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Interactive Video of Rigid Body Equilibrium in Lamongan Boranan Dance

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ABSTRACT

Objective: *This study aims to develop interactive video learning media that integrates rigid body equilibrium material in the context of Boranan Lamongan Dance, in order to improve students' understanding of abstract physics concepts while introducing local culture.* ***Method:*** *This study uses the ADDIE (Analysis, Design, Development) development method and was conducted at the high school level involving 3 physics teachers and 21 students. At the analysis stage, the need for learning media that is relevant to the material and local context was identified. The design stage includes the creation of an interactive video that presents an explanation of rigid body equilibrium through Boranan Dance visualization. At the development stage, the video was tested on a limited basis to obtain feedback. The assessment in this response observation gform uses a Likert scale score.* ***Results:*** *The results of the study showed that this media was effective in improving understanding of the material with a percentage score of 84.57%, which indicates that this learning media is very effective according to the responses of teachers and students. In addition, this video also succeeded in integrating local wisdom, increasing students' learning motivation, and introducing local culture in an interesting way.* ***Novelty:*** *The uniqueness of this study lies in the combination of local cultural elements with physics material that is often considered abstract, as well as the use of interactive video as a fun and participatory learning tool. This research contributes to the development of technology-based learning media that prioritizes the preservation of local culture.*

INTRODUCTION

Improving the quality of education continues to be the focus in the development of the learning system in Indonesia (Hasasiyah et al., 2020). One effort that can be made to improve the quality of learning is through the development of innovative and interesting learning media. Relevant learning media is not only able to improve students' understanding of the material but can also increase learning motivation (Hidyanto et al., 2016). One interesting approach is the development of interactive video-based learning media (Putri, 2017; Prastowo et al., 2015). This media offers an interactive, interesting learning experience and allows students to be more active in the learning process.

Rigid body equilibrium material is one of the topics in physics that requires a deep understanding of concepts such as torque, moment of force, and rotational equilibrium (Putra et al., 2021). However, this material is often considered difficult by students because it is abstract and requires good visualization skills (Pratiwi et al., 2021). Therefore, learning media are needed that can visualize these concepts in a more concrete and easy-to-understand way. Lumi interactive video is one of the potential alternative media to help students understand this material better. On the other hand, local culture can be used as an interesting and relevant learning context for students. Boranan Dance,

as one of Lamongan's unique cultural heritages, has unique movements that involve the principles of physics, including rigid body equilibrium. Integrating rigid body equilibrium material with local cultural elements such as Boranan Dance will not only enrich learning but can also preserve local culture while increasing students' love for their local culture (Deta, et al. 2024). The development of interactive video learning media for rigid body equilibrium in Boranan Lamongan Dance is needed to overcome students' difficulties in understanding the abstract concept of rigid body equilibrium by presenting concrete and interactive visualizations. By integrating the local cultural context of Boranan Lamongan Dance, this media not only makes it easier to understand the material, but also increases student involvement and strengthens appreciation for local culture. This media is expected to be able to improve the quality of learning, motivate students to learn, and at the same time contribute to the preservation of local culture (Hartini et al., 2017).

The uniqueness of this study lies in the integration of physics concepts, especially rigid body equilibrium, with local culture through Boranan Lamongan Dance. This approach is rarely found in the development of physics learning media, thus providing a new perspective in improving students' understanding of abstract concepts. By linking physics material with cultural elements, students not only learn about theory but also see its application in real life that is closer to them. In addition, this study utilizes Lumi interactive video as an innovative learning media. The use of Lumi as a visualization tool for physics concepts allows students to understand the material more concretely and interactively (Adawiyah, et al. 2021; Ahmadi, et al., 2019; Cahyadi, et al. 2019). Different from conventional learning media, Lumi interactive video not only presents animations and simulations, but also allows direct interaction with the material, thereby increasing student involvement in the learning process (Afza, 2016; Gunawan & Subagja, 2020). Another uniqueness of this study is the multidisciplinary approach that combines the fields of physics, educational technology, and local culture. This approach provides a broader contribution not only in the realm of physics education, but also in the development of learning media and the preservation of regional culture (Deta, et al., 2023; Deta, et al., 2024). By linking physics learning with local cultural elements, this study also supports efforts to maintain and introduce regional culture to the younger generation. More than just improving conceptual understanding, cultural integration in this learning also has the potential to increase student motivation and engagement. Learning that is contextual and close to everyday life tends to be more interesting for students, so they are more motivated to learn (Deta, et al., 2024). Therefore, this study not only contributes to improving the quality of physics learning, but also supports strengthening students' cultural identity through education.

