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Development of a Local Wisdom-Oriented Educational Game Learning Media to Facilitate Conceptual Understanding on Fluids Topic for Grade XI Students

Amelia Alhamdaniah[1] , Hidayati[2*] , Asrizal[3] , Dea Stivani Suherman[4]

[1,2,3,4] Department of Physics, Pada ng State University, Padang, Indonesia.

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Correspondence
Email : hidayati@fmipa.unp.ac.id

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ABSTRACT

Fluid is a physics topic that is abstract and therefore difficult for students to grasp. A needs analysis shows that the learning media used in schools is still limited, with educational game-based learning media that integrates local wisdom to support mastery of physics concepts. This study aims to create educational game learning media oriented towards local wisdom on fluid material for grade XI high school and to analyze the level of validity of the resulting media. This study uses the Research and Development (R&D) method with the Four-D (4D) model limited to the Develop stage. The results of the needs analysis showed that 77% of students had difficulty understanding the fluid material and 70% stated that the learning media used was still limited. Based on these results, a media design was prepared which was then validated by three validators using the Item Content Validity Index (I-CVI) and Scale Content Validity Index (S-CVI). The validation results showed that all assessment aspects obtained an I-CVI value of 1.00 and an S-CVI value of 1.00. Thus, the resulting learning media meets the valid criteria so that it is suitable for use as a learning medium to facilitate mastery of physics concepts in fluid material.

INTRODUCTION

Physics learning plays an important role in helping students understand natural phenomena through physics concepts, principles, and laws (Zahara et al., 2024). It also emphasizes students' ability to understand concepts, relate them to real phenomena, and apply knowledge to solve physics problems (Jannati, 2026). Concept mastery is essential because it enables students to understand and apply concepts in various learning situations and everyday life (Ramadhani et al., 2025). Therefore, physics learning needs to provide meaningful experiences that support students' mastery of concepts.

Fluid material requires good conceptual mastery because it involves relationships among concepts, mathematical representations, and everyday applications (Suherly et al., 2023). However, its abstract characteristics can make it difficult for students to understand concepts in depth (Danar et al., 2026). Students experience difficulties connecting static fluid concepts with their applications (Puspita et al., 2019), while difficulties in understanding dynamic fluids have also been reported. Students' conceptual understanding of static fluids likewise remains relatively low (Carnesia & Mufit, 2024). These conditions indicate the need for learning media that can present fluid concepts more concretely and interactively and facilitate students in relating concepts to familiar physical phenomena in everyday life.

Learning media can support students' learning by presenting concepts through visualizations, activities, exercises, and feedback (Habibah et al., 2023). Technological developments provide opportunities to develop interactive media that can visualize abstract concepts and increase student involvement (Qurroh & Suherman, 2026). Educational games combine game elements with learning objectives to create engaging learning experiences (Rahmadhea, 2024). Game-based learning can also be implemented in physics through interactive activities designed to support students' conceptual understanding (Oktaviani et al., 2025). Game elements such as goals, challenges, rules, and feedback can support student engagement during learning (Srimuliyani, 2023). Educational games on fluid material have also demonstrated high validity, indicating their potential as physics learning media (Muliyati et al., 2021). These characteristics make educational games a relevant medium for presenting fluid concepts through interactive learning activities.

Local wisdom can connect physics concepts with phenomena familiar to students' surrounding environment (Pilendia, 2024). Its integration into physics learning media can make learning more contextual by relating concepts to cultural and environmental phenomena (Fitriah et al., 2025). Interactive media integrated with local wisdom have also been developed to support students' concept mastery and learning activities (Purnama et al., 2025). In addition, physics learning media integrating traditional games as local wisdom have been reported to be suitable for learning (Mudjid et al., 2022), while traditional games can also be used to explore physics concepts and connect learning with students' cultural environment (Sari et al., 2023). These findings indicate that local wisdom can provide contextual situations for presenting physics concepts and learning activities.

Previous studies have developed educational games for fluid material (Muliyati et al., 2021) and physics educational games to support students' conceptual understanding (Oktaviani et al., 2025). Other studies have developed physics learning media that integrate local wisdom into interactive multimedia and learning activities (Anto et al., 2024). However, these approaches have generally been developed separately, leaving an opportunity to combine educational games and local wisdom in a single learning medium. The integration of these two elements may provide a more contextual and interactive way to present abstract fluid concepts and their applications in everyday life.This study therefore developed a local wisdom-oriented educational game learning media for Grade XI students on fluid material using the Four-D (4D) model through the Define, Design, and Develop stages. The novelty of this study lies in integrating educational game elements and local wisdom into one medium to present fluid concepts in an interactive and contextual manner. This study aimed to develop a valid local wisdom-oriented educational game learning media for fluid material and analyze its validity.

