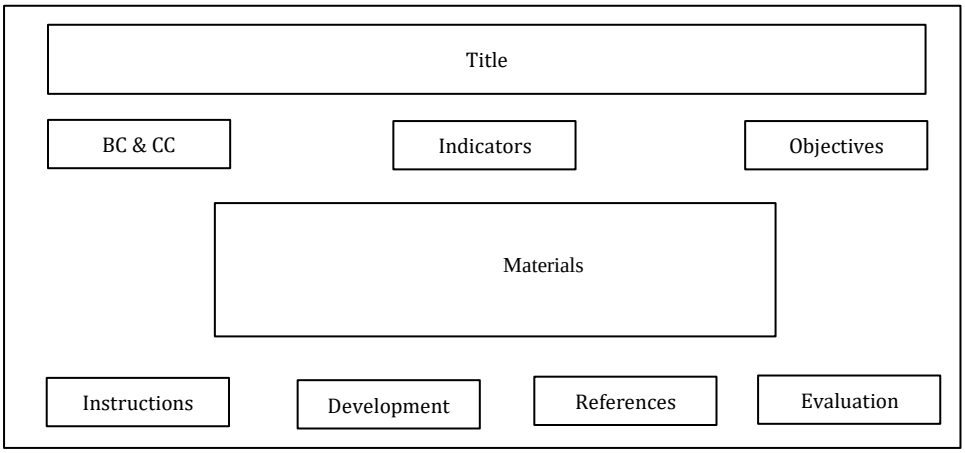

Figure 1. Design of Interactive Media for Newton's Law of Gravity

Development Phase

In the validity phase, the product was tested for validity using a product validity instrument. The instrument used had been previously validated and categorized as valid. First, the indicators of material substance consist of 3 indicators, namely accuracy, currency, and readability. The validity assessment results for the indicators of material substance can be seen in Figure 2.

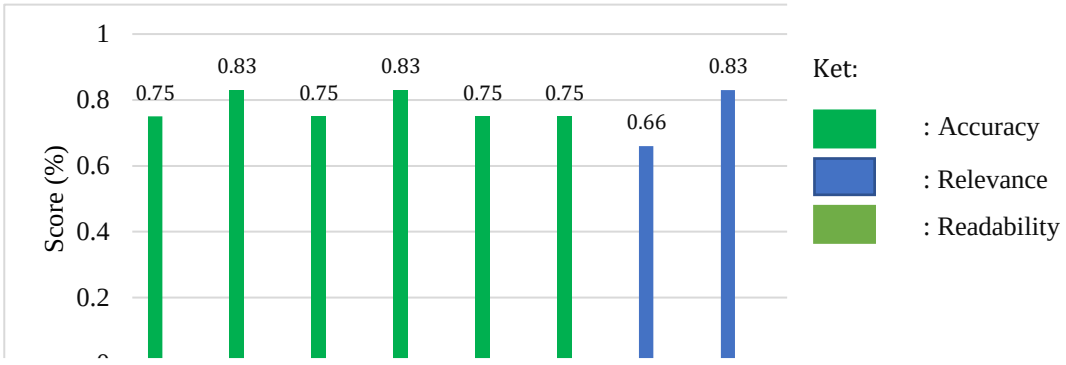

Figure 2 Validity Results for Material Substance

Based on the illustration in Figure 2, it can be observed that the validation scores for the indicators of material substance range from 0.66 to 0.92. Out of the 11 assessments conducted, there are 5 assessments that are considered highly valid, with scores ranging from 0.83 to 0.92, and 6 assessments that are considered valid, with scores ranging from 0.66 to 0.75. The average validation score for the indicators of material substance is 0.78.

Therefore, it can be concluded that the validation score for the indicators of material substance is considered valid.

For the evaluation of the validity of the second indicator, which is the audio and visual communication display component consisting of 4 indicators, the results of the validity assessment can be seen in Figure 3.