This study aims to develop and test a limited learning media in the form of interactive Lumi videos by integrating rigid body equilibrium material in the context of Boranan Lamongan Dance. This trial is expected to be able to evaluate the effectiveness of the media in improving students' understanding of the material while fostering appreciation for local culture. Thus, this study not only contributes to the development of innovative learning media, but also to the preservation of regional culture. The novelty of this research lies in its innovative integration of rigid body equilibrium an abstract physics concept with the local cultural context of Boranan Lamongan Dance, which is rarely explored in existing physics learning media. Unlike traditional methods of teaching physics, this study utilizes Lumi interactive video technology, which allows students to

engage with the material interactively, offering a deeper and more concrete understanding of challenging concepts such as torque, moment of force, and rotational equilibrium. Furthermore, this research introduces a unique multidisciplinary approach, combining physics, educational technology, and local culture, which not only enhances students' comprehension of physics but also fosters an appreciation for their cultural heritage. By providing a culturally contextualized learning experience, this study contributes to both the development of innovative physics learning media and the preservation of regional culture, making it distinct from existing studies in the field.

RESEARCH METHOD

This research is a type of development research that uses the ADDIE method (Analysis, design, develop, implement, evaluate) (Hidayah, 2020). However, in this limited trial it only reached the development stage. This method was chosen because it is a generic learning design method that provides a structured process in building products developed in research. In this study, the product to be developed is an interactive video of rigid body equilibrium in the Boranan Lamongan Dance that can be used for digital learning.

Figure 1. Research design

Figure 1 shows the analyze stage, the researcher conducted a needs analysis of the learning media. The needs analysis was carried out at the research location to be conducted, namely at the high school, then from several problems that existed in the research environment, the researcher proposed a solution in the form of developing an interactive video of rigid body equilibrium in the Boranan Lamongan Dance. The next stage is the initial design stage of the interactive video using Lumi software. In this stage, the researcher conducted an initial design in the form of an interactive video of rigid body equilibrium in the Boranan Lamongan Dance. The design was formed in such a way that it was aligned with the learning objectives in terms of sub-material. The development stage is a follow-up stage when the interactive video design has been completed, which was then tested limited to 3 physics teachers and 21 students at the high school. At this stage, it was carried out by filling out the response sheet and interviewing the trial of the interactive video of rigid body equilibrium in the Boranan Lamongan Dance. Filling in was carried out via gform and respondents watched the interactive video via a link sent via WA. The response sheet aims to determine the response after using the interactive video that has been produced. There are 9 aspects, each aspect has several statements, with a total of 20 statements. In addition to statements with a Likert scale, there is also a suggestion note column that can be filled in by respondents in Table 1.

Table 1. Aspects in the questionnaire

Aspect	Statement
Learning Objectives	Interactive videos help me understand the learning objectives clearly.
	This media is relevant to the competencies I must achieve.
	This media is in accordance with my learning needs.

Aspect	Statement
Student Needs and Characteristics	Interactive videos support my learning style (visual, kinesthetic, or others).
Content Quality	The material in the interactive video is delivered clearly and coherently.
	The information presented is accurate and in accordance with the equilibrium of rigid body materials.
	The example used (Boranan Lamongan Dance) helps me understand the concept of rigid body equilibrium.
Design and Interactivity	The video design display is attractive and supports learning.
	The interactivity in the video motivates me to learn more actively.
	Animation and visual effects help me understand the material better.
Feedback and Assessment	I get clear feedback from the interactions in the video.
	The interactions in the video help me know how far I understand the material.
Availability and Accessibility	This media is easily accessible through the devices I have.
	The time it takes to load the video is not too long.
Cost and Efficiency	The use of this media is cost-effective.
	The time used to learn with this video is effective.
Sustainability	This media can be reused for future learning.
	This video is relevant for various groups of students.
Security and Privacy	This media is safe to use without any risk of harming my device.
	My personal data is protected when using this learning media.

The assessment in this response observation gform uses a Likert scale score. The instrument is reviewed from the teacher and student response questionnaire. The assessment data is in the form of a checklist on the questionnaire form that has been given to teachers and students using a Likert scale as in Table 2.

Table 2. Likert scale score

Scoring	Scale Value
Strongly disagree	1
Disagree	2
Agree	3
Strongly agree	4

(Wati, 2021)

To calculate the percentage of the results of the teacher and student response questionnaire data, you can use the equation below.

$$Percentage\ (\%) = \frac{The\ number\ of\ scores\ obtained}{Maximum\ score}\ x\ 100\ \%$$

Table 3. Score interpretation criteria

Score Percentage (%)	Category
0 – 20	Not effective
21- 40	Less effective
41- 60	Quite effective
61- 80	Effective
81-100	Very effective

(Wati, 2021)

Table 3 shows that teacher and student responses to interactive videos can be declared effective if they meet the minimum effective criteria, namely ≥ 61%.