METHODS

This study employed a Research and Development (R&D) approach to develop a local wisdom-oriented educational game learning media for Grade XI students on fluid material using the Four-D (4D) model proposed by Thiagarajan et al. (1976). The development procedure consisted of the Define, Design, and Develop stages, while the Disseminate stage was not conducted. The study was conducted at SMAN 2 Batang Anai during the second semester of the 2025/2026 academic year. The Define stage involved one physics teacher and 30 Grade XI F2 students who were selected through purposive sampling. In the Develop stage, three lecturers with expertise in physics education and learning media development were selected as validators to assess the learning media. The development procedure is presented in Figure 1.

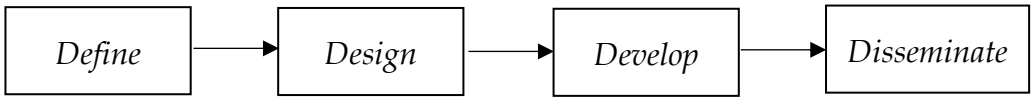

Figure 1. 4D Development Model Stages

The Define stage aims to identify the needs for developing the learning media. The activities in this stage include front-end analysis, learner analysis, task analysis, concept analysis, and specifying instructional objectives. Front-end analysis was conducted through interviews with physics teachers to identify learning conditions, media use, and the need for learning media development. Learner analysis was conducted to identify students' needs for learning media. Task analysis was conducted by analyzing learning activities and task types related to fluid materials. Concept analysis was conducted to identify the essential concepts of fluid materials to be included in the learning media. Furthermore, specifying instructional objectives was conducted through an analysis of the Physics Learning Outcomes (CP) for Phase F as the basis for developing learning objectives and concept mastery indicators.

The Design stage aims to produce the initial design of the learning media. The activities in this stage include designing learning activities within the game, selecting the media, determining the media format, preparing the storyboard and flowchart, designing the user interface, preparing learning materials and questions based on concept mastery indicators, integrating local wisdom elements, and developing the media validation instrument. The Develop stage aims to produce valid learning media. At this stage, the validation instrument was first validated by three validators to ensure the appropriateness of the aspects, indicators, and assessment items. The validated instrument was then used to validate the learning media. The validators assessed the aspects of content substance, media presentation, concept mastery, and local wisdom and provided suggestions and feedback as a basis for revision to obtain valid learning media.

The research data consisted of qualitative and quantitative data. Qualitative data included interview results, suggestions, and comments from the validators, which were analyzed descriptively as a basis for revising the instruments and learning media. Quantitative data were obtained from the needs analysis questionnaire, instrument validation, and media validation, with the needs analysis data analyzed using descriptive statistics in the form of percentages to describe learning conditions and students' needs. The needs analysis results were used as a basis for developing the learning media according to students' characteristics and learning objectives, while the developed media were validated by experts based on material feasibility, media presentation, concept mastery, and local wisdom. The validity of the instruments and learning media was analyzed using the Item Content Validity Index (I-CVI). Before the analysis, the assessment scores were categorized

into two groups, with scores of 3 and 4 classified as relevant and scores of 1 and 2 as not relevant. The I-CVI value was calculated using Equation (1).

$$I - CVI = \frac{n_e}{N} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

In Equation (1), n_e represents the number of validators who rated an item as relevant. Meanwhile, N represents the total number of validators. The I-CVI indicates the proportion of validators who considered each item relevant based on the predetermined criteria. The I-CVI values were used to determine the overall content validity of the learning media. The overall content validity was analyzed using the Scale Content Validity Index (S-CVI), calculated as the average of the I-CVI values across all indicators, presented in Equation (2).

$$S - CVI = \frac{\sum I - CVI}{k} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

In Equation (2), $\sum \mathrm{I} - \mathrm{CVI}$ represents the sum of the I-CVI values for all indicators, while, k represents the total number of epresents the total number of indicators assessed. The S-CVI value was used to determine the overall content validity of the learning media based on the assessment results provided by the validators. The instrument was considered valid when each indicator obtained an I-CVI value of 1.00, indicating that all validators agreed that the assessed indicators were relevant to the learning media. The overall content validity of the learning media was determined based on the S-CVI value obtained from the average of the I-CVI values. The learning media were considered to have good content validity when the S-CVI value was ≥ 0.90 (Polit & Beck, 2006).

