# Development of e-Module Using Problem-Based Learning Model Assisted by Heyzine Flipbook on Static Fluid Topic for Senior High School Students

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***Abstract*** *- This study aims to develop a valid and practical problem-based learning e-module using Heyzine Flipbook to enhance student understanding of static fluid concepts. This study employed the Research and Development (R&D) methodology using the 4D Model. The participants included expert validators, consisting of media experts, material experts, practitioners, and fifty eleventh-grade students from various high schools. Data were collected through validation instruments and student response questionnaires, and the results were analyzed descriptively. The findings revealed that the developed e-Module fulfilled the criteria of being highly valid and practical. Media expert validation achieved an average score of 85%, while material expert validation obtained a score of 83.5%, indicating that the e-Module is suitable for use. Student responses to the e-Module were overwhelmingly positive, with a practicality score of 88%. This study suggests that PBL-based e-Modules can serve as an effective alternative learning medium to promote interactive learning and enhance the quality of physics education. Future research should focus on evaluating the effectiveness of this e-Module on a larger scale and further exploring its application in teaching static fluid concepts.*

***Keywords****: e-Module; Problem Based Learning; Physics learning; High quality education*

## INTRODUCTION

Physics is a branch of science that plays an important role in everyday life, especially in the development of Science and Technology (Sidik & Kartika 2020). The development of digital technology has brought significant transformation to the world of education, including physics learning. Physics learning is closely related to the problem-solving process, where almost all aspects require solving problems in practice and theory (Tari & Kamaluddin, 2023).

However, students think physics is a difficult subject because of its characteristics, which are understanding the material, interest in physics subjects, and the teaching methods (Adam, 2023; Azizah, 2015). Furthermore, Static fluid, one of the physics topics, is also still considered difficult by students (Sofiuddin et al., 2018). On the other hand, Static fluid topic teaches students to think critically, identify and solve problems using relevant theories and concepts in everyday life (Datur, 2017). Therefore, it is important to tackle this issue to help students learning static fluid more easily.

To help students, developing teaching materials is a crucial effort to improve the quality of learning (Panoreka et al., 2022; Yachod et al., 2024). Therefore, various efforts have been made to develop teaching materials and learning media using Information and Communication Technology (ICT) in physics learning (Solihudin, 2018).

One of the media frequently developed is interactive e-Modules (Wulandari et al., 2022). It is because e-Modules can be used as learning media by the teacher and can also be used independently by students (Shobrina et al., 2020). Furthermore, e-module allows students to complete activities can be

accessed anywhere, anytime, so that the delivery process to the teacher becomes easier (Ajri & Diyana, 2023; Yachod et al., 2024).

However, the availability of e-Modules that integrate problem-based learning (PBL) models is still limited, even though the PBL approach has proven effective in training critical thinking skills and contextual problem solving through several stages from identifying daily life issues to analyzing and evaluating the problem-solving process (Windari & Yanti, 2021). In addition, the PBL model can also be applied by utilizing learning media in the form of learning media in the form of electronic modules (Sari et al., 2019; Kartini, 2023). It is important to consider this model because according to Putri et al., (2020), the learning process carried out by teachers still tends to prioritize a teacher-centered approach.

Furthermore, the use of appropriate software can help the student learning easier and joyfully. However, the use of innovative software such as Heyzine Flipbook is still limited. Heyzine Flipbook is an interactive learning media that is easy to access and use, and can display materials in the form of animations, videos, audio, and images through a browser, making learning more interesting (Kismawati et al., 2022). Heyzine Flipbook also offers various advantages, such as high interactivity with page animations that resemble printed books (Anggreni & Sari, 2022).

In addition, Heyzine's user-friendly interface makes it easy for teachers and developers to create learning content quickly and efficiently. The web-based Heyzine Flipbook supports the creation of e-modules, transforming PDF files into digital books, catalogs, or magazines that can be accessed via smartphones or PCs, thus providing convenience and flexibility to load various information (Ashari, 2024).

Furthermore, this study investigates the advantages of developing the e-module using the Problem-Based Learning (PBL) model to improve students' problem-solving abilities. In addition, the e-module is equipped with PBL-based questions to encourage students to think critically with the advantages of Heyzine Flipbook in fluid static topic. The e-module has great potential to increase visual appeal, interactivity, and student accessibility. However, research that integrates this technology into PBL-based e-modules for physics learning, particularly on static fluid topics, remains limited.