RESULTS AND DISCUSSION

Results

The results provide data obtained from research conducted in December 2024 on high school teachers and students. There are 3 teachers and 21 students who have used and provided responses related to the interactive video learning media for rigid body equilibrium in the Boranan Lamongan Dance which is used as one of the media that helps the learning process for rigid body equilibrium material. The data obtained are responses from teachers and students during the use of interactive video learning media for rigid body equilibrium in the Boranan Lamongan Dance. The research is described through the stages of the ADDIE model limited to development which contains Analysis, Design, Development.

Analysis

Through this stage, an analysis was carried out before the research was carried out to obtain an initial profile of learning activities, especially on physics material that had been implemented in high school. This stage was carried out as analyzing learning media in schools. Through interviews conducted, it was found that in high school there was no interactive electronic learning media that completely presented phenomena around students or local wisdom around students. This is very unfortunate if reviewed again from the results of research conducted by Wardani et al. (2018), Physics is a science that studies various phenomena or natural phenomena in everyday life. Then from the results of research by Satriawan et al. (2016) which stated that local wisdom makes it easier for students to gain understanding through phenomena around students to be able to convey moral messages. This strengthens the analysis of the needs and the background of this research to develop an interactive video of rigid body equilibrium in the Boranan Lamongan Dance.

Design

The initial design of the interactive video design of rigid body equilibrium in local wisdom was developed through the integration of local wisdom of Boranan dance. In the development of the interactive video, the discussion focus is on the material of rigid body equilibrium represented through the local wisdom of Boranan dance. The interactive video that was developed contains several backgrounds of Boranan Dance and discussions aimed at making it easier for students to understand the material of rigid body equilibrium through local wisdom. In addition to making it easier for students to understand the material, the development of this interactive video is also intended to be interactive in its use. At the beginning of the video, an explanation and introduction are given regarding the local wisdom of Boranan Lamongan dance and the parts contained in the local wisdom. Then it is also explained about Boran being able to be balanced when carried by the dancer, in addition there are several questions or statements as a form of user feedback. The part of the video that contains the simplest possible explanation so that students can also learn easily and enjoyably. For the explanation of the concept, it is equipped with the phenomenon of Boranan dance which is a form of local wisdom around students to make it easier for them to understand the concept. Some parts of the material explanation are also formed interactively and integrated into learning objectives that encourage students to master the knowledge.

