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Development of Interactive Learning Media Using Lectora Inspire Oriented towards Critical and Creative Thinking Skills on Simple Harmonic Motion

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Abstract

This study uses the Lectora Inspire application to develop interactive learning media oriented towards critical and creative thinking skills on valid simple harmonic motion topics. Research and Development (R&D) was employed in this study. The ADDIE model was used (analyze, design, development, implementation, evaluation). The instruments used in this study consisted of needs analysis instruments, student characteristics instruments, and validity instruments. The data analysis techniques used were needs analysis and validity analysis. Based on the study, the product validity value averages 0.83 for the very valid category. This demonstrates that the developed interactive learning media meets users' requirements (teachers and students).

Keywords: Creative Thinking Skills; Critical Thinking Skills; Interactive Learning Media; Simple Harmonic Motion

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INTRODUCTION

The progress metric of a nation can be determined by the degree to which the advancement of education during the 4.0 revolution advances science and technology (Rahim, 2021). Technology can be beneficial in supporting education (Williamson et al., 2020; Zubaidah, 2018). In the 4.0 industrial revolution, advances in science and technology represent a new challenge for education (Qureshi et al., 2021). Utilizing technology and exceptional advances can enhance the quality of education. The prosperity of a society is contingent upon its ability to maintain a relevant education. Technology makes the teaching and learning more manageable (Tyas & Naibaho, 2021). This is what causes social change to become a subject of study in order to prepare students for the challenges of the 21st century (Rahim et al., 2019; Waryono, 2019)

The solution that the government can implement is to modernize the curriculum. The current curriculum is the 2013 curriculum. The purpose of curriculum development is to enhance the quality of education (López-Entrambasaguas et al., 2020) by devising a new curriculum that requires students to

be more engaged in the learning process (Yusliani et al., 2019)

The 2013 curriculum emphasizes 21st-century skills. In the 2013 curriculum, students are expected to possess 4C skills (Communication, Collaboration, Critical Thinking, and Creativity) (Rahim et al., 2020, 2022), Science Literacy, Strengthening Character Education, and Higher Order Thinking Skills (HOTS) (Rozi & Hanum, 2019). The 2013 curriculum acknowledges that science cannot be transferred from teacher to student. Students can actively seek, process, construct, and apply knowledge. In the learning process, students must be able to construct knowledge (Usmeldi et al., 2017).

Effective learning occurs when students and teachers interact and use various teaching and learning materials and resources, such as learning media. Teaching materials are the most important factor in achieving learning objectives, where learning materials must be relevant to learning objectives, student characteristics, and the use of learning materials provided by teachers to students to attain specific competencies and skills (Husnah et al., 2019). Implementing student-centered learning is the strategy for learning that teachers can employ. Student-centered learning can foster creativity, innovation, and critical thinking in students. Students can make connections between learning and contextual problems in their daily lives. (Zubaidah, 2016).

Learning physics enables students to analyze the concepts of learning materials and solve problems presented during the learning process. There are two kinds of thinking skills: basic thinking skills, which are building understanding about common things, and high-order thinking skills. With high-order thinking skills, students must solve problems and make decisions (Mahmuzah, 2015). Sutrio et al. (2018) stated that the primary characteristics of high-order thinking are critical thinking and creative thinking.

Critical thinking skills are not a novelty in education. Students' critical thinking skills are one of the indicators that can be used to measure their success in learning. Critical thinking is a cognitive process in learning that enables students to recognize, analyze, and evaluate (Sari et al., 2022). Critical thinking skills enable the formulation and evaluation of information in a manner that is both relevant and objective (Winaya, 2016). Critical thinking is an essential skill for students to possess. When students possess critical thinking skills, they can apply scientific concepts, solve problems, and are not readily swayed by societal issues without solid evidence.