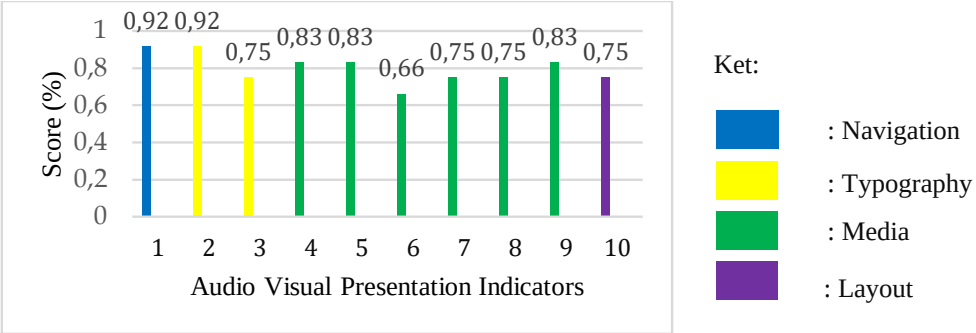

Figure 3. Results of Audio-Visual Display Validity

Figure 3 shows that the validation scores for the audio-visual communication indicator range from 0.66 to 0.92. Out of the 10 assessments conducted, 5 indicators are classified as highly valid, with scores ranging from 0.83 to 0.92, and 5 indicators are considered valid, with scores ranging from 0.66 to 0.75. The average validation score for the audio-visual communication indicator is 0.84. Therefore, it can be concluded that the validation of the audio-visual communication indicator is highly valid.

The validation assessment for the third indicator, which is the instructional design component, consists of 7 indicators. The results of the validation assessment for the instructional design indicator can be seen in Figure 4.

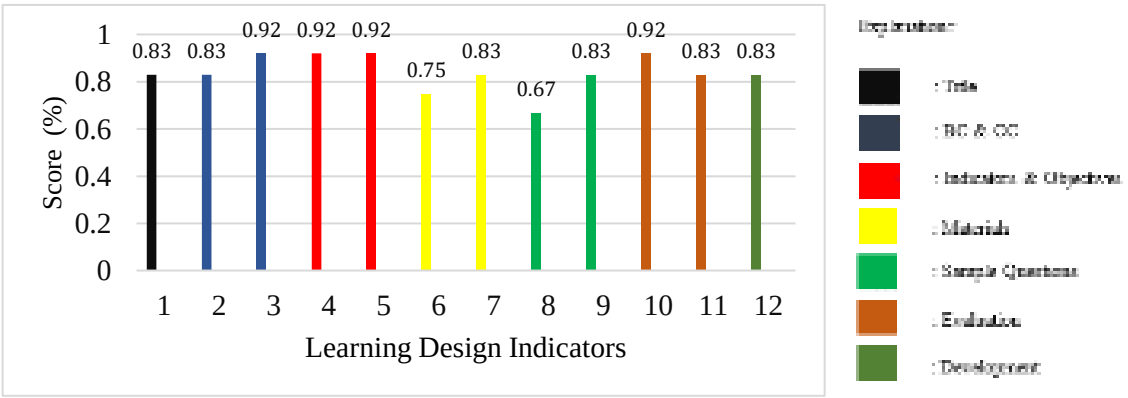

Figure 4. Validity Results of Instructional Design

From the illustration in Figure 4, it can be observed that the validity scores for the instructional design component range from 0.67 to 0.92. Out of the 7 assessment indicators, there are 10 indicators that are considered highly valid, with scores ranging from 0.83 to 0.92, and 2 indicators that are considered valid, with scores ranging from 0.67 to 0.75. The average validity score for the instructional design component is 0.84. Therefore, the validity of the instructional design component is considered highly valid.

The validity assessment for the fourth indicator, the software utilization component, consists of 3 indicators. The validity assessment results for the software utilization component can be seen in Figure 5.