RESULTS AND DISCUSSION

Results

Needs Analysis

The student questionnaire results showed that most students experienced difficulties in learning fluid material and needed more interactive learning media. The questionnaire results were also used to identify students' needs for local wisdom-oriented educational game learning media. The findings provided information about students' learning difficulties, preferences, and needs related to the use of learning media in physics learning. The identified needs were considered in selecting the content, learning activities, and contextual elements to be incorporated into the media.These data served as one of the bases for determining the characteristics of the learning media to be developed, as summarized in Table 1.

Table 1. Student Needs Analysis

Indicator	Percentage
Difficulty understanding fluid material	77%
Limitations of learning media	70%
The need for educational game learning media	82%
The need for integration of local wisdom	83%

Based on Table 1, 77% of students reported experiencing difficulties in understanding fluid material. Furthermore, 70% of students indicated that the learning media used were still limited and therefore did not support optimal learning. On the other hand, 82% of students stated that they needed educational game learning media, and 83% wanted the integration of local wisdom in physics learning. These findings indicate the need for more interactive and contextual learning media to support students in understanding fluid concepts. The findings also highlight the importance of providing learning activities that combine interactive game elements with familiar local contexts. The findings also highlight the importance of providing learning activities that combine interactive game elements with familiar local contexts for meaningful learning experiences.

Concept analysis was conducted to identify the alignment between the fluid material used in the school and the concepts to be presented in the learning media. The analysis covered five subtopics, including Hydrostatic Pressure (HP), Pascal's Law (PL), Archimedes' Principle (AP), Continuity Equation (CE), and Bernoulli's Principle (BP). This analysis also served as a basis for determining the scope and sequence of concepts presented in the learning media more systematically. The analysis ensured that the concepts included in the learning media were consistent with the fluid material studied by the students. The results are presented in Figure 1.

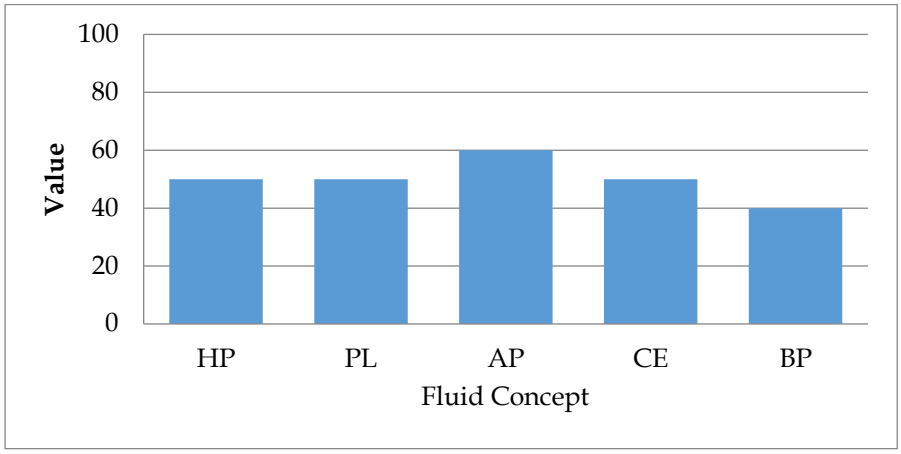

Figure 1. Concept Analysis

Based on the analysis results, the Archimedes' Law sub-material obtained the highest score of 60, while Bernoulli's Principle obtained the lowest score of 40. These findings indicate that the fluid material used in schools still requires development, especially in the presentation of contextual examples, concept visualization, and learning activities that can support student mastery of concepts. The lower score obtained for Bernoulli's Principle indicates that this sub-material requires greater attention, particularly in presenting concepts and their applications in everyday situations. Meanwhile, the higher score for Archimedes' Law indicates that this sub-material can be presented through contextual examples to strengthen students' understanding of the relationship between physical concepts and daily phenomena. The results of this analysis serve as a reference in determining the material, contextual examples, and game activities included in the learning media. Furthermore, an analysis of learning objectives is carried out to ensure the suitability of the developed material with the expected learning outcomes and learning needs of Grade XI students.

The analysis of learning objectives was conducted to evaluate the alignment of the learning objectives used at the school with the ABCD components (Audience, Behavior, Condition, and Degree). This analysis was conducted to determine the completeness of each component in the formulation of the learning objectives. The results of the analysis were used as a basis for developing the materials and evaluation activities in the learning media. Thus, the formulated learning objectives served as a reference for determining the materials and concept mastery indicators included in the learning media.

