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Designing e-book of Basic Physics Fluid Series Assisted by Virtual Laboratory to Improve Critical Thinking Skills

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ABSTRACT

This study aims to develop the e-book Basic Physics Fluid Series design assisted by virtual laboratory Tracker Video Analysis (TVA) that effectively improves students' critical thinking skills. The method used in this study is Research and Development. The graphic design developed, including illustrations and visual elements, was identified as necessary for improving critical thinking skills. At the same time, practice questions with varying difficulty levels allowed students to apply knowledge. The validation process, including the Content Validity Ratio (CVR) test, underlined high agreement and validity, with suggestions for improvement, including contextual design, material optimization, interactive elements, accessibility considerations, student feedback collection, and curriculum alignment. The test results showed that learning with this e-book effectively improved students' critical thinking skills. The results obtained in the indicator provided a simple explanation, concluding that it shows a high N-gain value. In contrast, several other indicators show moderate values. This e-book design can be a role model for developing similar media, especially related efforts to improve students' Critical Thinking Skills (CTS).

Introduction

In today's education world, fluid physics is a topic that is often challenging to teach, mainly due to the complexity of the concepts and the limited availability of practical learning resources. Many fluid physics materials in existing educational resources fail to facilitate in-depth understanding, especially regarding visualization and practical experiments. As a result, students often struggle to grasp concepts such as viscosity, laminar and turbulent flow, continuity, Torricelli's theorem, and Bernoulli equations. The lack of adequate visual aids and interactive media to illustrate these fluid phenomena can make the concepts feel abstract and complex for students to understand. This dramatically affects students' critical thinking skills. Addressing this issue is crucial because a solid understanding of fluid physics is highly relevant in academic learning and real-world applications. By providing interactive resources and supporting virtual experiments, students can gain meaningful learning experiences, connect theory to real-world phenomena, develop deeper conceptual understanding, and improve critical thinking skills (CTS). One aspect that needs to be explored is related to the learning media used.

Making learning media in the form of basic physics books in the fluid series requires a comprehensive approach that considers various aspects. The book's contents must follow the applicable curriculum, be presented clearly, and use language that is easy to understand to make it easier for students to understand fluid physics concepts. In addition, attractive graphic design, including the use of illustrations, supporting graphics, and good visual presentation, are key factors in facilitating effective

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understanding. In addition, practice questions and assignments that vary in difficulty provide opportunities for students to test their knowledge and apply the concepts they have learned. With a holistic approach like this, creating a series of basic fluid physics books can meet learning needs and become a valuable resource supporting understanding of fluid physics concepts (Habibbulloh et al., 2023).

Lack of alignment with the curriculum can significantly impact student learning outcomes. Several negative consequences can arise when learning materials or media do not match the applicable curriculum. One of the problems that occurs is related to inappropriate content. The book may not align with the relevant curriculum or not suit the target user's level of understanding, resulting in the book's irrelevance to learning needs. Unclearness in the presentation of fluid physics concepts is also a common problem. The book's content may not be able to explain these concepts adequately, making it difficult for learners to understand. Content that is not linked to contextual matters also worsens this, so students feel strange about the concepts presented. Unsupportive graphic design is also noted in reference articles as a problem. Inadequate illustrations, graphs, or pictures can hinder the understanding of fluid physics concepts (Y. Wang et al., 2021). Apart from that, the lack of practice questions and assignments in the fluid series books is a problem that is often found. Lack of practice and evaluation can limit students' ability to test their understanding and apply the concepts they have learned (Poon, 2022.). Finally, fluid series books often face the problem of incompatibility with user needs. Users, such as teachers and students, may have different expectations, and the book must be able to meet them. By understanding and overcoming these problems, developers can take the necessary corrective steps to create learning media that is more appropriate to needs and effectively supports understanding fluid physics concepts (Misbah et al., 2024).