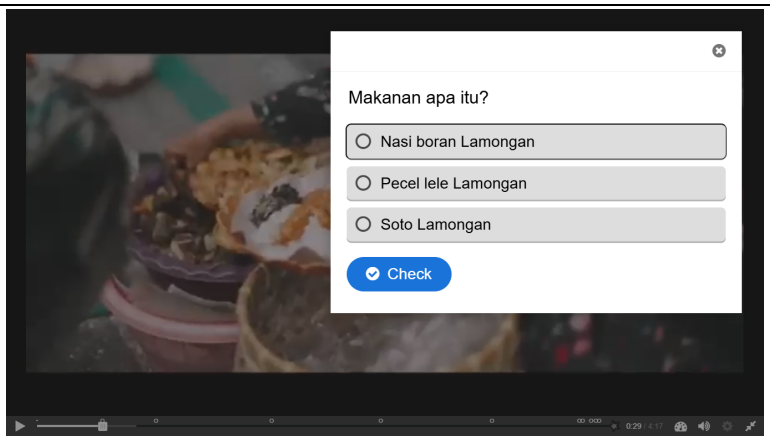
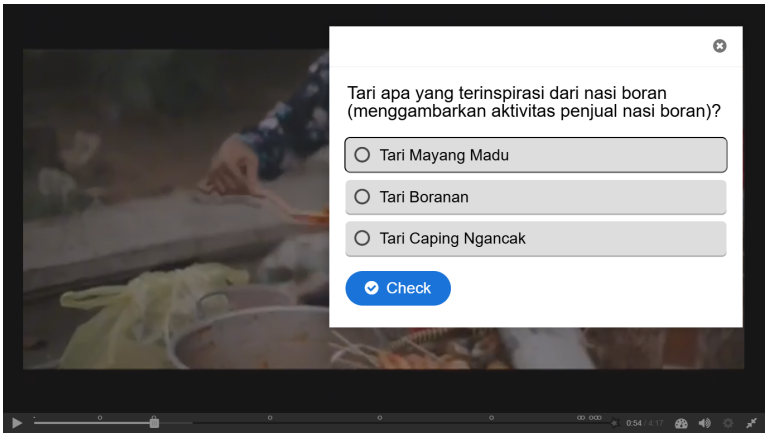
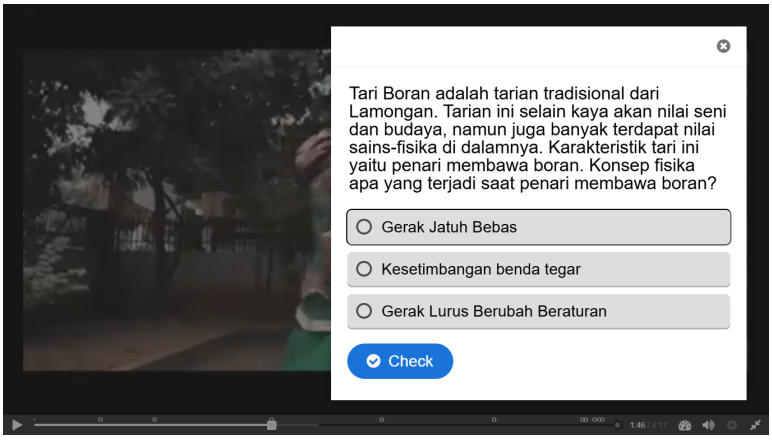
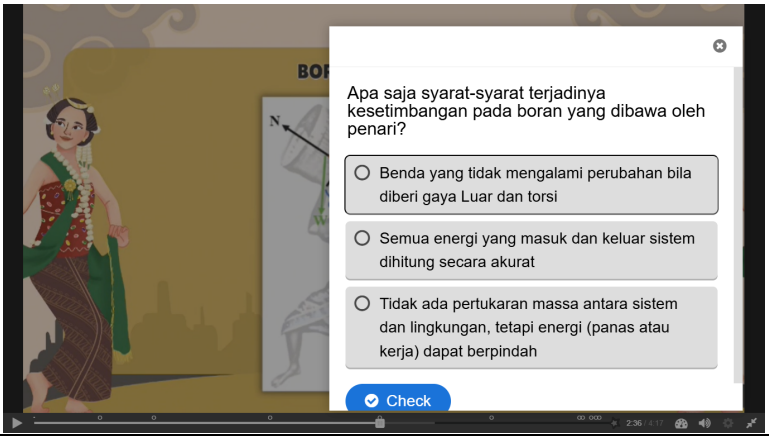
Research results, research results, research results, research results, research results, research results, research results, research results.