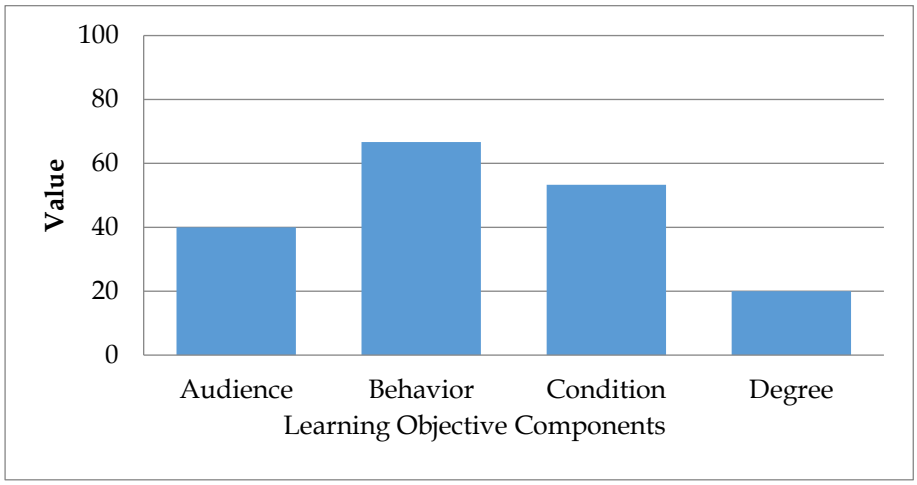

Figure 2. Analysis of Learning Objectives

Based on the analysis results, the Behavior component obtained the highest score of 66.7, while the Degree component obtained the lowest score of 20.0. The Audience and Condition components each obtained scores of 40.0 and 53.3, respectively. These results indicate that the learning objectives used in schools have not fully met the ABCD components, especially in terms of the level of success . These findings serve as the basis for reformulating the learning objectives in the media being developed to align with learning outcomes, concept mastery indicators, and development stages in the Design stage.

Media Planning Results

The Design stage produced the initial design of a local wisdom-oriented educational game learning media developed using Construct 2. The media was designed based on the results of the needs analysis so that the materials, game activities, and media presentation were adapted to the characteristics of the students and the learning objectives. The media design included the preparation of learning materials, game activities, evaluation questions, and local wisdom elements to be integrated into the learning media The design also considered the sequence of learning activities to ensure that the content and game components were presented in an organized manner. The design served as the basis for developing the learning media in the Develop stage.

The learning media consists of several components designed to support the presentation of fluid materials and learning activities. These components include a splash screen, main menu, user instructions, learning outcomes, learning materials, educational games, game questions, discussion, and developer profile. Local wisdom elements are integrated into the learning media through illustrations, game backgrounds, and question contexts related to the environment of West Sumatra. The main interface of the learning media is presented in Figure 3.

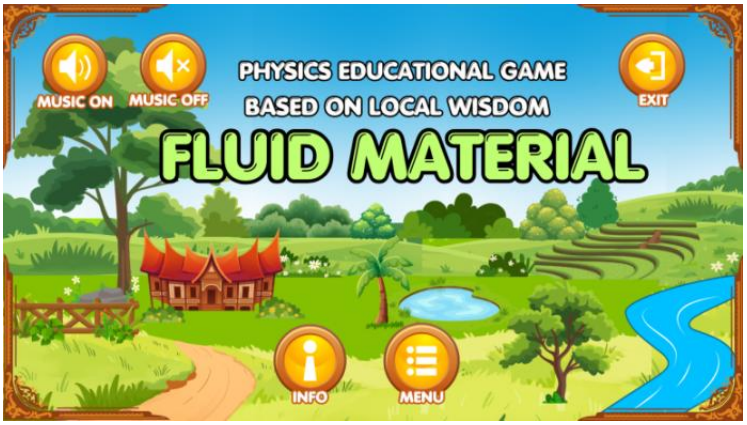

Figure 3. Main View of Learning Media

Figure 3 shows the main interface of the learning media, which provides access to the main learning components. The interface is designed to facilitate navigation between learning materials, educational games, evaluation activities, and other supporting components. The display also incorporates visual elements related to local wisdom to provide a contextual learning environment. The arrangement of the interface is designed to provide clear access to each component and support students in navigating the learning media effectively and independently.

