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# Validity of Phydeopale (Physics Video of Patil Lele) Media to Train Critical Thinking Skills of High School Students on Momentum and Impulse Material

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**Abstrak**

Perkembangan ilmu pengetahuan dan teknologi yang kian maju dapat menunjang proses pembelajaran melalui pemanfaatan media pembelajaran salah satunya berupa video pembelajaran interaktif. Integrasi teknologi ke dalam kegiatan pembelajaran dapat mendorong keberhasilan pengembangan keterampilan abad 21. Penelitian ini bertujuan untuk mengembangkan video pembelajaran interaktif pada materi momentum dan impuls yang dinyatakan valid. Penelitian ini menggunakan *Research and Development Method* dengan model pengembangan *ADDIE*. Implementasinya menggunakan *One Group Pretest-Posttest* dan diujicobakan secara terbatas di kelas XI Sains 2 SMA Labschool Unesa 1. Teknik pengumpulan data menggunakan lembar validasi. Validasi media ditinjau dari sepuluh aspek yakni konten, struktur, visual, audio, interaktivitas, durasi, kreativitas, penggunaan teknologi, etnofisika, dan bahasa. Teknik analisis data yang digunakan adalah perhitungan persentase dengan kriteria kelayakan validasi persentase ≥ 61%. Validator terdiri dari dua dosen pendidikan fisika Universitas Negeri Surabaya dan satu guru fisika SMA Labschool Unesa 1. Video pembelajaran interaktif materi momentum dan impuls dinyatakan sangat valid dengan persentase 92% berdasarkan hasil validasi. Aspek durasi pada media menunjukkan persentase terendah. Penelitian selanjutnya disarankan untuk mengoptimalkan durasi video pembelajaran interaktif. Dengan demikian dapat disimpulkan bahwa video pembelajaran interaktif yang dikembangkan layak digunakan dalam pembelajaran fisika materi momentum dan impuls untuk melatihkan keterampilan berpikir kritis peserta didik SMA.

**Kata kunci:** Media *Phydeopale*, Keterampilan Berpikir Kritis, Video Pembelajaran Interaktif, Momentum dan Impuls, Permainan Tradisional Patil Lele

***Abstract***

*The development of science and technology that is increasingly advanced can support the learning process through the utilization of learning media, one of which is an interactive learning video. The integration of technology into learning activities can encourage the successful development of 21st century skills. This study aims to develop an interactive learning video on momentum and impulse material which is declared valid. This research used the Research and Development method with the ADDIE development model. The implementation used One Group Pretest-Posttest and was tested on a limited basis in class XI Science 2 Labschool Unesa Senior High School 1. The data collection technique used a validation sheet. Media validation was reviewed from ten aspects, namely content, structure, visual, audio, interactivity, duration, creativity, use of technology, ethnophysics, and language. The data analysis technique used was percentage calculation with percentage validation eligibility criteria ≥ 61%. The validators consisted of two physics education lecturers at State University of Surabaya and one physics teacher at Labschool Unesa Senior High School 1. The interactive learning video of momentum and impulse material was declared very valid with a percentage of 92% based on the validation results. The duration aspect of the media shows the lowest percentage. Further research is recommended to optimize the duration of interactive learning videos. Thus it can be concluded that the interactive learning video developed is feasible to be used in learning physics material on momentum and impulse to train critical thinking skills of high school students.*

***Keywords:*** *Phydeopale Media, Critical Thinking Skills, Interactive Learning Video, Momentum and Impulse, Patil Lele Traditional Game*

## INTRODUCTION

The rapid development of technology today has affected human activities such as working, socializing, playing, and learning. The development of science and technology has become an integral part of human life, almost all fields of life use technology. In essence, technological progress is a positive thing that can facilitate human activities (Ammar, 2020). Technological developments are dynamic, driven by massive advances in science and technology (IPTEK)

which have provided significant transformations in every field of life, especially in the field of education. The education process in Indonesia needs to adapt and utilize technology to support the learning process. According to Syafawani and Prasetyo (2024) the utilization of innovative learning media allows educators to make learning activities interesting and relevant to the current context. These learning practices are consistent with the demands of 21st century learning, where educators not only play a role in delivering learning materials, but also as facilitators in providing 21st century skills to students in responding to global challenges. However, the main challenge in implementing 21st century learning is adaptation to technology. According to Sakti (2023), educators' competence in integrating technology into learning activities can encourage the successful development of 21st century skills for students.