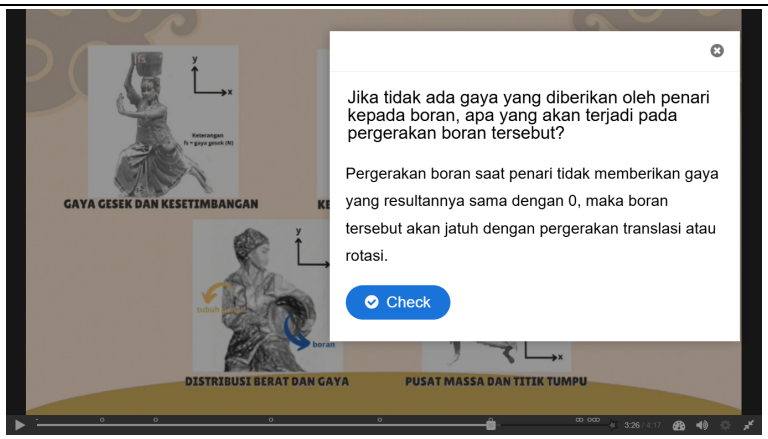
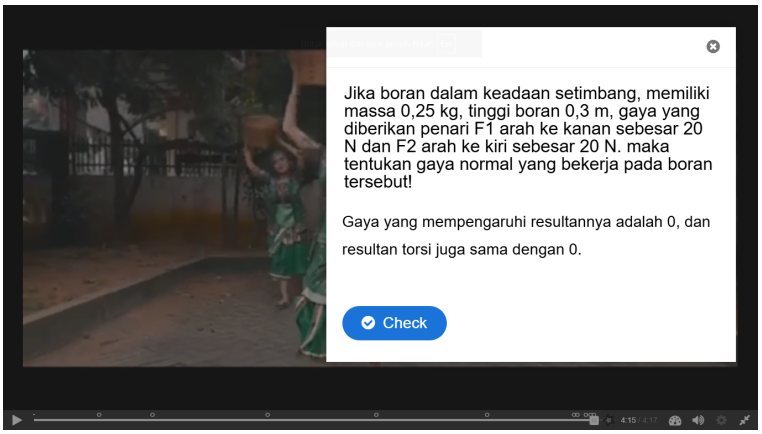
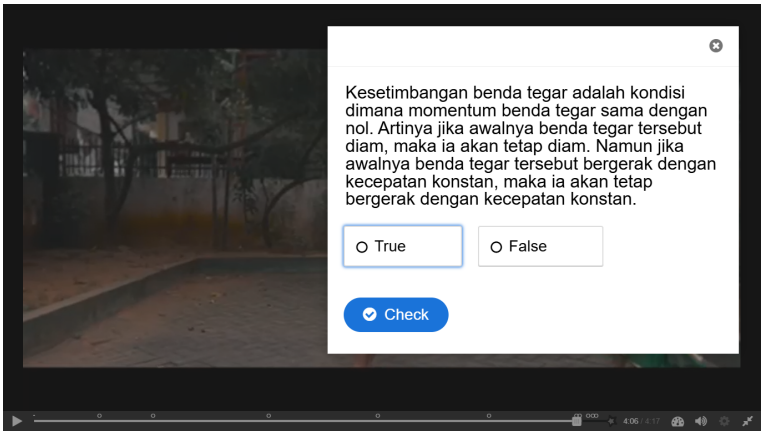
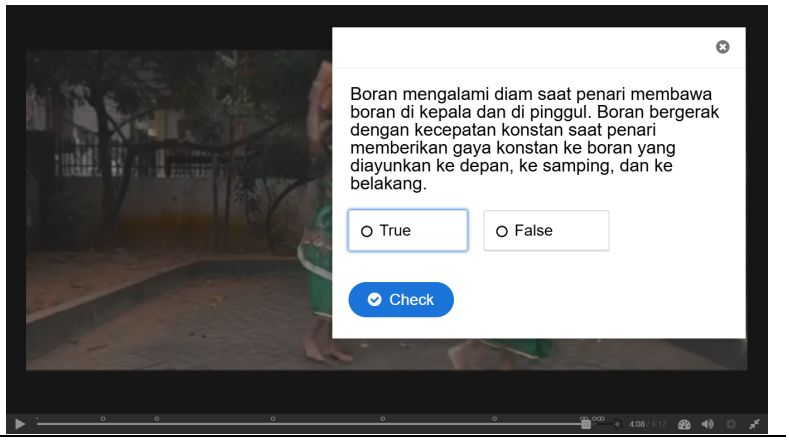
Development

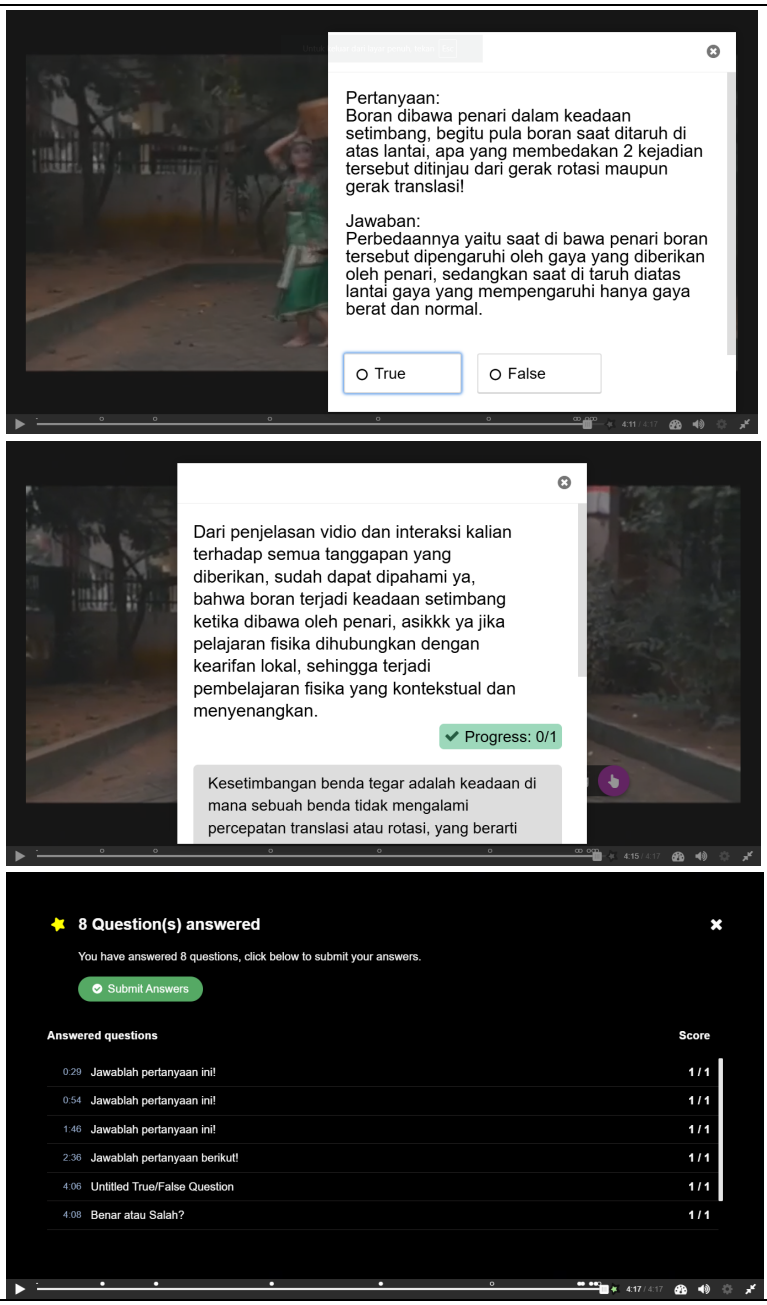
At the development stage, it is the stage of realizing an interactive video integrated with the local wisdom of the Boranan Lamongan dance on the material of rigid body equilibrium. The interactive video developed contains components of the local wisdom of the Boranan Lamongan dance, rigid body equilibrium material, as well as materials and readings intended to train students' knowledge. Interactive videos based on local wisdom have a number of significant advantages in supporting student learning. First, the contextual relevance of the material taught makes it easier for students to understand and relate science concepts to their daily lives, thereby increasing interest and motivation in learning. In addition, the use of local wisdom helps preserve traditional culture and knowledge, fostering a sense of pride and cultural identity among students. Interactive video products are made by utilizing a free website called lumi. Interactive video products are published by sending video links to respondents. Video links can be accessed online. The display when accessing the video can be seen in Table 4.