The educational game is one of the main components of the learning media. The game presents fluid materials through gameplay activities integrated with physics questions and challenges. Local wisdom elements are incorporated into the game through visual representations and question contexts related to the students' environment. The appearance of the educational game is presented in Figure 4.

Figure 4. Educational Game Display

Figure 4 shows the educational game interface, which presents fluid concepts through gameplay activities, questions, and feedback. Students can learn the concepts through challenges provided in the game and receive explanations related to their answers. The game incorporates local wisdom elements through visual representations and question contexts related to the students' environment. These features connect fluid concepts with contextual phenomena while providing an interactive learning experience. The combination of these components allows students to engage with the concepts while receiving immediate feedback during gameplay.

The learning media is designed to facilitate students' learning of fluid concepts through material presentation, challenge-solving activities, feedback, and discussion of each question. The design of the learning media in the Design stage was based on the needs analysis conducted in the Define stage. Each media component, including learning materials, game activities, evaluation questions, feedback, and local wisdom integration, was designed according to the students' characteristics and learning objectives. The combination of concept presentation, game activities, and everyday contexts is expected to support students in developing meaningful mastery of concepts. In addition, Construct 2 enables interactive media presentation and supports student engagement during learning activities. The media design produced at this stage then became the basis for the validation process in the Develop stage.

Media Validity

Media validation was conducted by three validators using an instrument that had been declared valid. The assessment was conducted to determine the conformity of the learning media with the predetermined aspects. The assessed aspects included content substance, media presentation, concept mastery, and local wisdom. Each aspect was assessed based on the relevance of the indicators to the developed learning media. The overall results of the media validation are presented in Table 2.

Table 2. Learning Media Validity Results

Aspect	Number of Grains	$I-CVI$	Category
Material Eligibility	4	1.00	Valid
Media View	12	1.00	Valid
Concept Mastery	6	1.00	Valid
Local wisdom	6	1.00	Valid
$S-CVI$	28	1.00	Valid

Based on Table 2, all four assessed aspects obtained an I-CVI value of 1.00, indicating that all indicators were considered relevant by the validators. The Material Feasibility, Media Display, Concept Mastery, and Local Wisdom aspects each achieved the same I-CVI value of 1.00. The overall S-CVI value was also 1.00, indicating a high level of agreement among the validators regarding the content validity of the learning media. These results show that the learning media meets the validity criteria in terms of material content, media presentation, concept mastery, and local wisdom integration. The consistent I-CVI values across all aspects indicate that no assessed indicator was considered irrelevant by the validators. Therefore, the local wisdom-oriented educational game learning media for fluid material was considered valid based on the content validity assessment.

To provide a more detailed description of the content validity results, the I-CVI values were further examined for each indicator within the assessed aspects. This analysis was conducted to identify the consistency of validator assessments regarding the relevance of each indicator in the learning media. The Material Feasibility aspect is presented in greater detail because it describes the suitability of the material content with the learning objectives and the characteristics of fluid material for Grade XI students. The I-CVI values for each indicator of the Material Feasibility aspect are presented in Figure 5.

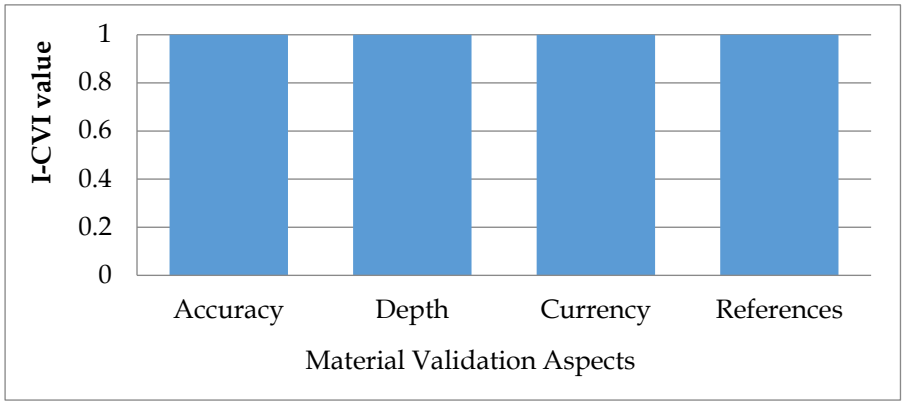

Figure 5. I-CVI Value for Each Material Feasibility Aspect Indicator

Based on Figure 5, all indicators in the Material Feasibility aspect obtained an I-CVI value of 1.00. The assessed indicators included accuracy, depth, currency, and references, indicating that all indicators were considered relevant by the validators. The accuracy indicator shows that the concepts presented in the learning media are appropriate and consistent with the fluid material. The depth indicator indicates that the material is presented in accordance with the learning outcomes targeted for Grade XI students. The currency and references indicators indicate that the information presented is supported by relevant and up-to-date sources. Thus, the Material Feasibility aspect meets the validity criteria and supports the suitability of the learning content presented in the media.