Creative thinking skills involve finding new things that have never existed before, being original, developing multiple solutions for each problem, and generating new, diverse, and unique ideas (Leen et al., 2014). Creativity in the production of a new product or the combination of extant items is an example of the results of creative thinking skills (Ekasari et al., 2017). Creative thinking skills are essential for generating and locating problem solutions (Jarrotul, 2018). Each individual has unique characteristics of creative thought. It is anticipated that supplying stimuli will foster students' creative thinking skills. The development and ownership of creative thinking skills by students during and after the learning process is crucial (Hakim et al., 2017). To develop creative thinking skills in learning, it is necessary to actively engage students so that their creative thinking skills can be adequately developed (Trianggono & Yuanita, 2018).

There are various categories of learning media, including printed media, audio media, audio-visual media, and

interactive media. Interactive learning media is a means for delivering messages from the teacher to the students through technological systems and infrastructure in the form of application programs and electronic media as part of the educational method. Through interactive learning media, the learning process can be conducted anywhere and at any time. Good interactive physics learning media contain material substance, auditory and visual communication display, learning design, and software application. Media use in the learning process will encourage more innovations in learning methods that can increase student motivation and learning outcomes (Nababan & Putri, 2022; Widyaningsih et al., 2020).

The results of the 2019 National Examination showed that 39% of students correctly answered questions about simple harmonic motion (Puspendik, 2019). This percentage reflects the low skills of students whose scores are below 50%. After analyzing the KKO on National Examination items, categories for critical and creative thinking skills are obtained. In the KD analysis, content about simple harmonic motion is included in KD 3.11 and 4.11, where competency requirements are at the analyzing stage. Bloom's revised taxonomy (Anderson et al., 2001) places analysis at the C4 cognitive level. In activities involving analysis, students can comprehend a concept, identify and differentiate concepts, and correlate the concept to observable phenomena.

The observations regarding physics learning materials showed that simple harmonic motion is categorized as challenging for students. Critical and creative thinking skills in this topic are difficult for students to grasp because the teacher continues to use the lecture method to explain the material. According to general observations, this material is only explained verbally, making it difficult for students to comprehend.

The students of class X SMA in the city of Padang were also observed in terms of their learning manner, interest in interactive learning media, and capacity for critical and creative thinking. Based on the analysis of the student data, it can be concluded that students have difficulty comprehending physics learning materials, prefer audiovisual learning, have a strong interest in comprehending physics material through interactive learning media, and have average critical and creative thinking skills. The active participation of students in the learning process is an essential aspect of the learning process, and teachers are expected to know the characteristics of their students so that they can adapt their teaching style to these characteristics.

The existence of interactive learning media can stimulate students to improve their critical and creative thinking skills by presenting more engaging material that includes images, animations, videos, and practice questions so that it saves time in understanding the material and can be accessed from anywhere.

This product will involve the development of a simple harmonic motion topic. Bloom's taxonomy places simple harmonic motion at the C4 level. The C4 level is analyzing (Anderson et al., 2001), which is included in the HOTS. HOTS encompasses the abilities of analysis, evaluation, and creation. Critical thinking is the foundation for creative thinking (Susilowati & Sumaji, 2021). In addition, this material contains numerous concepts concerning the environment of daily existence. This can be used to help students develop their critical and creative thinking skills through conceptual questions.

Researchers are interested in developing interactive learning media because the use of media in the learning process can increase student motivation and learning outcomes (Nababan & Putri, 2022; Widyaningsih et al., 2020). The researcher aims to develop valid

interactive learning media that can enhance students' critical and creative thinking skills.

METHOD

This study employed Research and Development (R&D) research. The R&D model used was the ADDIE model, which consists of analysis, design, development, implementation, and evaluation phases to obtain learning media products using the Lectora Inspire application for simple harmonic motion topics to enhance students' critical and creative thinking skills.

The study was conducted per the ADDIE phases of Analysis, Design, Development, Implementation, and Evaluation to produce a valid product. In this study, only the developmental stage was examined. Figure 1 illustrates the stages of the ADDIE model.