The research conducted by Aji focuses on developing problem-based learning (PBL) based physics learning modules to improve students' ability to solve physics problems. This study found that the PBL-based physics learning module, especially on balance and vibration, effectively enhanced students' ability to solve problems. This improvement was assessed by material experts and physics teachers, who considered this module to be handy and resulted in an increase of 91.7% in students' ability to solve problems (Davidović et al., 2020). Mahayukti also conducts research on the development of problem-based electronic books (e-books) to improve students' critical thinking skills. This e-book module encourages students to address and solve problems independently, providing practical experience in solving issues (Rother, 2024). This research is in line with the development of a website-based PBL model. This PBL e-book model has interactive videos and visual images of physics problems, encouraging critical thinking skills and problem-solving abilities while helping students understand important concepts (Trocaru et al., 2020). This e-book also features formative and summative assessment tools, allowing students to see their progress, express creative ideas, and develop solutions for their projects. Some of these studies provide an overview and emphasize that one way to improve students' CTS is with the help of e-books relevant to students' needs and linked to contextual matters or innovative learning models such as problem-based learning.

The use of learning media in schools is still not optimal, especially in the context of physics subjects. Several significant problems cause this. First, the complexity of physics concepts is difficult for most students to understand (Pratidhina et al., 2020). Second, student interaction and involvement in the learning process are lacking. Third is the existing technology's limitations(Tang et al., 2020). These problems can result in difficulties for students in understanding physics material and achieving good learning outcomes (Zhang et al., 2020). Therefore, teachers and learning media designers need to take an active role in overcoming this problem. This includes selecting appropriate learning media, effectively integrating media with physics learning, and paying attention to holistically integrating learning(Yu et al., 2021).

Nowadays, in the digital age, students increasingly rely on e-books as their primary learning resource. Good e-book design is visually appealing and significantly impacts their critical thinking skills (Dwiki Putri Pratiwi & Noviani, 2019). Good e-book design is essential. It makes it easier for students to understand the material better. With an organized layout, students can easily find the information they need, compare arguments, and evaluate different points of view. Good design helps convey information systematically, which is essential in

analyzing and synthesizing information. Furthermore, it can stimulate active student engagement. Features such as links, quizzes, and discussion forums allow students to explore topics in more depth and discuss them with their peers. This interaction encourages them to question, debate, and explore new ideas. Effective use of visuals, such as graphs, diagrams, and illustrations, can strengthen understanding of complex concepts. Well-designed visuals help students connect information, identify patterns, and make inferences, all of which are integral to critical thinking. In addition, good e-book accessibility allows students with various backgrounds and abilities to access information. Responsive and user-friendly design enhances the learning experience, reduces frustration, and encourages further exploration of relevant material. With collaborative features, students can share thoughts and opinions, learn from each other, and broaden their perspectives. The discussions that emerge from these interactions stimulate critical thinking and help them develop analytical skills. Thus, the importance of good e-book design cannot be overstated. An investment in effective design is an investment in student learning. Through a well-designed e-book, students gain not only knowledge but also critical thinking skills that are essential to facing future challenges.

In dealing with the complexity of physics concepts, teachers and learning media designers must focus on simplifying material and using media that can visualize physics concepts more clearly. In addition, student interaction needs to be increased by using learning methods that encourage active student participation, such as group discussions, experiments, or physics-based projects. Apart from that, the use of technology must also be considered carefully. Teachers and learning media designers must select and develop appropriate technology to support physics learning (Lin et al., 2023). This includes using simulations, interactive software, or online learning platforms that can improve students' critical thinking skills. Integrating learning media with physics learning must be done carefully (Tian et al., 2021). Learning media must be a tool that supports the physics learning process, not a substitute for teachers. Teachers must be essential in directing students to use this media effectively. In addition, physics learning must be integrated holistically so that students can see the relationship between various physics concepts and apply them in real situations. With this careful and integrated approach, it is hoped that learning media in physics learning can be more optimal and students can achieve better learning outcomes. Thus, this research aims to develop an e-book essential physics simulation assisted by a virtual laboratory to improve students' critical thinking skills.

Method

This type of research is Research and Development, a process for developing new products that can be accounted for. The development model used is the ADDIE model, which contains analysis, design, development, implementation, and evaluation. Research on the development of this model is limited to analysis, design, and development, which supports the aim of this research, which is limited to developing learning media for physics e-books in the fluid series assisted by a virtual laboratory that is valid for implementation based on the assessment of the validator team. The first three stages of the ADDIE model aim to ensure that the product being developed has been well designed and developed based on the needs analysis. This provides a strong foundation for ensuring the quality of the design before it is implemented and evaluated.