The media display aspect was assessed to determine the suitability of the visual and functional elements presented in the learning media. This aspect covered twelve indicators: Audio Quality (AQ), Audio Comfort (AC), Graphic Quality (GQ), Cultural Visualization (CV), Color Combination (CC), Visual Movement (VM), Language Use (LU), Readability (R), Communication Style (CS), Interactivity (I), Navigation (N), and Aesthetics (A). The assessment was conducted to determine whether the media display supports students in accessing and using the learning activities effectively. The I-CVI values for each indicator of the Media Display aspect are presented in Figure 6.

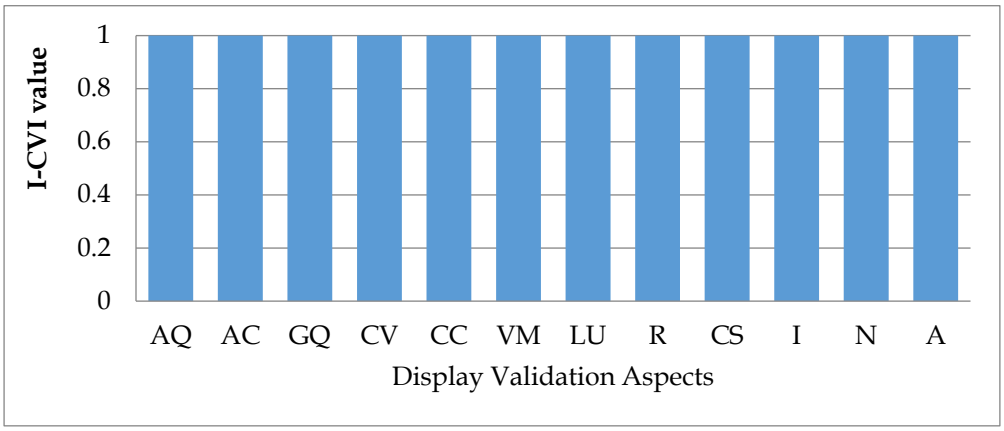

Figure 6. I-CVI Values for Each Media Display Aspect Indicator

Based on Figure 6, all indicators in the Media Display aspect obtained an I-CVI value of 1.00. The assessed indicators included audio quality, user comfort, graphic quality, cultural visualization, color combination, visual movement, language use, readability, communication style, interactivity, navigation, and aesthetics. The results indicate that the visual and functional elements of the media were considered relevant by the validators. The

high I-CVI values indicate that the media provides a clear and readable presentation while maintaining appropriate visual and interactive elements. The navigation and interactivity indicators also indicate that the media components are appropriately designed to support users in accessing the learning activities. Therefore, the Media Display aspect meets the validity criteria.

The Concept Mastery aspect was assessed to determine the suitability of the learning media in supporting students' mastery of physics concepts. This aspect covers indicators related to the learning materials, game activities, evaluation questions, and feedback provided in the media. The assessment was conducted to ensure that the components of the media were aligned with the intended concept mastery indicators. The I-CVI values for each indicator of the Concept Mastery aspect are presented in Figure 7.