Critical thinking skills are skills that are not acquired by a person from birth but rather skills that must be developed through practice (Arifin, 2022). Critical thinking skills have become one of the skills needed in today's modern era. According to Fahim and Pezeshki (2012) critical thinking skills are competencies needed in the lives of students. Its implementation in the context of education, especially in physics learning, is essential.

According to various recent studies confirming the low level of high-level skills possessed by students in physics learning, namely critical thinking skills that are still low. Sundari (2021) found an average score of only 55 in physics learning on temperature and heat material at a high school in Sidoarjo for these skills, while Ramadhani (2024) reported that critical thinking skills were in the very low category owned by students at a high school in Surabaya which was known during physics learning on static fluid material. Similar findings were reinforced by Permata et al (2019) on momentum and impulse material, with low achievements for the five indicators of critical thinking skills according to Ennis (1985).

The dominance of students' habits in memorizing physics materials and formulas rather than understanding concepts in depth is the root of the problem of low critical thinking skills. This phenomenon is supported by Sundari's (2021) findings through a critical thinking skills test given to high school students which shows that critical thinking skills are still low. Students tend to memorize physics equations and work on physics problems without understanding the concept as a result it is difficult to solve problems and the perception arises that physics is difficult. This is in line with research from Ufairiah et al (2020) which shows physics learning on momentum and impulse material is considered difficult. This condition arises because students have not been able to apply physics concepts in solving problems which has a direct impact on the low achievement of critical thinking skills. Therefore, it is important to train critical thinking skills through interactive learning media on momentum and impulse materials.

The momentum and impulse material was chosen in this study because it has appropriate characteristics to develop students' critical thinking skills. This material is not only important for students to learn because it is included in the learning outcomes of class XI SMA semester F which often appears in summative evaluations such as school exams, but also has a close relationship with real phenomena in everyday life. The material of momentum and impulse is also relevant to the traditional game patil lele. This game can be associated with physics learning so that it can encourage deeper understanding and avoid learning physics based on memorization. Research by Dani et al (2022) showed that local culture can be used to deepen the concept of impulse momentum in physics learning. In addition, according to Yelensi et al (2020), learning using traditional game videos can make students discover physics concepts so that students' thinking skills. Furthermore, Saenab (2025) emphasized that the connection between learning materials with daily activities and local culture can improve critical thinking skills. Platform-based interactive learning videos such as Edpuzzle are effective in practicing critical thinking skills. Research by Sari et al (2024) showed that critical thinking can be encouraged by answering interactive questions that are displayed between video shows using Edpuzzle. This is supported by Oktaviani (2025) who revealed that Edpuzzle interactive videos can improve students' critical thinking skills with moderate criteria as seen from the percentage obtained of 64%. Although similar media development has been done, this research aims to develop an interactive learning video that integrates the ethnophysics of traditional patil lele game into momentum and impulse material to improve students' critical thinking skills which is declared valid. The development of this media is based on a needs analysis in the target school, as well as responding to the findings of Eliezanatalie and Deta (2023) who revealed that physics learning in the school has not linked physics learning materials with local culture. The contextual approach and physics concepts in the traditional game patil lele are expected to optimally develop students' critical thinking skills while preserving Indonesian culture. Technological advances

in the era of globalization have caused traditional values to fade, especially among students, the lack of traditional values among students can have an impact on the weak critical thinking skills of learners.

## RESEARCH METHODS

This research uses the Research and Development (R&D) method with the ADDIE development model which consists of 5 stages, namely: (1) Analyze, (2) Design, (3) Develop, (4) Implement, and (5) Evaluate.