The analysis stage begins with identifying problems that need to be solved in developing the fluid series physics e-book with the help of a virtual laboratory tracker video analysis. It is essential to understand the challenges and needs that exist in learning physics. The next step is conducting a needs analysis and studying related literature. In needs analysis, it is necessary to understand what pupils and pupils do in the context of physics learning using virtual laboratories and video analysis methods. Literature studies will provide an in-depth understanding of learning approaches, relevant physical theories, and the latest developments in learning technology.

At the e-book requirements design stage, the first step is to prepare a design plan that includes understanding the characteristics of students who will use the e-book, dividing the material into sub-materials, and determining the content that will be included in the e-book. This content includes text, images or graphics, videos, and evaluations. Next, in the transcription stage of the e-book manuscript, the focus is on changing the physics learning material into a clear and easy-to-read manuscript, considering the choice of language and text arrangement. The next stage is determining the e-book instruments, including video analysis, interactive, and evaluation

tools. All of these instruments need to be planned well to support learning objectives. Finally, in digital learning, the e-book container design stage involves creating a website, which includes designing a video analysis web link tracker, selecting a website template, and selecting a hosting website (Fu et al., 2022).

In developing e-book content, the initial step involves inserting material into the e-book, which includes writing the title, writing text using Microsoft Office Word 2019, creating the front and back covers of the e-book, and creating images using Adobe Photoshop and saving in PNG format. Next, the material is presented contextually. Formative evaluation using the description option measures students' understanding and acceptance of the material presented in the e-book. After all the e-book's contents are ready, including text, images, videos, animations, and evaluations, they are packaged into an e-book in print-out form. At the intrinsic or validation stage, the resulting data is evaluated by various parties, including learning media experts, graphic design experts, and physicists, to ensure the quality and effectiveness of e-books in supporting physics learning (Zhao et al., 2021). Next, the trial result data was analyzed descriptively, and the expert validation data was analyzed using the content validity ratio (CVR). According to Wilson, Pan and Schumsky (2012), the CVR value can be calculated using Equation 1.

$$CVR\ Test = \frac{n - \frac{N}{2}}{\frac{N}{2}} \qquad (1)$$

Information
N : Number of panel experts
n : Number of panel experts who said it was appropriate

Learning media is considered eligible for use if the calculated Coefficient of Variation to Range (CVR) value exceeds the critical CVR value, as Wilson, Pan, and Schumdky suggested in 2012. They suggest that in an assessment panel consisting of 5 individuals, the threshold The CVR limit is considered critical when at least four individuals from the panel must provide consent. In other words, learning media is considered adequate if the entire assessment panel (5 individuals) approves. In contrast, if one individual disagrees, then the media still needs to be revised before it is considered eligible for use.

Students were given pre-test and post-test questions consisting of 5 aspects of indicators, according to Ennis (2011), which include several elements: providing simple explanations, determining the basis for decision-making, concluding, providing further explanations, estimating, and combining. Furthermore, from the pre-test and post-test, the N-gain value of the test results was analyzed and categorized based on the five indicators used (Ennis, 2011). The N-gain value category used is based on Cohen (1998). The N-gain score is a measure used to evaluate the increase in students' understanding or critical thinking skills after participating in learning (Cohen, 1998). The N-gain score category is generally divided into three groups:

Low N-gain (0.0 - 0.3): Minimal improvement. This indicates that students experience little or no progress in understanding or skills after learning.
Medium N-gain (0.3 - 0.7): Moderate improvement. Students show quite good progress, indicating that the learning method applied has a positive impact.
High N-gain (0.7 - 1.0): Significant improvement. This indicates that students have experienced substantial progress in their understanding or skills.