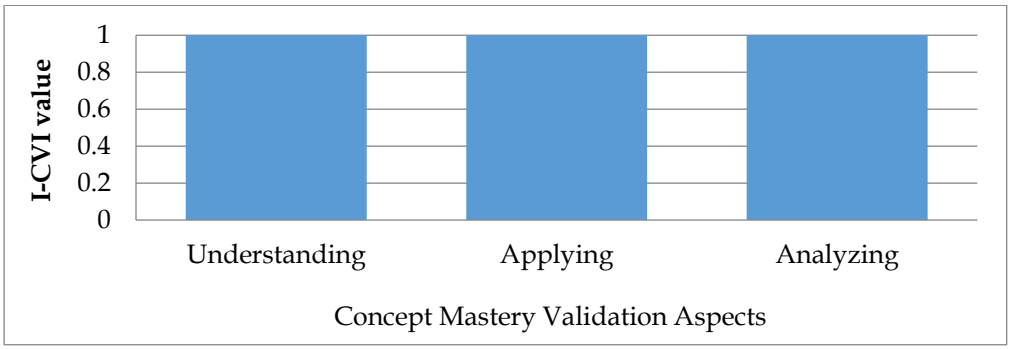

Figure 7. I-CVI Values for Each Concept Mastery Aspect Indicator

Based on Figure 7, all indicators in the Concept Mastery aspect obtained an I-CVI value of 1.00. The assessed indicators included learning materials, game activities, evaluation questions, and feedback provided in the learning media. These results indicate that the components of the media were considered relevant to the indicators of students' concept mastery. The integration of learning materials, game activities, questions, and feedback provides complementary components for presenting and reinforcing fluid concepts. Therefore, the Concept Mastery aspect meets the validity criteria and is appropriate for supporting the intended concept mastery in the learning media.

The Local Wisdom aspect was assessed to determine the suitability of the local wisdom elements integrated into the learning media. The assessment focused on the relevance of local wisdom elements presented through learning materials, illustrations, and game activities. These elements were selected and presented to connect the learning content with contexts familiar to students. The I-CVI values for each indicator of the Local Wisdom aspect are presented in Figure 8.

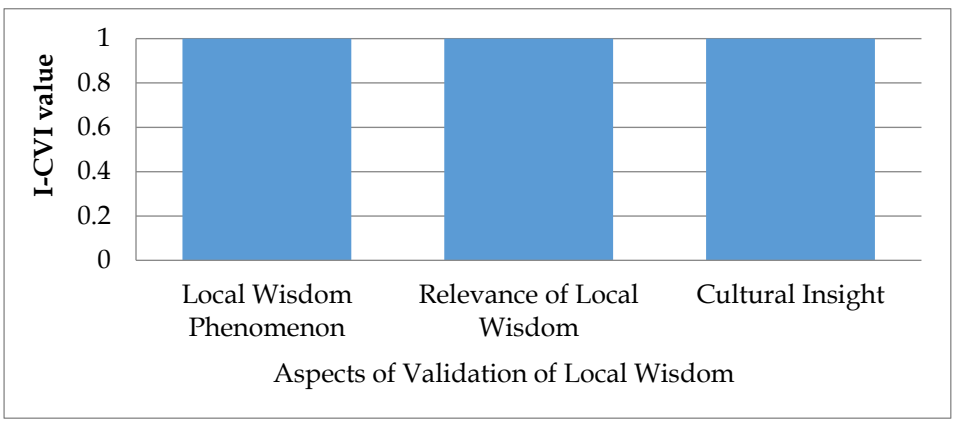

Figure 8. I-CVI Values for Each Local Wisdom Aspect Indicator

Based on Figure 8, all indicators in the Local Wisdom aspect obtained an I-CVI value of 1.00. The results indicate that the local wisdom elements integrated into the learning media were considered relevant by the validators. The integration of local wisdom also supports the presentation of fluid concepts through situations that are closer to the students' cultural and environmental experiences. In this way, local wisdom is not only presented as a visual element but is incorporated into the learning content and activities provided through the media. The consistent I-CVI value across all indicators indicates that the integration of local wisdom meets the relevance criteria established in the validity assessment. Therefore, the Local Wisdom aspect of the learning media meets the validity criteria.

Overall, the validation results show that the local wisdom-oriented educational game learning media meets the validity criteria across all assessed aspects. The S-CVI value of 1.00 indicates complete agreement among the validators regarding the relevance of the assessed indicators. The results across these aspects indicate that the developed media has been assessed not only from the accuracy and suitability of its learning content but also from its presentation, support for concept mastery, and integration of local contexts. The consistency of the validation results across the assessed aspects strengthens the evidence that the components of the media are appropriately aligned with the intended learning objectives. These results provide evidence that the developed media has adequate content validity for use in the subsequent development process. The learning media can therefore proceed to the practicality testing stage after considering the revisions based on validator feedback.

Discussion

The needs analysis revealed that 77% of students experienced difficulties in understanding fluid material, while 70% reported that the learning media used were limited. These findings indicate that the available media have not fully supported students in understanding abstract fluid concepts and relating them to everyday applications. Difficulties in connecting fluid concepts with representations and their applications in everyday life have also been reported in previous studies (Puspita et al., 2019). Students' conceptual understanding of fluid material was also reported to be not yet optimal, indicating the need for learning media that present concepts more meaningfully (Carnesia & Mufit, 2024). Therefore, interactive and contextual learning media are needed to support students' physics conceptual understanding.