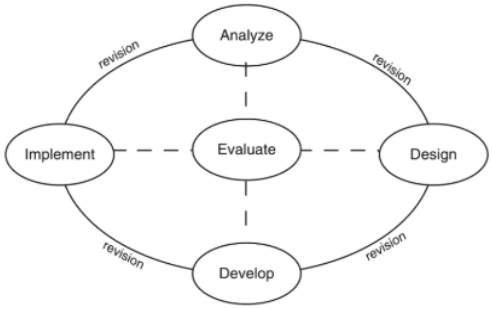



**Figure 1.** ADDIE Model
Source : (Branch, 2009)

Based on **Figure 1**, it is known that the ADDIE model developed by Branch (2009) consists of five stages, namely Analyze, Design, Develop, Implement, and Evaluate which has revisions and evaluations at each stage. The analyze stage is a stage to identify problems from the results of information collection and literature studies. In this stage, learner needs analysis, content analysis, and media analysis are carried out. Needs analysis aims to identify gaps between current facts and expected conditions. Content analysis is carried out by selecting high school physics material Merdeka Curriculum class XI Phase F which is relevant to the traditional patil lele game. In addition, learning outcomes and learning objectives were also analyzed. Media analysis is carried out with the aim of knowing the media that has been used before and supporting facilities in using the media when learning in class. The design stage is designing the media to be developed which begins with the stages of reviewing physics materials and concepts for high school, making Phydeopale media storyboards, creating scripts and determining backsound, exploring the concepts of momentum and impulse physics in traditional patil lele games, and making quizzes. In the develop stage, the making of Phydeopale learning media is in accordance with the structural framework, content systematics, and presentation of the material refers to the storyboard. At the development stage, media validation, research instrument validation, learning instrument validation and product revision were also carried out. The validation was carried out by two physics education lecturers at Surabaya State University and one physics teacher at Labschool Unesa Senior High School 1. The next stage is implement, namely the limited trial of Phydeopale media products in one of the XI Science classes of Labschool Unesa Senior High School 1 to determine the effectiveness of Phydeopale media in training students' critical thinking skills. The evaluate stage is done through analyzing the results of Phydeopale media trials in learning activities.The sample used in this study was one class, namely class XI Science 2 with a total of 19 students. The trial design used was one group pretest-posttest. Learners take a pre-test at the beginning of learning after which treatment is given in the form of applying Phydeopale media in learning. At the end of the learning activities, students took the posttest and filled out a questionnaire on students' responses to the use of Phydeopale media. The analysis method used in the validation stage research is to analyze the validity level of the media developed and the instruments that have been made. The percentage of validity is obtained based on the Likert scale calculation. The instruments and learning media developed can be declared valid if they meet the validation criteria with a percentage of $\geq 61\%$.

The students' questionnaire consists of positive statements and negative statements. The following is a table of percentage scores that are used as a reference in assessing the validity of Phydeopale media.

**Table 1. Validity Score Interpretation Criteria**

| Percentage (%) | Interpretation Criteria |
|---|---|
| 0-20 | Highly Invalid |
| 21-40 | Less Valid |
| 41-60 | Moderately Valid |
| 61-80 | Valid |
| 81-100 | Highly Valid |

(Source : Riduwan, 2013)

Based on **Table 1**, it is known that Phydeopale media is declared valid if the average percentage value obtained is $\geq 61\%$.

## RESULTS AND DISCUSSION

### *Analyze*

In the analysis stage, needs analysis, content analysis, and media analysis are conducted. Needs analysis is carried out to identify gaps between existing facts and expected conditions. Content analysis was carried out to determine physics learning materials for grade XI high school based on the implementation of the Merdeka Curriculum at Labschool Unesa 1 Senior High School.

Based on the results of the analysis, momentum and impulse material was chosen to be presented in an interactive learning video because of its relevance to the

traditional patil lele game. The material includes the basic concepts of momentum, the basic concepts of impulse, the law of conservation of momentum, and the exploration of physics concepts in the traditional game of patil lele. The learning outcomes refer to Phase F of class XI of the Merdeka Curriculum. Evaluation at the analysis stage is carried out during guidance with the supervisor and literature review. Researchers discuss with supervisors to determine the depth of material to be used in the developed media and determine the needs of students, learning objectives, and the applicable curriculum. Literature review is used to determine the 21st century skills that need to be supplied to students through the media.