Table 4. Interactive video display

Interactive Explanation	Interactive Screenshot
When accessing the video link, the learning objectives and procedures for using interactive videos first appear.	
Background explanation of Boranan Lamongan Dance.	

Interactive Explanation	Interactive Screenshot
When starting the video there are questions that must be answered.	
Questions about students' knowledge in the insight of Boranan Lamongan Dance.	
Questions about students' knowledge in the insight of boran equilibrium in Boranan Lamongan Dance.	
Questions about students' knowledge in the insight of equilibrium conditions.	

Interactive Explanation	Interactive Screenshot
Statements about the concept of equilibrium in boran.	
	
Conclusion of choice, as a reflection of students' knowledge.	
	

Interactive Explanation	Interactive Screenshot
End of video.	

Interactive video products on the material of rigid body equilibrium for grade XI students are displayed with the integration of local wisdom of Boranan Lamongan Dance. The video displayed is 4 minutes 17 seconds long to teach students and capture their attention and arouse further curiosity regarding equilibrium in boran. Interactive video products are equipped with 9 aspects, 20 statements about their knowledge of Boranan Lamongan dance and basic rigid body equilibrium. The advantages and disadvantages of interactive video products are known based on the answers of students and teachers during interviews which have been summarized in Table 5.

Table 5. Interview summary

Question	Respondents	Answer
In your opinion, what are the advantages of using interactive videos of rigid body equilibrium in Boranan Dance?	Teachers	An interesting innovation to attract the attention of students, an easy-to-understand approach because the Boranan dance is an interesting local wisdom when viewed from the balance of the Boran.
	Learners	Interesting and not boring because it contains contextual information that makes you curious to know more about the Lamongan Boranan dance and the material on the equilibrium of rigid objects.
In your opinion, what are the disadvantages of using interactive videos of rigid body equilibrium in Boranan Dance?	Teachers	The questions presented are not enough to explore information on the objectives of the lesson and there must be a lot of improvements related to the appearance of the video when the question appears to be responded to.
	Learners	It can still be changed to find the correct answer to the question presented. So it is less challenging when filling in the answers from the video interaction.

The Response Questionnaire given to teachers and students through gform can find out feedback on the interactive video of rigid body equilibrium integrated with the local wisdom of Boranan Lamongan dance that was developed. The assessment applied in the student response questionnaire was carried out through a Likert scale. The statements in this questionnaire consist of 9 aspects with a total of 20 statements and end with criticism and suggestions. The results of the recapitulation of the overall student responses from the interactive video learning media of rigid body equilibrium on the local wisdom that was developed can be seen in Table 6. Then the percentage of the recapitulation of student responses to the interactive video integrated with the local wisdom of Boranan Lamongan dance that was developed is in Figure 2.