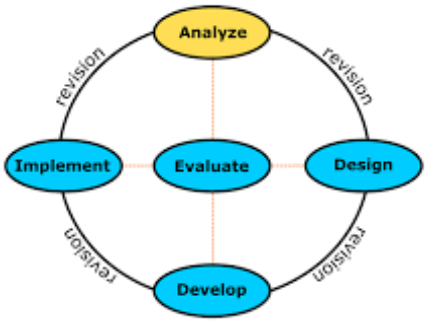

Figure 1 The stages of *the ADDIE* model

The first stage of analysis consisted of developing learning materials in the form of interactive media in order to define a problem to be addressed. The second stage involved analyzing the students' requirements, curriculum, and personalities.

The design stage involved developing a design for an interactive learning media framework so that the problems identified in the analysis stage could be resolved. At this stage, a storyboard was created to facilitate the systematic development of the product.

The third phase was development, which seeks to import the prepared document directly into Lectora Inspire. This stage's goal is the production of interactive learning media in order to achieve learning objectives.

At the first design stage, applications were selected after a feasible application for the intended research had been identified. The second stage entailed the collection of materials and designs that would be transformed into content for the to-be-developed learning media. The final step in the design process was to incorporate the product into the Lectora Inspire application, allowing the researchers to create learning media readily.

This study employed three analysis instruments, one of which is a needs analysis instrument. The instrument for needs analysis is used to determine the actual conditions of students and teachers. This instrument consists of an interview sheet and a questionnaire. The teacher was asked for the interview, while the questionnaire was distributed to the students. The indicators of the instrument are the student's learning styles, the learning media utilized, and the student's critical and creative thinking skills.

The second instrument is a student characteristics instrument. A questionnaire containing queries about learning styles, the use of interactive learning media, and critical and creative thinking skills is used to measure the characteristics of students.

The third instrument is the validity instrument. This instrument is used to ascertain the feasibility level of the developed product. The contents of the validity instrument include material substance, aural and visual communication display, learning design, software utilization, assessment of critical and creative thinking skills, and evaluation of critical and creative thinking skills.

The needs analysis results were determined by calculating each respondent's score using Equation 1.

$$P = \frac{\sum x}{\sum xi} x100\% \quad \ldots (1)$$

Notes:
P = percentage
x = score obtained on each indicator
xi = the number of respondents

The results of the needs analysis are categorized based on Table 1.

Table 1 Needs analysis

Percentage (%)	Category
0-20	Very weak
21-40	Weak
41-60	Moderate
61-80	Strong
81-100	Ver strong

(Riduwan, 2010)

The obtained data was analyzed utilizing Aiken's validity index. The index value's category is determined after obtaining the rater agreement index. Table 2 displays the results of the category decision based on Aiken's V Index (Retnawati, 2016).

Table 2 Decision based on Aiken's V index

Interval	Category
$\leq 0,4$	Less valid
$0,4 < V \leq 0,8$	Moderate
$0,8 < V$	Valid

RESULT AND DISCUSSION

The study's results include the outcomes of the analysis, design, and development phases.

Analysis phase

The interviews and questionnaires completed by physics teachers at public high schools in Padang showed that PowerPoint, Microsoft Word, and YouTube learning videos are the most common forms of learning media. The teacher's teaching and learning materials are not classified as interactive and cannot enhance students' critical and creative thinking.

Curriculum analysis is performed to make the interactive learning media developed by the researchers correspond to the school curriculum (Sari et al., 2019). In this study, interactive learning media with simple harmonic motion topics were developed.

A questionnaire in Google Forms was distributed to inquire about the students' learning styles, interactive learning media, and critical and creative thinking skills. Students typically prefer audio and visual learning styles in order to analyze the characteristics of students. Students believe that learning will be more engaging if they use interactive learning media, as revealed by the results of a questionnaire distribution.

Design phase

Lectora Inspire was selected as the application to be used in product development. Lectora Inspire was chosen because it is believed to contain components that facilitate the development of interactive learning media oriented towards developing students' critical and creative thinking skills (Ridho et al., 2021).

The next step is compiling references that would be incorporated into the developed interactive learning media. The collected references were then compiled into an initial draft of interactive learning media. Then, the prototype of this product was created by using PowerPoint.