***Design***

At the Design stage, researchers began designing the media to be developed in accordance with the results obtained at the analysis stage. At the design stage there are 5 phases. The first phase is reviewing physics materials for high school. The material studied is the basic concepts of momentum, impulse, momentum impulse theorem, and the law of conservation of momentum which are adjusted to the Merdeka Curriculum. The second phase is to create a Storyboard which begins with identifying learning objectives, explaining the content of the main material to be delivered, and exploring physics concepts in the traditional patil lele game. In this study, two storyboards of Phydeopale media were made. The storyboard is arranged based on the sequence of learning materials, practice questions in the video, quiz placement, and let's practice critical thinking scenes. The third phase is to create a narrative and determine the backsound for Phydeopale media. This narrative script is developed based on the learning content which is then presented as a message that wants to be said or conveyed to the audience. The creation of the narrative aims to facilitate researchers in doing voice over to make it easier for the audience to receive the information conveyed in the Phydeopale media. The fourth phase is exploring the concept of physics in the traditional game of patil lele. This study successfully formulated the average force equation for the three stages of the traditional game patil lele (nyuthik, namplek, and nuthuk). The fifth phase is to develop quizzes in the form of true-false and multiple choice statements. The interactive quiz is one example of the main features developed in the Phydeopale media. The phydeopale media created has two main features, namely interactive quizzes and Mari Berlatih Berpikir Kritis scenes to train critical thinking skills in high school students. Evaluation at the design stage is carried out when consulting related products that have been designed.

***Develop***

In the development stage, the interactive learning video Phydeopale (Physics Video of Patil Lele) is developed with the presentation of learning materials that refer to the storyboard, narrative, and systematic content that has been compiled at the design stage. The development stage (Develop) consists of three more detailed sub-stages, namely production, validation process, and revision process.

***Production***

In the production stage, the process of making learning videos using Canva design platform and video editing process using Capcut. Interactivity on Phydeopale media is developed using ActivePresenter software.

1. Learning Video Development

In the development of learning videos, there are three stages including visualization of learning material concepts, production of audiovisual content, and development of interactivity in the media.

*a) Visualization of Learning Material Concepts Using Canva Platform*

The process of visualizing the concept of learning materials begins with the integration of the reviewed momentum and impulse material into the Canva platform which includes material explanations, momentum and impulse equations, and supporting graphic elements such as images and graphs. In addition, video footage of the traditional game patil lele from YouTube is also included in the Canva design so that the audience can recognize and understand traditional games well.

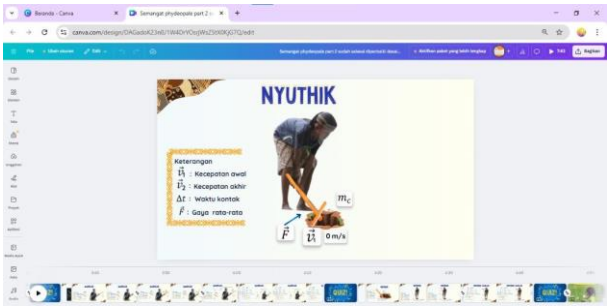



**Figure 2.** Visualization of physics concepts at the nyuthik stage

In Figure 2, the visualization is shown clearly with the notation of the physical quantity, the description of the physical quantity, and the arrow applied directly to the picture of a child who is shaving.

b) *Audiovisual Content Production (Recording, Audiovisual Synchronization, and Editing) Using Capcut Application*

The audiovisual content production process in Phydeopale media development consists of three stages including recording, audiovisual alignment, and video editing. In the alignment stage, the audio of both the narrator's voice and the background music (backsound) is synchronized with the video display. Furthermore,

the previously designed slides were exported in MP4 format so that the video could be edited using the Capcut application. The recording process was carried out directly by the researcher by utilizing the recording feature on the Capcut application. The recording process was carried out simultaneously with video viewing. The audio contained in the Phydeopale media comes from three sources, namely the narrator's voice recording, audio contained in Youtube videos, and audio backsound taken from royalty-free music collections.