Based on this background, research was carried out with the title "Development of a Problem Based Learning e-Module assisted by Heyzine flipbook Static fluid material." This research aims to produce an e-Module based on a PBL model on static fluid material that is valid, practical and effective in improving students' conceptual understanding and problem-solving abilities.

## RESEARCH METHODS

The research used the Research and Development (R&D) method. This research developed by Thiagarajan employed a 4D development model which consists of four stages, namely the definition, design and development, and dissemination stages. However, this research is limited to the development stage because the main focus is on the development process. Meanwhile, dissemination will be evaluated in other research (Panoreka et al., 2022).


**Figure 1.** The development procedure used

The product developed is an e-module problem-based learning on static fluid

material with the help of Heyzine flipbook. The stages of problem-based learning include orienting students while studying, organizing students while studying, guiding individual and group investigations, developing and presenting results, analyzing and evaluating the process and results of problem solving (Putri et al., 2022). Validity testing is carried out using an expert judgment sheet with 4 criteria. The assessment criteria for research instruments can be seen in table 1.

**Table 1.** Criteria for expert assessment of research instruments

| Criteria | Score |
|---|---|
| Very Suitable (VS) | 4 |
| Compliant (C) | 3 |
| Not Conforming (NC) | 2 |
| Very Inappropriate (VI) | 1 |

Ramadayanti, (2021)

The validation data is then analyzed using equations

$$P = \frac{\Sigma X}{\Sigma Xi} \times 100\% \quad (1)$$

Description:

$P =$ Percentage of each criterion

$\Sigma X =$ Scores obtained from each aspect

$\Sigma Xi =$ Maximum score of each aspect

After a percentage score is obtained, the percentages of validation are categorized in Table 2.

**Table 2.** Percentage of Valid Scores

| Score | Category |
|---|---|
| 0% - 20% | Very invalid |
| 21% - 40% | Invalid |
| 41% - 60% | Fairly Valid |
| 61% - 80% | Valid |
| 81% - 100% | Very Valid |

Akhzami (2024)

Furthermore, the practicality data are categorized into Table 3.

**Table 3.** Percentage of Practicality Score

| Score | Category |
|---|---|
| 0% - 20% | Impractical |
| 21% - 40% | Less practical |
| 41% - 60% | Fairly practical |
| 61% - 80% | Practical |
| 81% - 100% | Very practical |

(Nada, 2024).

## RESULTS AND DISCUSSION

### Define

At the Define stage, a series of analyzes were carried out to determine the need for developing the Problem-based Learning e-module on static fluid material. The defining activities include: preliminary study, objective specification, and concept analysis (Erlangga, 2022). At this stage, a needs analysis and determination of learning objectives were carried out. The needs analysis was obtained through interviews with physics teachers regarding teaching methods, student learning interests, and the teaching materials used. The results of the interviews showed that the learning process was dominated by the use of thick printed books and LKS, while teachers more often took an active role in teaching and learning activities. In addition, the delivery of physics material tends to use the lecture method, which results in students being less actively involved in learning.

Based on the results of the observation, the researcher tried to implement a learning model that could actively involve students and reduce dependence on teachers as the center of learning. One alternative is to utilize learning media in the form of e-modules based on Problem-Based Learning. According to Kertinus et al., (2019) Problem-based learning is a learning model that makes students actively involved in the learning process. Thus, problem-based learning greatly influences the ability to understand concepts and problem-solving abilities. According to Hidayatullah (2020) the PBL model is designed by providing

problems that require students to obtain important knowledge so that students become proficient in solving problems, have their learning strategies, and have the ability to participate in teams.

The Problem-Based Learning (PBL) model is an approach that actively involves students in solving real problems. Physics, as a subject that studies natural phenomena related to everyday life, is closely related to problem solving, so that it can train students to think critically in finding solutions to various life problem situations (Dwikoranto, 2023). Furthermore, the analysis of learning objectives is carried out by referring to the curriculum, basic competencies (KD), syllabus, and curriculum applied in schools.