Table 6. Percentage of response results for each aspect

Aspect	Percentage
Learning Objectives	88.09
Student Characteristics Needs	89.88
Content Quality	88.88
Design and Interactivity	86.90
Feedback and Assessment	88.09
Availability and Accessibility	92.26
Cost and Efficiency	86.90
Sustainability	86.90
Security and Privacy	89.88

The score that received the least score was in the sustainability aspect, according to one of the students, that the sustainability of the material provided did not cover all the sub-materials given by the teacher which were usually in the form of physics calculation questions, but were more basic. The highest score was in the availability and accessibility aspect. According to one of the students, that the LKPD used was easily accessible in helping to understand the local wisdom of the Boranan Lamongan dance which was integrated by the rigid body equilibrium material. In design and interactivity, it got a percentage of 86.9%, so it can be said to be very effective, even though the value is lower than other aspects. The learning media is said to be interactive because there is active interaction between students and the media, both in the form of choices, and direct responses to the activities provided. This is in line with Sukma's research (2024) Lumi interactive video, can be designed to provide features such as navigation buttons, interactive quizzes, physics concept simulations, and direct feedback that allow students to be actively involved in the learning process. With this interaction, students are not only passive recipients of information, but can also explore materials, make decisions, and obtain feedback independently, so that learning becomes more interesting, participatory, and effective.

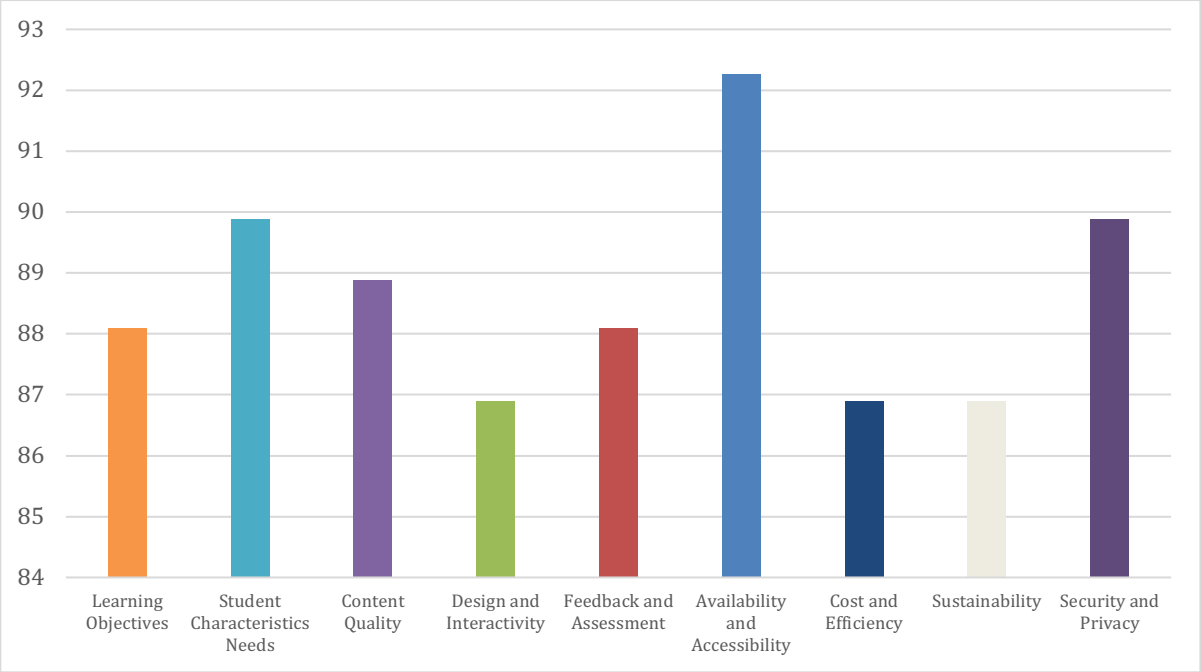


Figure 2. Percentage of response results for each aspect

This student response questionnaire was filled out by students after the interactive video trial of rigid body equilibrium integrated with local wisdom that had been developed. The results of the student response assessment were 84.57% with a very effective category.

Table 7. Teacher and student responses

No.	Respondents' Responses
1.	At the beginning of the video, the learning objectives must be explained.
2.	It's good, needs improvement at the end of the video, a score is given
3.	Is it possible to access it offline?

No.	Respondents' Responses
4.	Can you specifically show photos of the food, not just in the video?
5.	It's very interactive
6.	It's good, but in my opinion it would be clearer if the image was enlarged.
7.	Good video
8.	Very helpful in understanding the less

Based on respondents' responses, overall interactive video learning media is considered good and very helpful in understanding the lesson, and is considered interactive. However, there are several inputs for improvement, such as adding an explanation of the learning objectives at the beginning of the video, giving a score at the end, ensuring that the video can be accessed offline, enlarging the image to clarify the material, and displaying food photos specifically, not only in the video. This shows that although this media is effective, there is still room for improvement to be more optimal and in accordance with user needs.