After the audiovisual media has been aligned, the video editing process is then carried out by adjusting the position of the video clips and eliminating unnecessary parts of the video clips. The video clips are arranged based on the sequences contained in the storyboard.

*c) Development of Media Interactivity Using ActivePresenter Software*

Phydeopale media was developed by utilizing ActivePresenter software to make the media interactive. Learning videos that have previously been produced using Canva and Capcut are inserted into ActivePresenter software.

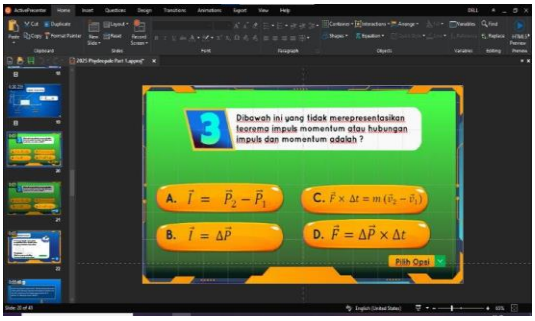



**Figure 3.** Interactive quiz creation process

The interactivity feature was added through the insertion of interactive quizzes in some parts of the video. The quizzes were programmed to appear automatically during video playback. In addition, supporting elements such as navigation buttons and automatic feedback were added. The developed Phydeopale media contains interactive quizzes complete with discussion of each answer. The learning video is then exported in HTML 5 format so that it can be accessed through a web browser without an internet connection.

2. Phydeopale Media Product Development Results

In this study, 2 Phydeopale media products were produced, namely Phydeopale Part 1 and Phydeopale Part 2 media. Phydeopale stands for Physics Video of Patil Lele. Phydeopale media is an interactive audiovisual media. It implements a quiz completion-based video access restriction system. Users can only access the next video content after answering the quiz question, while the previous video content can still be accessed. Phydeopale media is equipped with pause, restart, and playback speed buttons to support user accessibility. Phydeopale Part 1 media presents basic concepts of momentum, basic concepts of impulse, impulse-momentum theorem, relevant exercise questions, and the law of conservation of momentum. The media can be accessed by users by opening the media through a browser found on a laptop or PC even though the device is not connected to the internet network. The display of the Phydeopale Part 1 media product development results is shown in **Figure 4.**


**Figure 4.** *Phydeopale Part* 1 Media Display

Phydeopale Part 2 media contains an exploration of the physics concepts of momentum and impulse in the traditional game of patil lele at each stage, a complete patil lele game video, rules and how to play patil lele. The display of the Phydeopale Part 2 media product development results is shown in **Figure 5**.

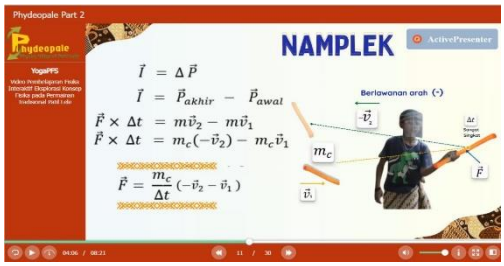



**Figure 5.** *Phydeopale Part* 2 Media Display

3. Preparation of Learning Instruments and Research Instruments

The process of preparing learning instruments and research instruments is carried out in tandem with media production, this is because the media developed and the learning instruments to be used must be in accordance with the Merdeka Curriculum. The final production is a research instrument in the form of a critical thinking skills test sheet, observation sheet, and student response questionnaire.

**Validation Process**

Validation aims to seek approval for the feasibility of the media, learning tools, and research instruments that have been developed before conducting the learning media trials.

Validation is an evaluation activity at the development stage. At this stage, media validation was carried out by three validators. A total of two validators from physics education study program lecturers at State University of Surabaya and one physics teacher Labschool

Unesa Senior High School 1. The validation results of the Phydeopale media can be observed in **Table 2**.