**Design**

At the design stage, a number of activities were carried out, such as preparing reference tests, selecting media, selecting formats, as well as the initial design of e-Modules based on Problem-Based Learning. The purpose of preparing the reference test is to produce an instrument for assessing the feasibility of the designed e-module. The instrument includes a validation sheet used to assess the level of validity of the e-module. The design process involved preparing a systematic framework for developing interactive learning media using the Heyzine Flipbook platform, with a focus on Static Fluid material.

This e-Module development utilizes various applications, such as Canva, Heyzine Flipbook, and Google Forms. Canva is used to design e-modules by utilizing its easy-to-operate features. Furthermore, to make it easier to access evaluation questions in the e-Module, Google Forms is used. After the e-Module has been created, Heyzine Flipbook is used as a medium for distributing and accessing the e-Module digitally, with the output being a link that can be opened via a browser such as Google Chrome, which can be accessed at any time via a smartphone or PC.

This e-Module development utilizes three main applications, namely Canva, Heyzine Flipbook, and Google Forms. Canva was chosen as a graphic design tool for designing e-Modules by utilizing various templates and creative features available, considering its ease of use, which is suitable for beginners. Apart from that, Google Forms is integrated into the e-Module as a digital-based evaluation medium. Once the e-Module design is complete, Heyzine Flipbook is used as a digital distribution platform to convert the design results into an interactive format that can be accessed online. The output from Heyzine Flipbook is a unique link that can be opened via a web browser such as Chrome or Firefox, which allows users to access e-Modules on smartphones, tablets, or computers without location restrictions. The combination of these three applications guarantees easy accessibility, interactivity, and efficiency.

According to Saprudin et al., (2021) Technological advances, especially in software development, which are increasingly rapid and easily accessible, allow learning modules to be designed in electronic form (e-Modules). This e-Module can integrate various elements such as text, images, videos, simulations, animations, quizzes, and evaluations interactively so that students can interact more actively with the program that has been designed. e-Modules can also be used repeatedly anytime and anywhere, so that when material is not yet understood, students can study it again with the help of the learning videos presented (Waruwu et al., 2024).

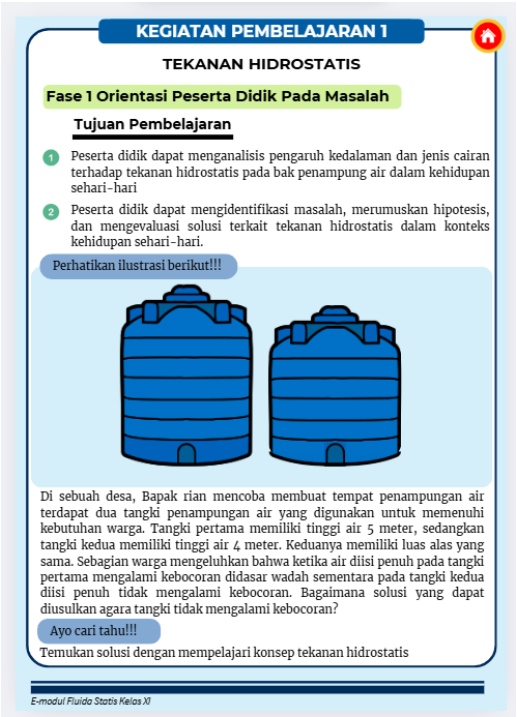


**Figure 2.** orientation to the problem

Figure 2. Stages of the PBL e-Module assisted by Heyzine flipbook in Phase 1, namely, orienting students to the problem. This stage aims to introduce students to a real problem. In this stage, students are encouraged to analyze the problem, propose initial hypotheses, and begin evaluating basic concepts related to the material.