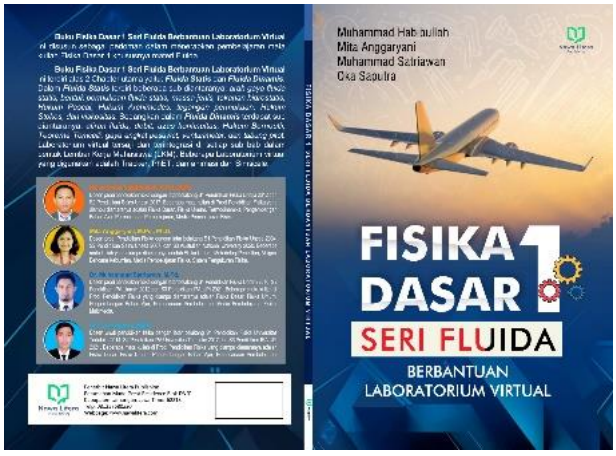
Furthermore, about the application of the developed media that can be applied in class, teachers will use virtual laboratories as part of the learning process to facilitate experiments that are difficult or impractical to do directly in class. This media will be applied in interactive learning sessions, where students can access the virtual laboratory through devices provided by the school or use personal devices if available. The teacher will guide the session with clear instructions and experimental objectives, utilizing the virtual laboratory as a support for the theoretical material that has been delivered. Students can interact directly with the laboratory simulation features through the resulting e-book design, conduct experiments, change variables, and observe the results. This provides a hands-on experience without the safety risks and equipment constraints. The virtual laboratory provided with steps in the e-book also allows students to explore science concepts further, as they can try different experimental configurations without being limited by the availability of physical equipment. After the experiment is completed, the teacher will facilitate a discussion session where students can share their findings, reflections, and understanding of the material. This helps develop critical thinking skills

and deeper understanding. This is also facilitated in the e-book developed

Result and Discussions

Choosing a research topic regarding Torricelli's theorem in the case of a leaking gallon tank with three different hole heights as part of an introductory physics fluid series is an exciting choice for students because of its relevance to daily life, especially in the context of water availability which is essential in students' routines. This study provides opportunities for students to apply Torricelli's theorem in practical situations, investigate hole height variations as a research variable, and develop experimental design and data analysis skills. In addition, this research opens up discussions about water resource conservation and the impact of leaks on water availability, enriching students' understanding of sustainability and the importance of managing water resources efficiently.

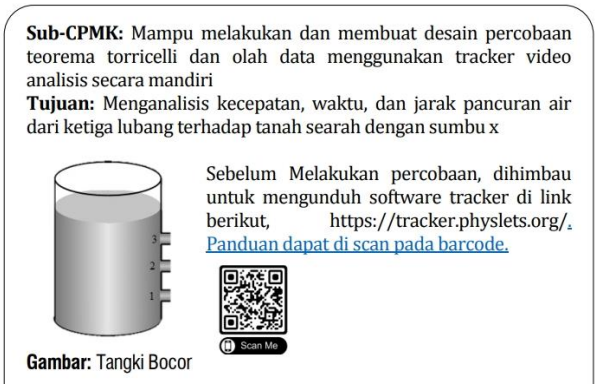
Figure 1
Cover e-Book Basic Physics 1 Fluid Series Assisted by Virtual Laboratory Contains Images That Represent the Application of Fluid Concepts in Daily Life



This e-book, "Basic Physics 1 Fluid Series Assisted by Virtual Laboratory," offers an innovative approach to learning fluid physics using the Tracker Video Analysis (TVA). This e-book not only provides a clear explanation of basic fluid principles, such as Torricelli's theorem and Bernoulli's law but also invites students to engage in practical activities that involve the use of the TVA (Firdaus et al., 2023). Each concept is reinforced with supporting illustrations, and students are invited to observe and analyze the behavior of fluids in real situations, such as water flow through holes of varying heights in a gallon tank (Chen et al., 2021). Through this book, students learn the concepts of fluid physics and develop skills in using the latest technology in physical observations and analysis. It is hoped that with this innovative approach, students will gain a deeper understanding of fluid physics and experience the joy of scientific exploration (Z. Wang et al., 2020).

This e-book design also contains several exciting cases to improve students' CTS responses. One of them is to provide a picture of a leaking hole case. In this case, a Tracker Video Analysis (TVA) link is also provided so that students can investigate further regarding the physics case.

Figure 2
Leaking Gallon Tank Case for Three Holes



In the e-book design, physics phenomena in everyday life are also provided in Figure 3. This section can motivate students to learn the teaching material while stimulating students to provide simple explanations.