Discussion

The development of interactive video learning media based on Lumi that integrates rigid body equilibrium material with local cultural elements of Boranan Lamongan Dance is an innovative step in improving the quality of physics learning. Rigid body equilibrium material is often considered difficult by students, especially because it is abstract and requires good visualization skills. By combining elements of Boranan Lamongan Dance, which involve physics principles such as torque and balance, this media presents physics concepts in a more concrete and easy-to-understand way. Integration of local culture not only enriches the understanding of the material but can also foster students' love for their regional culture (Hartini et al., 2017; Hidayah & Karimah, 2020). The analysis stage in this study shows that in high schools, there is no interactive learning media that combines surrounding phenomena or local culture in the teaching and learning process. This finding aligns with previous research, which emphasizes the need for innovative learning media that bridge theoretical concepts and real-life contexts (Cahyani et al., 2021; Rokhim et al., 2022). Through interviews and observations, it was found that both students and teachers expressed the need for learning media that could overcome the difficulties in understanding physics material. Therefore, the development of interactive videos using Lumi, which combine rigid body equilibrium material with Boranan Lamongan Dance, is expected to meet these needs (Afza, 2016; Deta et al., 2023). In the design stage, the interactive video was created to simplify the understanding of rigid body equilibrium. The explanation of the principles of physics within the context of Boranan Dance was made simple and easy to follow. This video is also equipped with interactive elements, such as questions that test students' understanding after watching the explanation of balance in the dance. Such interactive features aim to make learning more active and participatory, where students are not only recipients of information but also active participants in exploring the material (Greipl et al., 2020). This aspect mirrors the research by Sumandal (2023), who highlighted that interactive elements enhance student engagement and motivation.

The results of the limited trials conducted during the development stage showed that this interactive video was effective in improving students' understanding of rigid body equilibrium. Based on the response questionnaire filled out by the teacher and students,

the media received a percentage of 84.57%, indicating that it was highly effective for learning. Moreover, this video successfully aroused the interest and motivation of students who previously had difficulty understanding abstract physics concepts. The combination of physics material with local cultural elements provided added value, with students feeling more connected to the material being taught (Adawiyah et al., 2021; Sumandal, 2023). These findings align with previous studies that suggest integrating local culture into education enhances student motivation and learning outcomes (Deta et al., 2024; Wardani & Suniasih, 2022). However, there were several suggestions for improvement. Some respondents stated that the video should be accessible offline to overcome internet access constraints, which is an important consideration for future development (Cahyadi, 2019). Additionally, suggestions were made to enlarge the display of images in the video for better comprehension and to provide feedback in the form of scores or assessments at the end of the video. These insights are consistent with previous research indicating that accessibility and timely feedback are crucial for effective learning media (Greipl et al., 2020; Wati et al., 2021).

The uniqueness of this study lies in the integration of local culture, which not only serves as a context to enrich learning but also functions as a tool to preserve local wisdom. The Boranan Lamongan Dance, which includes movements that illustrate the principles of physics, is highly relevant to bridging the gap between physics theory and students' real-life experiences. This approach makes physics learning more tangible and meaningful, and it also aligns with research on ethnoscience and the use of local wisdom in education to make learning more relatable and engaging (Hartini et al., 2017; Hidayati, 2016). Therefore, the development of interactive videos like this is expected to serve as a model for the creation of innovative learning media that prioritize local cultural aspects in education (Prastowo, 2015; Deta et al., 2023). Overall, this study contributes positively to the development of technology-based learning media that not only improves understanding of scientific concepts but also introduces and preserves local culture. With the rapid advancement of technology, this kind of interactive learning media has the potential to be expanded and developed further, not only in the context of physics education but also in other subjects. The findings of this study emphasize the importance of integrating technology, local culture, and interactive features to create more engaging and effective learning experiences.

CONCLUSION

Fundamental Finding: This study shows that the development of interactive video learning media based on Lumi that integrates rigid body equilibrium material with Boranan Lamongan Dance is effective in improving students' understanding and enriching learning through local cultural contexts. **Implication:** This media is proven to be able to increase students' motivation and engagement in learning physics, although there are some limitations such as offline accessibility and the number of interactive questions that need to be improved. **Limitation:** The results of this study provide important implications for the development of innovative learning media that combine technology and local culture, but further research is needed to test its effectiveness in a broader context. **Future Research:** The development of this kind of learning media has the potential to be applied to various subject matter, opening up opportunities for further research on the use of technology in more inclusive and contextual education.

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