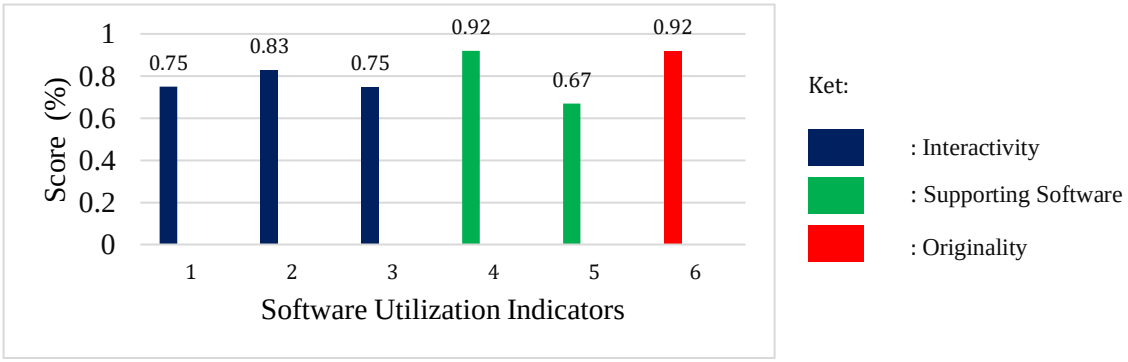

Figure 5. Validity Results for Software Utilization Indicator

Based on Figure 5, it can be observed that the validity scores for the software utilization component range from 0.67 to 0.92. Out of the 6 assessment indicators, there are three indicators that are considered highly valid, with scores ranging from 0.83 to 0.92, and three indicators that are considered valid, with scores ranging from 0.67 to 0.75. The average validity score for the software utilization component is 0.81, indicating a highly valid category.

The validity assessment for the fifth indicator, the critical thinking skills component, consists of 3 indicators. The validity assessment results for the critical thinking skills component can be seen in Figure 6.

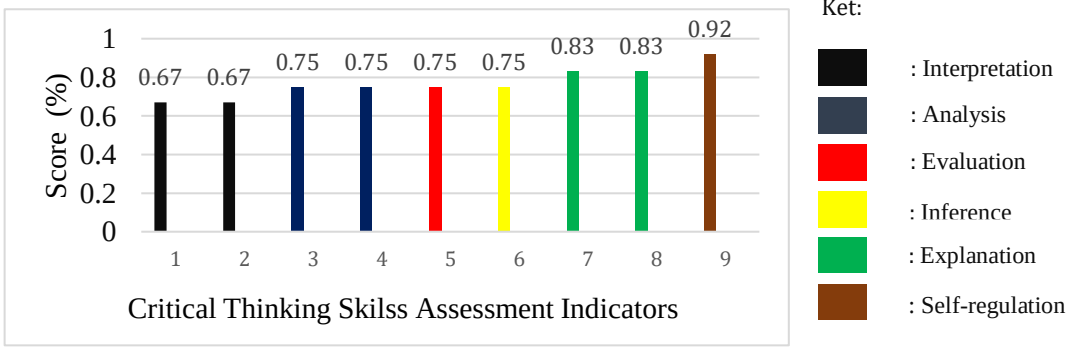

Figure 6. Validation Results for Critical Thinking Assessment Indicators

Based on Figure 6, it can be observed that the validation scores for the critical thinking skill component range from 0.67 to 0.92. Out of the 9 assessment items, 3 items are classified as highly valid, with scores ranging from 0.83 to 0.92, and 6 items are classified as valid, with scores ranging from 0.67 to 0.75. The average validation score for the critical thinking skill component is 0.67, indicating a moderate level of validity.

Assessment of the validity of the sixth indicator, namely the creative thinking skill component consisting of 4 indicators, can be seen in Figure 7.