Development

The development stage pertains to interactive learning media development. The draft created by researchers was transmitted to the application Lectora Inspire. The developed product included the cover, KI and KD, indicators, learning objectives, material, evaluation and discussion, instructions for using the product, references, and biodata. Figure 2

displays the developed product.

Figure 2 Cover of the interactive learning media developed

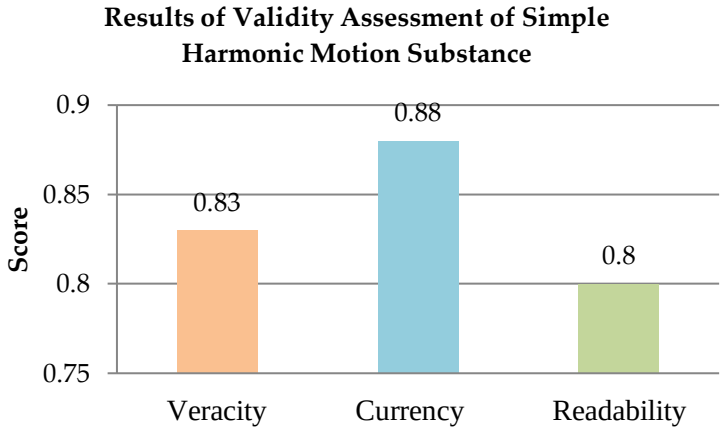

Figure 3 Validation of the simple harmonic motion topic substance

Validity testing is conducted after the product has been created. Validity is determined by evaluating the product's validity with a validity instrument. The used instrument has been validated with a valid category in advance.

The first validity is the material's substance, which consists of three indicators: veracity, currency, and readability. Figure 3 displays the results of the validity assessment of the indicators of the substance of simple harmonic motion topic.

The substance of simple harmonic motion topic has a very valid category with an average value of 0.83 based on the three indicator values in Figure 3. Figure 3 demonstrates the results of the assessment indicators regarding the veracity of the notion that it enhances students' comprehension, as the media developed already includes coverage of scientifically accurate material, the physics equation presented is correct, and the material presented is by the applicable principles and laws in the field of physics. Indicators of currency showed that the developed learning media can independently construct students' knowledge since the presentation of the learning content is consistent with the advancement of science. Indicators of readability showed that the developed learning media use effective language and are simple to comprehend so that the content in the developed learning media does not lead to multiple interpretations (Ruqiah, 2020).

This description indicates that there are assessment items that support the developed learning media. The assessed assessment items are already consistent with the required assessment indicators. This is consistent with the assessment results, which consider these three indicators valid.

The second validity is the physical form of audio and visual communication. It has four evaluation criteria: navigation, typography, media, and layout. Figure 4 depicts the results of audio and visual communication display validation.

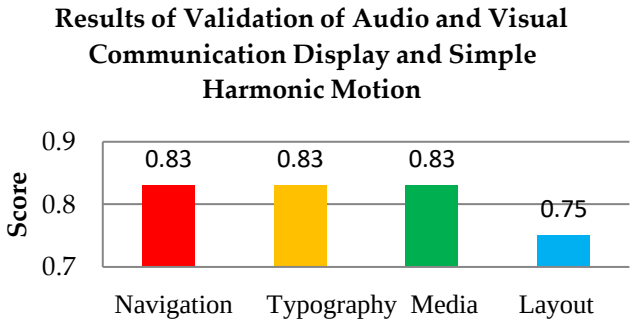

Figure 4 Validation of Audio and Visual Communication Display

Figure 4 shows that the validation value of the audio and visual communication display falls into the very valid category with an average of 0.83. The results of the navigation indicator indicate that the navigation on the developed learning media has functioned correctly, thereby facilitating the proper use of the learning media. In the typography indicator, font type, and letter size on the developed learning materials are appropriate, and the color scheme is appealing. Indicators of media assessment (icon sound, image, animation) indicate that the developed learning media include animations, audio, images, and clear illustrations that support learning. The layout indicators showed that this learning media's design is proportional and appealing.