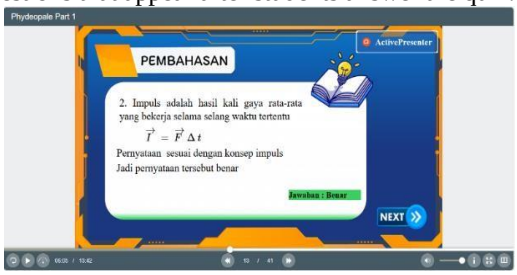
**Table 2. Result of Media Validation**

| Aspect | Percentage score | | | Average Aspect |
|---|---|---|---|---|
| | V1 | V2 | V3 | |
| Content | 94% | 94% | 100% | 96% |
| Structure | 100% | 75% | 88% | 88% |
| Visual | 96% | 89% | 93% | 93% |
| Audio | 88% | 100% | 100% | 96% |
| Interactivity | 94% | 88% | 94% | 92% |
| Duration | 75% | 100% | 75% | 83% |
| Creativity | 83% | 83% | 92% | 86% |
| Technology | 88% | 100% | 88% | 92% |
| Etnophysics | 100% | 100% | 100% | 100% |
| Language | 100% | 100% | 88% | 96% |
| Validator Average | 92% | 93% | 92% | 92% |
| Total Average | | | | 92% |
| Criteria | Very Valid | Very Valid | Very Valid | Very Valid |

Based on **Table 2**, the results of media validation that have been obtained, the average results on content aspects are 96%, structural aspects are 88%, visual aspects are 93%, audio aspects are 96%, interactivity aspects are 92%, duration aspects are 83%, creativity aspects are 86%, aspects of the use of technology are 92%, ethnophysical aspects are 100%, and language aspects are 96%. Phydeopale media gets an average percentage value of 92% which means that the Phydeopale learning media is declared feasible to be tested and interpreted in accordance with the validation criteria in **Table 1**, then the media validation results are included in the criteria very valid.

Based on the validation results that have been obtained in the Phydeopale media development stage, it will be described more deeply in the discussion. The media revisions from suggestions or comments given by validators can be observed in **Table 3**.

**Table 3. Revision Suggestions from Validators**

| No | Before Revision | After Revision |
|---|---|---|
| **Media Revision** | | |
| 1 | There is no complete video of patil lele game. | A complete video of the traditional patil lele game with three stages has been added.   |
| 2 | No Scene Mari Berlatih Berpikir Kritis | Mari Berlatih Berpikir Kritis *scene* has added   |
| 3 | There is no feedback in the form of discussion of questions that appear directly after students answer the quiz. | Feedback has been added in the form of discussion of questions that appear after students answer the quiz.   |

Phydeopale media validation assessment was obtained from the overall average validity criteria of

92% with very valid criteria. The aspects measured in media validation consist of 10 aspects, namely content, structure, visual, audio, aspects, namely content, structure, visual, audio, interactivity, duration, creativity, use of technology, ethnophysics, and language.