The concept analysis showed that Archimedes' Principle obtained the highest score of 60, whereas Bernoulli's Principle obtained the lowest score of 40. The higher score for Archimedes' Principle indicates that this subtopic was relatively better represented in the existing learning process, while the lower score for Bernoulli's Principle suggests a greater need for supporting representations and contextual explanations. This finding is consistent with the characteristics of fluid material, which involves relationships among concepts, mathematical representations, and physical phenomena that may be difficult for students to connect without appropriate representations (Suherly et al., 2023). Previous studies have also reported that students experience conceptual difficulties in understanding fluid concepts, particularly when relating abstract concepts to physical phenomena (Danar et al., 2026). The analysis of learning objectives showed that the Behavior component obtained the highest score of 66.7, whereas the Degree component obtained the lowest score of 20, indicating that the expected student actions were more clearly specified than the expected level of achievement. This finding highlights the importance of aligning learning objectives with learning activities and assessment criteria. The results of the concept analysis also

provided direction for determining the emphasis of the learning content and the types of activities presented in the media. In particular, the lower score obtained for Bernoulli's Principle indicated the need to provide clearer representations and contextual examples so that students could relate the concept to observable fluid phenomena. Based on these findings, the concept and learning objective analyses were used to determine the materials, learning activities, concept mastery indicators, and evaluation components presented in the developed learning media.

The developed media combines educational game elements and local wisdom through materials, illustrations, challenges, questions, and feedback. Interactive learning media can support the presentation of abstract concepts through visualizations and learning activities (Putri et al., 2025; Syafei, 2025). The use of technology in learning can also provide more interactive learning experiences and support student involvement (Wibawanto, 2024). Game elements such as objectives, rules, challenges, and feedback can support student engagement in physics learning (Srimuliyani, 2023). Local wisdom was integrated into the materials, illustrations, and questions to connect fluid concepts with contexts familiar to students, which can make learning more contextual and meaningful (Pilendia, 2024). The integration of these elements was designed to ensure that the game functioned not only as an activity for presenting questions but also as a medium for presenting concepts, contextual situations, and feedback within a single learning environment. The combination of visual representations, game challenges, and local contexts also provides opportunities for students to encounter fluid concepts in situations that are closer to their everyday experiences. In this way, the characteristics of the developed media respond directly to the needs identified during the Define stage. Thus, the combination of educational game elements and local wisdom provides the developed media with an interactive and contextual learning characteristic relevant to the identified needs.

The validation results showed that all assessment aspects, namely material feasibility, media display, concept mastery, and local wisdom, obtained an I-CVI value of 1.00, with an S-CVI value of 1.00. This finding indicates that the developed media met the established content validity criteria. Educational games on fluid material have also been reported to obtain high validity (Muliyati et al., 2021). Game-based learning media have likewise demonstrated high feasibility based on expert validation (Nur'aini & Haryani, 2025). The integration of local wisdom into physics learning media has also been reported to support contextual learning (Fitriah et al., 2025). Unlike these previous studies, which generally developed educational games and local wisdom-based media separately, the present study integrates both approaches into a single medium for fluid material. This integration represents the main contribution of the developed media.

The developed media can serve as an alternative for presenting fluid material in physics learning by integrating educational games, local wisdom, and concept mastery indicators into a single medium. The integration of these components provides a contextual and interactive learning environment for presenting fluid concepts to Grade XI students. The validity results indicate that the developed media meets the established content validity criteria and is suitable for use based on the assessment of the validators. However, this study was limited to analyzing the validity of the developed media and did not examine its practicality or effectiveness in the learning process. Further research is therefore needed to determine the practicality and effectiveness of the media in facilitating students' physics conceptual understanding.

CONCLUSION

This study successfully developed a local wisdom-oriented educational game learning media on fluid material for Grade XI senior high school students using the Four-D (4D) model through the Define, Design, and Develop stages. The developed media integrates educational game elements, local wisdom, and concept mastery indicators into a single learning medium for presenting fluid concepts. The validation results showed an I-CVI value of 1.00 for all assessment aspects, indicating that all assessed indicators were considered relevant by the validators. The overall S-CVI value was also 1.00, indicating that the developed media met the established content validity criteria. These results indicate that the developed media has good content validity in terms of material feasibility, media presentation, concept mastery, and local wisdom integration. The main contribution of this study is the integration of educational game elements and local wisdom into one medium to provide a contextual and interactive presentation of fluid material. Further research is recommended to examine the practicality and effectiveness of the media in facilitating students' physics conceptual understanding.

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