Furthermore, in the e-book section, students are also trained to determine the basis for making decisions. Students are taught to think logically when deciding the physical phenomena around them. Figure 4 shows a snippet of training students' critical thinking skills by determining the basis for making decisions. Furthermore, Figure 5 shows that this section invites students to practice critical thinking to conclude the phenomena.

Figure 6 shows the e-book section that trains students' critical thinking skills by providing further explanations. Students are asked to conduct experiments, and then they try to offer additional explanations based on the results of the data analysis obtained.

Figure 3
In The Initial Part of The Explanation of Static Fluids, The Phenomenon of Submarines is Given

FLUIDA STATIS

Gambar 1. Kapal Selam strategis bertenaga nuklir Project 941 kelas Akula Angkatan Laut Rusia Dmitry Donskoy. (www.trenasia.com)

Pernahkan anda bertanya, bagaimana cara kerja kapal selam? Kita tahu bahwa kapal selam terbuat dari logam baja, bagaimana mungkin kapal selam bisa terapung atau melayang di air laut? Pada pembahasan bab Fluida Statis di buku ini anda akan menemukan jawabannya.

Figure 4
The e-book Section that Trains CTS Through Determining the Basis for Decision Making

FISIKA DASAR 1 SERI FLUIDA; Berbantuan Laboratorium Virtual

Gambar 5. Perbandingan ukuran 1 kg besi (kiri) dengan 1 kg Kumpulan bulu (kanan) (sumber : youtube.com)

Berdasarkan gambar di atas, maka pernyataan besi lebih berat dari bulu adalah salah. Yang benar adalah besi lebih padat/rapat daripada bulu. Oleh karena itu besi memiliki massa jenis yang lebih besar dari bulu.

Figure 5
The Part that Trains Students' CTS to Make Conclusions

Mari Berpikir Kritis.

Telur. Fatimah membeli dua butir telur ayam kampung di warung. Setibanya di rumah, ia merebus salah satu telurnya untuk makan siang. Setelah telur direbus matang, Fatimah meletakkan nya di dekat telur mentah dan membiarkannya hingga dingin. Ketika Fatimah akan memakan telur rebus, dia baru sadar terlupa memisah-kannya dengan telur mentah. Fatimah mengalami kesulit-an karena tidak dapat membedakan telur yang matang dengan telur mentah. Kemudian Fatimah menimbang bahwa massa telur tersebut berbeda sekitar 1,2 kg dan 0,5 kg dengan volume keduanya adalah 1 m³. Diletakkan dalam air dengan massa jenis 1 kg/m³. manakah yang tergolong telur yang matang. Karena telur kategori matang adalah telur yang tenggelam?

Penyelesaian

Telur dengan massa 1 kg

$$\rho = \frac{m}{V} = \frac{1.2}{1} = 1{,}2 \text{ kg/m}^3$$

Telur dengan massa 0,5 kg

$$\rho = \frac{m}{V} = \frac{0.5}{1} = 0{,}5 \text{ kg/m}^3$$

Dapat diketahui bahwa $\rho_{air} < \rho_{telur}$, maka telur yang tenggelam dan matang adalah telur dengan massa 1,2 kg.

Figure 6
The Part That Trains Students' CTS to Provide Further Explanations

5. Catat data yang diperoleh dalam tabel yang telah disediakan

Tabel Data Percobaan

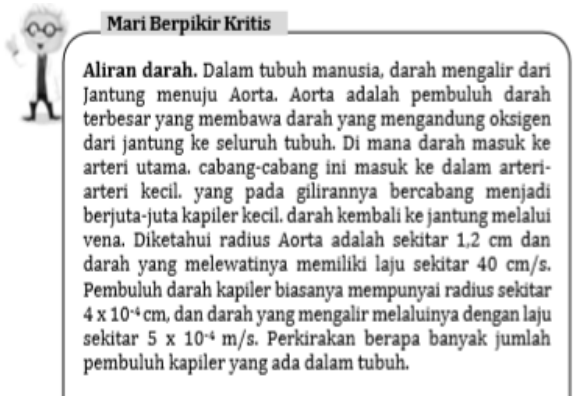
Jenis Benda	Massa Air	Massa Benda	Volume Air	Volume Benda	Massa Jenis Air	Massa Jenis Benda
Alumunium	105600 kg	1 kg 2 kg 3 kg 4 kg	105,60 L	2 L		
Dst.....						