1) Content Aspect
   This content aspect assesses the suitability of the media content with the material presented and the ease of understanding the content in the video. The results of the validator's assessment of the content aspect of the Phydeopale media obtained an average value of 96% so that it can be stated that the contents of the media are in accordance with the physics learning objectives on momentum and impulse material with a very valid categ
2) Structure Aspect
   Learning media in the form of interactive learning videos must fulfill structured aspects in terms of video composition, the material in the video is arranged logically and coherently. The results of the validator's assessment on the structure aspect obtained an average percentage value of 88% so that it can be stated that the Phydeopale media is systematically arranged and has a good structure with a very valid category.
3) Visual Aspects
   The visual aspect is an important component that cannot be separated from the development of learning media in the form of videos. The appearance is not only related to the beauty or attractiveness of the design but also from the readability of text and images that can be seen clearly. The results of the validator's assessment of the visual aspects of the media obtained an average percentage value of 93% so that it can be stated that Phydeopale media has a very clear and attractive appearance (visual) with a very valid category.
4) Audio Aspect
   Audio in learning videos can be in the form of background music (backsound), video sound, and narrator's voice. The results of the validator's assessment on the audio aspect of the media obtained an average percentage value of 96%. Based on the percentage value, the audio aspect of the Phydeopale media is included in the very valid category.
5) Interactivity Aspect
   The interactivity aspect is the main requirement for interactive learning media. The assessment of interactivity aspects in terms of interactive quizzes includes the relevance of quizzes, quiz operations, and interactive elements in the form of buttons and feedback for students. The results of the validator's assessment on the interactivity aspect of the media obtained an average percentage value of 92% so that it can be stated that the Phydeopale media meets the criteria of interactive learning media and is included in the very valid category.
6) Duration Aspect
   In making learning videos, an important thing to consider is the duration of the learning video. The duration of the interactive learning video developed does not exceed 15 minutes, Phydeopale Part 1 media lasts 13 minutes 42 seconds and Phydeopale Part 2 media lasts 08 minutes 21 seconds. The results of the validator's assessment on the duration aspect of the media obtained an average percentage value of 83%. Based on the percentage value, the duration aspect of the Phydeopale media is included in the very valid category.
7) Creativity Aspect
   The developed Phydeopale media is included in digital learning media. The development of digital learning media must pay attention to aspects of creativity and the use of technology. The results of the validator's assessment on the creativity aspect of the media obtained an average percentage value of 86% so that it can be stated that Phydeopale media is included in creative digital learning media with a very valid category.
8) Aspect of Technology Use
   Learning media should be easy to operate and access by learners. The media can be used without being connected to the internet network. Phydeopale media is also easy to operate. The results of the validator's assessment on the aspects of the use of technology in the media obtained an average percentage value of 92% so that it can be stated that Phydeopale media is easily accessed and operated using technology with a very valid category.
9) Ethnophysical Aspect
   The ethnophysical aspects of Phydeopale media need to be considered in the development of traditional game-based interactive media. The traditional game used in the media is the traditional game patil lele. The ethnophysical aspect assessment process is reviewed from the suitability of the traditional game of patil lele to be used in physics learning activities. The results of the validator's assessment of the ethnophysical aspects of the media obtained an average percentage value of 100%. Based on the percentage value, the ethnophysics aspect of the Phydeopale media is included in the very valid category. This shows that patil lele as a traditional game applied in Phydeopale media can be used to explain the physics concepts of momentum and impulse.
10) Language Aspect
    In the language aspect, the language used by the voice actor (narrator) in delivering the narration and the language contained in the information or learning content in the Phydeopale media obtained an average percentage value of 96% which includes the use of Indonesian language in accordance with Indonesian language rules and the language used is easily understood by students with a very valid category. Thus, it can be stated that every aspect contained in the Phydeopale learning media has been declared very valid. This is in accordance with Islamiyati's research in 2022 which assessed the

validity of interactive learning media with the acquisition of feasibility assessment results of 87.5% with a very valid category for use in learning.

The results of data analysis showed that all aspects of Phydeopale media met the validity criteria, although the duration aspect recorded the lowest percentage compared to other aspects.

Based on these findings, Phydeopale is declared valid and feasible to use in physics learning on momentum and impulse material through the integration of ethnophysics of traditional patil lele games. This conclusion is in line with the research of Wahyuni et al (2022) who reported that interactive learning media based on Articulate Storyline for physics subjects were classified as very valid. In addition, the findings of Pramudita and Rahayu (2024) also reinforce that interactive learning media can train students' critical thinking skills.

## CONCLUSION

Phydeopale interactive learning video has been successfully developed by integrating ethnophysics of traditional game patil lele in physics learning. Phydeopale media in the form of interactive learning videos on momentum and impulse material has been validated with an average of 92% classified as very valid. So that the interactive physics learning video developed is declared feasible to use as physics learning media to train the critical thinking skills of high school students on momentum and impulse material. This learning media still needs to be developed further in accordance with the suggestions of the validator.

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