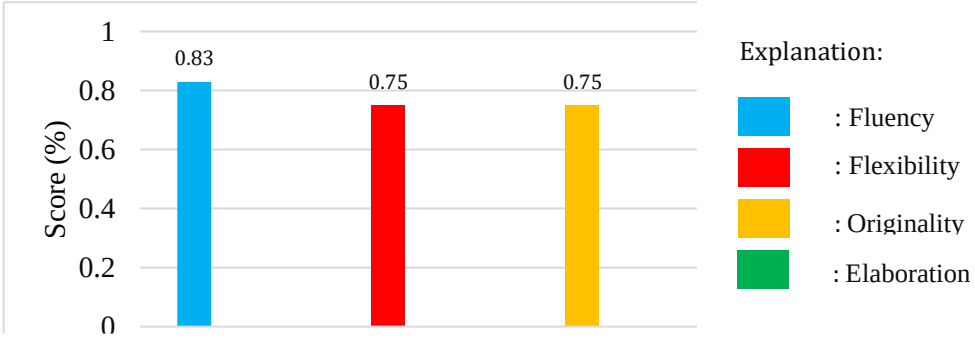

Figure 7. Validation Results for Creative Thinking Skill Assessment Indicators

Based on Figure 7, it can be observed that the validation scores for the creative thinking skill component range from 0.75 to 0.83. Out of the 4 assessment indicators, one indicator falls under the highly valid category with a score of 0.83, while the remaining three indicators fall under the valid category with a consistent validation score of 0.75. The average validation score for the creative thinking skill component is 0.77, indicating that this component is considered valid. The validation results for all assessment indicators are summarized in Table 5.

Table 5. Overall Validation Scores of Interactive Learning Media

Assesment Aspect	**Validation Score (%)**	**Criteria**
Substance Material	0,78	Valid
Audio-Visual Communication Design	0,79	Valid
Instructional Design	0,84	Highly Valid
Software Utilization	0,81	Highly Valid
Critical Thinking Skill Assesment	0,77	Valid
Creative Thinking Skill Assesment	0,77	Valid
Total	4,76	Valid
Average	0,79	

Implementation Phase

In this implementation phase, a practicality test is conducted on the interactive learning media to be used. The practicality test involves teachers' questionnaire responses as an assessment. The practicality test is carried out in schools representing the high, medium, and low categories based on the average scores of the Physics National Exam in 2019. This phase is limited to the practicality test involving teachers only. The objective of the practicality test is to determine the level of practicality of the developed interactive learning media. In assessing the practicality of this learning media, physics teachers from three schools are involved. The selected schools for the practicality test represent the high, medium, and low school categories. Based on these categories, the high school category is represented by SMAN 2 Padang, the medium school category is represented by SMAN 8 Padang, and the low school category is represented by SMAN 12 Padang. The results of the practicality test will serve as a guide for improving the developed learning media.

The instrument for the practicality test consists of three aspects of assessment. These aspects include: 1) Ease of understanding, 2) Attractiveness, 3) Efficiency. A summary of the results of the practicality questionnaire on the teacher's responses in the high school category, specifically SMAN 2 Padang, is presented in Table 6

Table 6. Analysis of the Practicality Questionnaire in All School Categories

Practicality Aspect	**Average(%)**	**Category**
Easy to Understand	86.64	Very Pratical
Engaging	92.45	Very Pratical
Efficient	87.75	Very Pratical
Total	266.81	Very Pratical
Average	88.94	

The teachers' assessment of the interactive learning media is categorized as highly practical, with a score of 88.94%. Based on the collected data, the highest aspect of

practicality is the attractiveness. This is due to the interactive learning media being able to attract students' interest in learning. Respondents stated that this interactive learning media makes it easier for teachers to explain the concepts of physics in the Newton's Law of Gravity topic and is also practical to use.