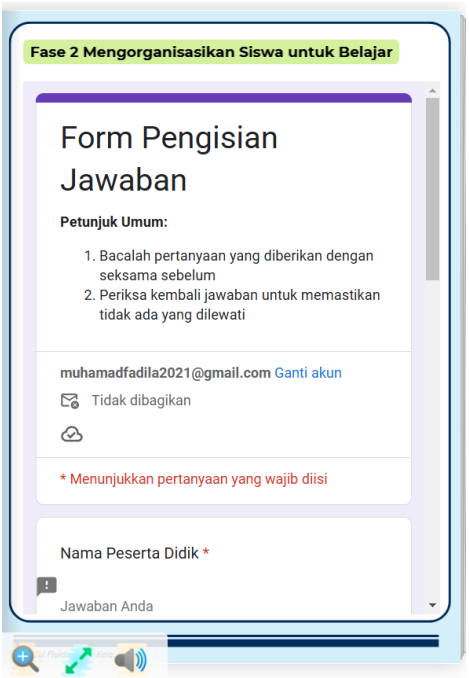


**Figure 3.** Organizing students to learn

Figure 3 indicates Phase 2 of PBL, namely organizing students to learn. In this phase, students are directed to continue to Phase 2, working on questions provided in the answer form using Google Forms, which is designed to facilitate data collection and provide an interactive and independent learning experience. In addition, there are learning materials and videos that can be accessed in the e-Module that has been created.

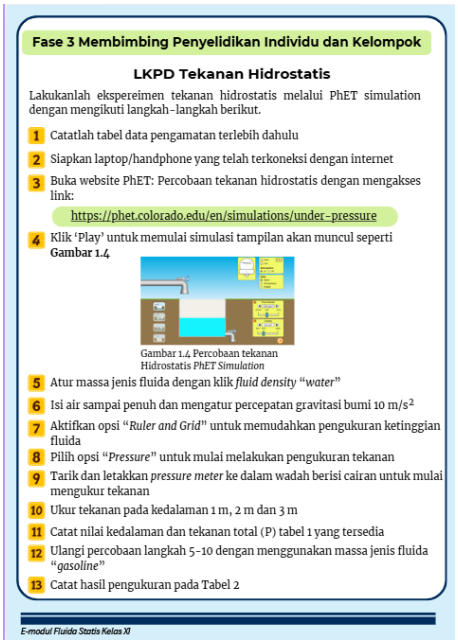


**Figure 4.** Individual and group investigations

Figure 4 shows the third stage of the Problem-Based Learning (PBL) model, namely guiding individual and group investigations, which is applied through interactive experimental activities using PhET simulations on static fluid materials. Students are directed to carry out investigations independently or in groups using structured steps. This module provides a guide for accessing simulations on the PhET Simulation site. Students are invited to record observation data in the provided tables. Therefore, the students can compare various data based on the experiment. This approach not only improves students' inquiry skills but also facilitates experiment-

based learning relevant to real physics concepts.

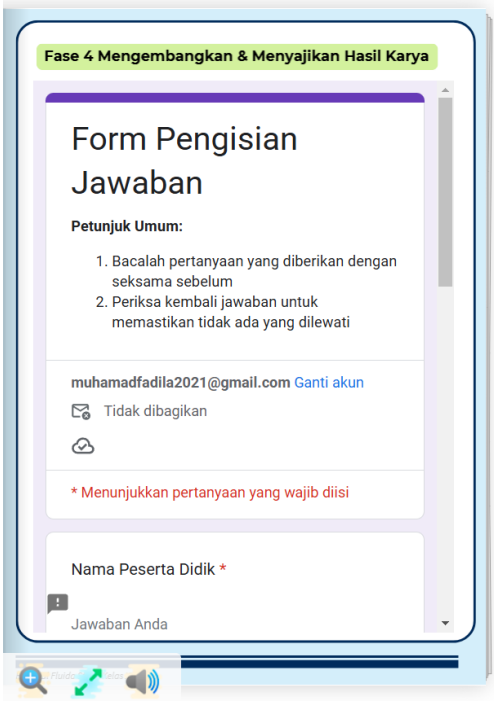


**Figure 5.** Developing and presenting results

Figure 5 shows the fourth stage of PBL, namely developing and presenting the results of the work, which is implemented through a Google form. It is designed to facilitate students in organizing and presenting the results of investigations. The included general instructions help students understand the procedures for filling in and ensure their answers are complete and accurate. With this format, students can compile reports on experimental or analytical results systematically and present them in a form that is easily accessible to educators. The digital approach not only improves students' technical skills in using technology but also supports an interactive and organized learning process.