The preceding description demonstrates that the developed learning media includes the necessary assessment items for developing learning media. The criteria in the assessment indicators are also based on the 2010 Ministry of Education Modification so that audio and visual communication conforms to the guidelines for learning materials. This is consistent with the study's results, which determined that audio and visual communication display aspects are very valid.

The third validity is the learning design, which includes seven assessment indicators: title, KI, and KD; indicators and learning objectives; material, sample questions, evaluation/simulation, and developers. Figure 5 depicts the results of the learning design validation.

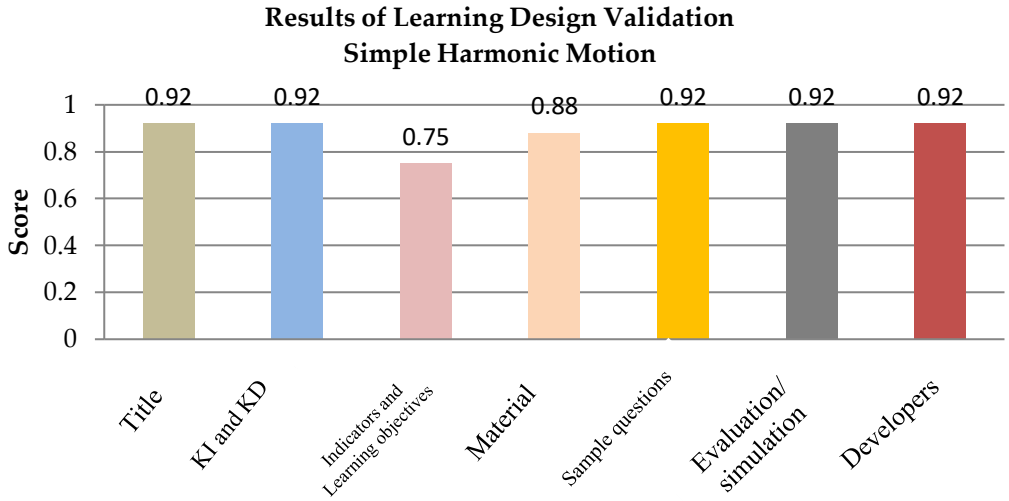

Figure 5 The learning design validation

Figure 5 demonstrates that the obtained results are 0.92, 0.92, 0.75, 0.88, 0.92, 0.92, and 0.92, with a mean of 0.88 for a very valid category. According to the data in Figure 4, the indicator for title assessment is that the title presented in the learning media corresponds to the content of the learning media. The KI and KD assessment indicators demonstrate that the developed interactive learning media contain KI and KD that conform to the Content Standards. The assessment elements of indicators and learning objectives on interactive learning media conform to the KD. On the material assessment item, it is determined that the presented learning material conforms to KI and KD and that each sub-material in the learning media contains sample questions and discussions to help students better comprehend the learning material. In the evaluation/simulation assessment indicator, the developed learning media include evaluation questions corresponding to the presented material and a discussion of the questions. The identities of the developers were also found in the learning media.

The results showed that this learning design contains the necessary indicators for developing this learning media. The presented indicators have assisted in preparing learning materials devised in such a manner. The learning design aspect is classified as very valid based on the obtained validation results.

The fourth validity is software utilization, which consists of three indicators: interactivity, supporting software, and originality. Figure 6 depicts the results of product validation on the software utilization.