Discussion

The use of interactive learning media is one of the methods that teachers can employ to enhance students' learning achievements. The use of interactive learning media is expected to assist students in understanding and accepting the learning process facilitated by teachers. Interactive learning media can represent what the teacher may have been unable to convey, making the learning process more effective and efficient (Mudinillah, 2019). Physics education is closely related to everyday events. In physics education, it is important to emphasize providing direct experiences about the surrounding environment to develop students' competencies (Hussein et al., 2018). This research involves product description, validation by experts, and testing the practicality of interactive learning media. The analysis stage is carried out through three methods: needs analysis, curriculum analysis, and student analysis. Data for needs analysis are obtained through observations, interviews, and questionnaires filled out by X-grade students. Based on these activities, it is concluded that the problem with learning media in schools is the lack of interactivity and interest. Well-designed and engaging interactive learning media are expected to have a positive impact on educational quality improvement and students' learning potential. Furthermore, the student analysis results in the conclusion that students find it easier to understand materials, especially abstract ones, when they are presented interactively and in an easily comprehensible manner. This view aligns with (Yanto, 2019), statement that interactive learning media serve as a mediator in the delivery of materials between teachers and students, enabling interaction and mutual reactions between them, thus assisting in explaining abstract learning materials through interactive and mutually influential interactions.

The product design stage follows the guidelines for developing ICT-based teaching materials provided by the Ministry of Education and Culture (Kemendiknas, 2010). According to (Kemendiknas, 2010) effective and efficient learning media should consider the components of material substance, audio and visual communication, instructional design, software utilization, as well as critical and creative thinking skills. The product development stage is carried out based on the designed framework, taking into account each component of the product development. After going through the revision stage based on the suggestions and feedback from the validators, the validation process is conducted. According to (Arikunto, 2021), a product is considered valid if it can measure what it is supposed to measure. In this validation stage, the assessed components include material substance, audiovisual communication, instructional design, software utilization, as well as the assessment of critical and creative thinking skills.

In this implementation stage, a practicality test of the product is conducted. The research focuses on three schools in the city of Padang, selected using the proportional stratified random sampling technique to represent schools in the high, medium, and low categories based on the results of the national examination in 2019. The selected schools are SMAN 2 Padang, SMAN 8 Padang, and SMAN 12 Padang. These schools already use media in their teaching, but the media used is not interactive and not optimal in supporting the learning process. The practicality test of the students is analyzed based on the practicality assessment sheet for the interactive learning media that was developed. The practicality assessment instrument consists of three indicators: 1) ease of understanding, 2)

attractiveness, and 3) efficiency. The practicality of a product can be categorized according to (Riduwan, 2019). In addition to the ease of understanding the material, interactive learning media should also have an attractive color composition, not be boring, and not confuse users when using the learning media. According to Rochmad (2012), in product development research, a product is considered practical if experts and practitioners theoretically state that the product can be applied in the field, and the level of product implementation is categorized as good. Based on the conducted practicality test results, it was found that the developed product was highly practical according to the feedback from six teachers representing the high, medium, and low school categories.

Based on the conducted research, there were several challenges encountered in each stage of the ADDIE research, including the following. In the analysis stage, the challenge was faced during the distribution of questionnaires to students. The distribution of questionnaires was conducted online through Google Forms, as the learning implementation at schools was conducted online due to the COVID-19 pandemic. Therefore, the completion of the questionnaires could not be directly supervised by the researcher. However, the data obtained could be strengthened by conducting interviews with physics teachers and observing the types of learning media used. Moving on to the design stage, the challenge was faced in the multiple revisions suggested by the supervisor during the product design. These revisions included components that should be included in the product and adjustments according to the application used for product development. Then, in the product development stage, there were challenges related to the validation aspects that were not fully met as expected. Continuous improvements were made to the interactive learning media based on the feedback and suggestions provided by the validator, making the media practical to use. However, this research has limitations as it only reached the implementation stage with the practicality test conducted by teachers. Therefore, in the future, other researchers can continue the research to the evaluation stage.

CONCLUSION

The results of this research have produced an Interactive Learning Media aimed at improving critical and creative thinking skills in the topic of Newton's law of gravity. The characteristics of this interactive learning media include the title, competency standards and basic competencies, competency achievement indicators, content, evaluation questions, and author's biodata. The validation results of the interactive learning media indicate that this product has a moderate level of validity. The validated components of this product include the content, audiovisual communication display, instructional design, software utilization, assessment of critical thinking skills, and assessment of creative thinking skills. This research provides a foundation for further investigation by other researchers on the influence of interactive learning media on critical and creative thinking skills.

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