Pertanyaan Analisis. *(Berpikir Kritis)*

1. Faktor apa saja yang mempengaruhi benda dapat tenggelam ? dan jelaskan alasannya !
2. Faktor apa saja yang mempengaruhi benda dapat terapung ? dan jelaskan alasannya !
3. Faktor apa saja yang mempengaruhi benda dapat melayang ? dan jelaskan alasannya !
4. Temukan nilai tetapan massa jenis air dan massa jenis dari keempat benda dalam percobaan lalu bandingkan dengan massa jenis sesuai teori ? apakah sama atau berbeda ? dan jelaskan alasannya.
5. keterkaitan hukum Archimedes dengan dibangunnya piramida mesir ? keadaan manakah yang sesuai? Berikan alasan yang tepat.

Next, Figure 7 shows the part of the e-book that trains students' critical thinking skills through estimation and combining concepts that students have learned with contextual things in everyday life. This section shows how, through the e-book, students are invited to estimate the number of capillaries in the body and combine the concept of continuity with blood flow in the human body.

Figure 7
The Part that Trains Students' CTS to Estimate and Combine



The following are the stages of developing an e-book on fluid topics, which several related experts have validated. The following are validation results by several experts involved in Table 1.

The results of the interpretation of the validation table by several media experts for the CVR (Content Validity Ratio) test show the level of agreement and validity of the indicators in the aspects of application assessment. For the accuracy of using fluid e-books assisted by video analysis trackers, all experts agreed that this indicator was very valid, with a maximum CVR value (7/7). Likewise, in selecting the topic of Torricelli's theorem as a learning medium and a guide to the analysis of Torricelli's theorem on a leaking gallon tank with the help of a video tracker, all indicators get maximum CVR values. However, regarding the aspect "A view of e-book design that has contextual problems as a background," there is a slight difference of opinion among media experts, reflected in the CVR value of 0.9.

Even though it is still considered valid, some experts may have a slightly different view regarding choosing an e-book design that focuses on contextual issues. Furthermore, in the aspect "Feasibility of using e-books for students to improve learning comprehension," one indicator appears to get a slightly higher rating. Low with a CVR of 0.9. This shows some doubts or differences of opinion regarding the appropriateness of using e-books in improving students' learning understanding. Overall, the CVR test results show that most of the indicators in this application aspect were well received by media experts, indicating that the e-book has high validity in supporting fluid physics learning with the help of video analysis trackers (Albattat & Hoteit, 2021).

Table 1
The Results of the Validation Test Use the CVR Assessment

Appraisal Aspects	Values per Indicator	CVR Test Result
Accuracy of using fluid e-books assisted by Tracker Video Analysis (TVA)	7	1
Choosing the topic of Torricelli's theorem to be used as a learning media	7	1
Easy guide for Torricelli's theorem analysis of leaking gallon tanks using the Tracker Video Analysis (TVA)	7	1
A view of e-book design that has contextual problems as a background	6	0.9
Feasibility of using e-books for Student students to improve learning comprehension	6	0.9

Based on the CVR test results by a team of experts, it can be suggested that this learning media has received high approval and is considered valid to support fluid physics learning. However, several suggestions may need to be considered to improve the quality of learning media. First, in developing context in e-book design, the indicator "A view of e-book design that has contextual problems as a background" is still considered valid. Still, it might be worth considering further developing or clarifying the context of the contextual problem (Piechowiak et al., 2021). This can help improve student understanding and ensure the problem context supports learning.

Furthermore, in optimizing material that improves understanding, one indicator in the aspect "Feasibility of using e-book for students to improve learning comprehension" received a slightly lower rating. Therefore, it is recommended that further review of the material be conducted to ensure that the content can effectively improve student understanding. In

addition, interactive elements in learning materials also need to be considered to increase student engagement, such as using simulations, interactive exercises, or reflection questions that can help students apply Torricelli's theorem more actively.