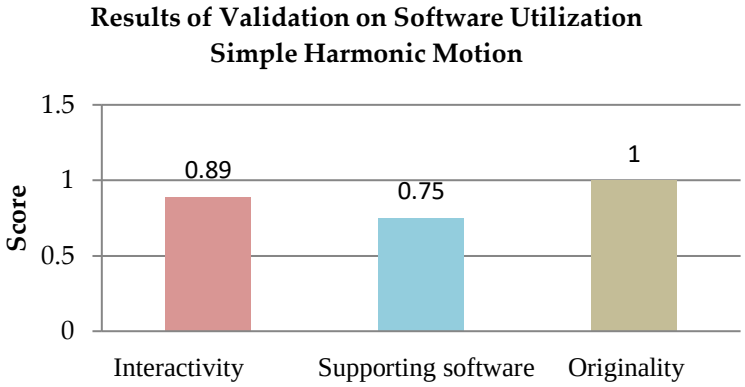

Figure 6 Validation of the software utilization

Figure 6 demonstrates that the average of the three indicators is 0.86, corresponding to a very valid category. Assessment indicators of the software utilization for the created learning media include interactivity (system-to-user feedback), supporting software, and originality. In the interactivity indicator, there is motivation in the learning media that can stimulate students' motivation for learning, and the content of the evaluation questions can provide students with feedback that can actively reconstruct their knowledge. This developed learning media's supporting software assessment item can be accessed via computer, laptop, or smartphone, and this developed learning media can function correctly.

The preceding description shows that the software utilization in this learning media has been applied effectively. In addition, this learning media is readily accessible because it can be used on computers, laptops, and smartphones, allowing students to actively engage in learning and access it anywhere. This software's validation results have been classified as belonging to a very valid category.

The fifth validity is the assessment of critical thinking skills. Six indicators are evaluated for the assessment of critical thinking skills. Validators evaluated the developed media to determine whether or not they can enhance students' critical thinking skills. Interpretation, analysis, evaluation, inference, explanation, and self-regulation are assessment indicators. Figure 7 depicts the product validation results of the critical thinking skills assessment.

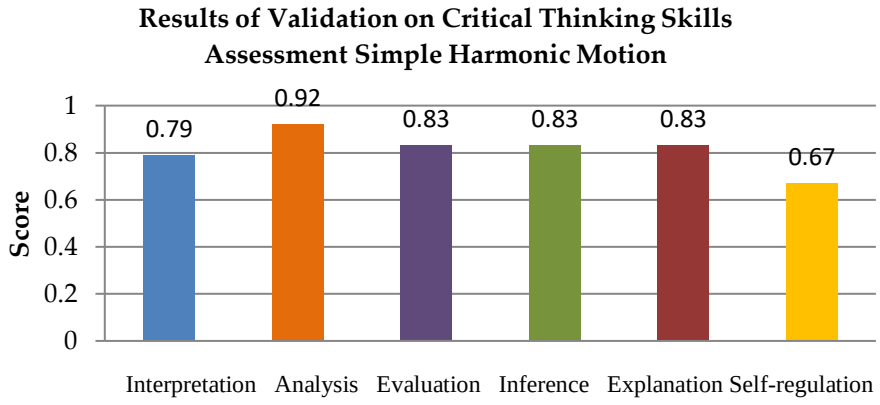

Figure 7 Validation of critical thinking skills assessment

Figure 7 demonstrates that the average validity of the assessment of critical thinking skills is 0.81, with a very valid category. The first assessment indicator is interpretation, and learning media provides students with a stimulus to enable them to write the problem's meaning clearly and precisely. This learning resource also instructs students on how to write clearly and correctly in response to queries. The analysis indicator showed that the developed learning media requires students to integrate concepts that can be applied to problem-solving and affords students opportunities to finish the queries. The evaluation indicates that this learning media provides students with opportunities to solve problems. The inference indicator demonstrates that this learning media assists students in drawing logical conclusions. Explanation indicators determined that the developed learning media has enabled students to write the final problem-solving results.

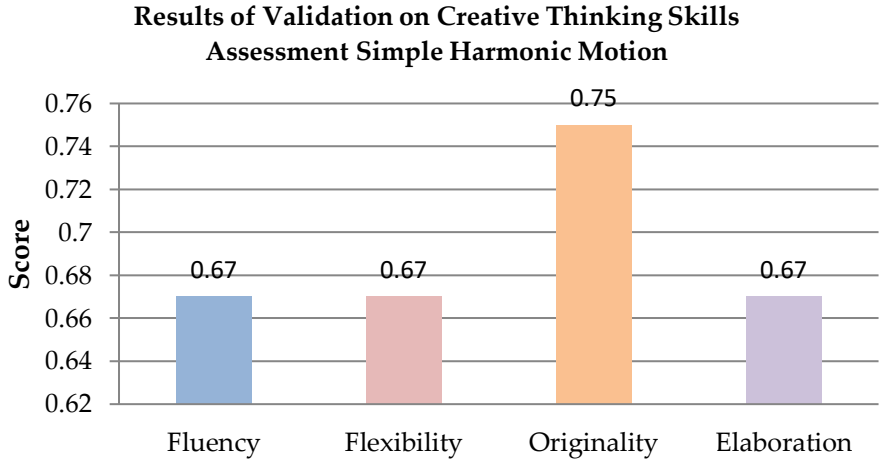

Figure 8 Validation of creative thinking skills assessment

The preceding results demonstrate that the developed learning media can assist students in developing their critical thinking skills. This learning media also includes a stimulus, a problem, and an illustration designed to improve students' critical thinking. The validation results for the assessment indicators of critical thinking skills fall into the very valid category.

The sixth validity is the evaluation of creative thinking skills. Validators evaluated the developed media to determine whether or not they can foster students' creative thinking skills. Figure 8 displays the validation results of the creative thinking skills assessment on the simple harmonic motion topic.

The average validation result for the assessment of creative thinking skills is 0.69, with a valid category, as shown in Figure 8. The assessment results for the fluency indicator show that the developed media can provide students with opportunities to generate diverse ideas, as depicted in Figure 8. Evaluating the indicator for flexibility in thinking shows that the developed learning media can help students address problems in various ways. The originality in thinking indicates that the developed learning media contains a fresh and original explanation of the presented material. Indicators of elaboration demonstrate that the developed learning media can facilitate discovering concepts in the presented material and provide evaluation.

The description of the results on creative thinking skills indicates that numerous factors can assist students in enhancing their creative thinking

abilities. This is consistent with the validation results indicating that the developed learning media is valid.

The validation results for the substance of the material, the audio and visual communication display, learning design, software utilization, assessment of critical thinking skills, and creative thinking skills show the validity value of the developed interactive learning media oriented towards critical and creative thinking skills on simple harmonic motion topics. The average value of the validity of the developed learning media on the simple harmonic motion topic is 0.83, with a very valid category.

Table 1 Validation of interactive learning media oriented towards critical and creative thinking skills on simple harmonic motion topic

Assessment	Validity value	Category
Material substance	0.81	Very Valid
Audio and visual communication display	0.83	Very valid
Learning design	0.88	Very Valid
Software utilization	0.85	Very valid
Assessment of critical thinking skills	0.81	Very valid
Assessment of creative thinking skills	0.77	Valid
Average	**0.83**	**Very Valid**

Table 4 displays the average results for each indicator of the developed product's validity. Based on Table 4, the product validity obtained a value of 0.83 for a very valid category. The evaluation of the validity results conforms to the classification of product feasibility results (Retnawati, 2016)

According to the validation results, the developed interactive learning media using Lectora Inspire can enhance critical and creative thinking skills. This is to the research conducted by Latifah et al. (2020); the developed media are deemed very valid and can enhance students' thinking skills.

The design of the developed interactive learning media, which includes learning design, communication, and audio-visual skills, is very valid so that the media can encourage student learning motivation. According to Akbarini et al. (2018), interactive learning media that is packaged attractively and effectively will undoubtedly positively affect efforts to improve the quality of education and the students' learning potential.

CONCLUSION

The study results show that the interactive learning media with the following characteristics have been developed to enhance students' critical and creative thinking skills regarding simple harmonic motion topics. The interactive learning media contains the title, competency standards, fundamental competencies, indicators of competency achievement, content, evaluation questions, and developers' identities. The results of the validation of interactive learning media to enhance critical and creative thinking skills on simple harmonic motion with the category of validity value are very valid. This product's validity characteristics are in terms of material substance, audiovisual communication display, learning design, software utilization, and critical and creative thinking skills assessment.

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