Ensuring that students with different levels of technology availability can access and understand this learning media is an essential step by ensuring that tracker analysis videos can be accessed easily or provide suitable alternatives if access to technology is limited. Furthermore, collecting feedback from students regarding using these learning media is essential, as students can provide valuable perspectives regarding how much the press supports their understanding and provide constructive suggestions for improvement. Lastly, ensuring that the content of this learning media follows the applicable curriculum is critical to ensuring that the material taught is relevant and can support achieving the desired learning objectives. By considering these suggestions, learning media development can be further optimized to support students' understanding of fluid physics using a video analysis tracker (Agamawi et al., 2021).

The students' CTS test results consisting of a pre-test and post-test, which were then analyzed using the N-gain value based on the critical thinking indicator aspects, were obtained in Figure 8.

Figure 8
N-Gain Value of Students' CTS Based on Pre-Test and Post-Test; and Classified Into 5 Indicators

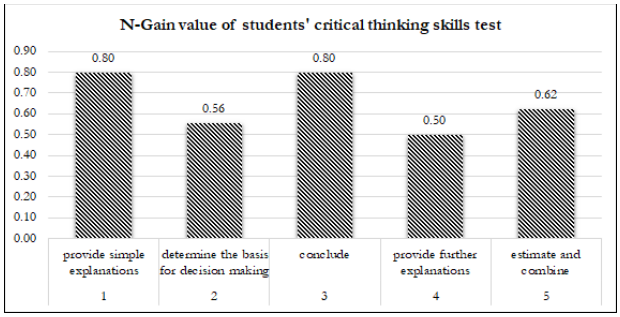


Figure 8 shows the N-gain values for five indicators of critical thinking skills based on the test results. The following is an analysis of each indicator of critical thinking skills. In the Provide Simple Explanations section, the N-gain value is 0.80. This shows that students have a significant increase in their ability to provide simple explanations after being given learning with the Basic Physics Fluid Series e-book assisted by Virtual Lab. This increase is included in the high category, which means that the learning intervention has improved students' basic understanding of the concepts taught. In the Determine the Basis for Decision-Making indicator, the N-gain value is 0.56. This skill improvement is in the moderate category. This shows that although students can determine the basis for making decisions, they still need further reinforcement to achieve optimal abilities. This may be related to challenges in applying concepts to real situations or determining logical arguments.

In the Conclude indicator, the N-gain value is 0.80. Like the first indicator, students' ability to draw conclusions has increased significantly. This shows that students can organize the information provided and make decisions based on the available information well. In the Provide Further Explanations indicator, the N-gain value is 0.50. This value indicates a moderate increase. Students still have difficulty developing more complex or in-depth explanations. This shows that their ability to explore further topics still needs improvement. In the Estimate and Combine indicator, the N-gain value is 0.62. This value is included in the moderate category. This means that students can combine various information and make estimates, but there is still room for improvement. This could indicate that they need more practice synthesizing information and evaluating multiple possibilities before deciding.

Figure 8 shows that overall, students have improved their critical thinking skills after learning with the Basic Physics Fluid Series e-book assisted by Virtual Lab. The Provide Simple Explanations and Conclude indicators are the ones that have experienced the highest improvement, indicating that students are better at providing essential explanations and drawing conclusions. The lowest N-gain was obtained in the indicator of offering further explanation. This can be used to reflect that when the design was made, a stimulus was needed to encourage students to be more reliable in providing further explanations. However, in the Provide Further Explanations indicator, students' abilities still need to be developed to improve in-depth understanding and more comprehensive argument delivery.

Conclusions

Design of Learning media in the form of e-books assisted by virtual laboratory TVA for essential physics learning of fluid series shows positive results compared with expert research. High support from the expert team, in line with previous research findings, and high validity according to the CVR test. However, it is essential to consider the suggestions put forward by experts, especially regarding improving interactive aspects and aesthetic elements in learning media. This learning media has achieved a

good level of agreement and validity, and there is room for improvement in the media's quality, student engagement, and visual appeal. Further development and adjustment according to expert feedback and student needs can bring this learning media towards an optimal balance between effectiveness and visual appeal. The results of the critical thinking skills test (CTS Pre-test and Post-test) show that the Basic Physics Fluid Series e-book media assisted by this virtual laboratory is efficacious in improving students' CTS. One of the exciting things is that the design of this e-book can significantly enhance the CTS of students who initially remarkably could not provide straightforward explanations. With the use of this e-book, the ability has increased sharply. However, considering the limited research samples, this must also be tested in-depth.

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