Figure 6 shows the fifth stage of the Problem-Based Learning (PBL) model, namely, analyzing and evaluating problems, students are directed to solve practice questions. This stage is designed to improve students' analytical skills in applying the concepts they have learned to real situations. The module also provides links for collecting answers, making it easier for students to submit the results of their analysis online. This approach aims to improve students' skills in solving problems while validating their understanding of the material studied.

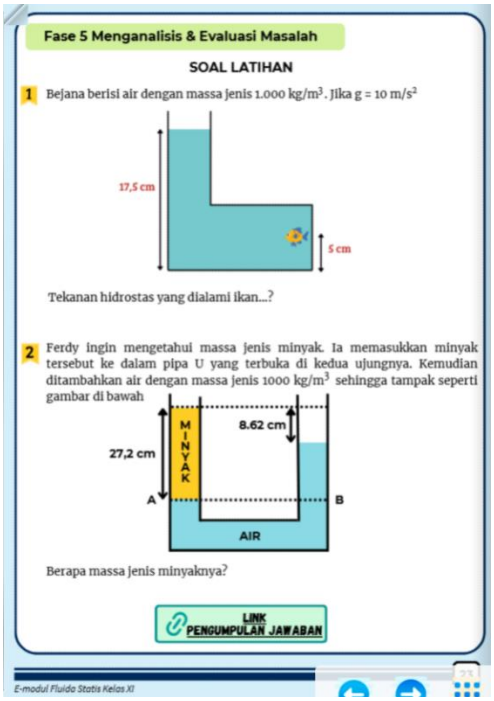


**Figure 6.** analyzes and evaluates solutions

## Develop

The validation stage is carried out by material expert validators. The practical tests are carried out by teachers and students.

**Table 4.** Results of Material Expert Validation

| No | Aspect | Expert Assessment | Category |
|---|---|---|---|
| 1 | Material/ content | 87% | Very Valid |
| 2 | Presentation | 80% | Very Valid |
| | Average | 83,5% | Very Valid |

Based on Table 4. The material expert validation results for the e-Module that has been developed are in the Very Valid category with an average percentage of 83.5%.

**Table 5.** Media Expert Validation Results

| No | Aspect | Expert Assessment | Category |
|---|---|---|---|
| 1 | Language | 83% | Very Valid |
| 2 | Graphical | 87% | Very Valid |
| | Average | 85% | Very Valid |

Table 5 indicates an average value of 85%, which is in the very valid category. Furthermore, the modules can be categorized very well by validation indicators. Thereby producing effective electronic teaching materials for independent learning, increasing students' abilities and knowledge (Purwaningsih et al., 2023). This is in line with the Previous research results show that using applications such as Flip PDF Professional produces valid e-Modules (Sriwahyuni et al., 2019).

**Table 6.** Practicality Test Results

| Test Name | Average rating | Category |
|---|---|---|
| Teacher Practicality | 84% | Very practical |
| Students' practicality | 88% | Very practical |

In addition, Table 6 shows that the module is very practical. Both teachers and students indicated positive responses to the module. The participants gave positive comments and input, including that e-Modules are very helpful for students as additional teaching materials outside of school, because they can be accessed online.

The practicality of the e-Module is obtained from the student response questionnaire after the learning process is complete. Students are asked to fill out a questionnaire according to their respective opinions based on the experiences they have had during learning activities using e-Modules. As for the results of the e-Module practical test, students obtained a score of 88%. So it can be said that the e-Module produced is very practical because of the advantages that the e-Module has. Time efficiency in learning can also be realized because e-Modules are flexible, allowing students to learn independently anywhere, and are easy to carry. In line with what Suharsono (2018) in Muzijah (2020) stated that e-Modules are electronic-based learning materials designed to make it easier for students to understand lesson content independently without relying on direct guidance. Heyzine Flipbook-based PBL e-module is able to present an interactive learning experience equipped with features such as animation, multimedia integration, and its accessibility supports various student learning styles, both visual, auditory, and kinesthetic. With this approach, students can be more actively involved, increase learning motivation, problem-solving skills in everyday life. This finding is in line with research conducted by Tullah et al., (2025) where the use of Heyzine Flipbook can improve critical thinking and collaboration skills of students with the topic of Static Fluid material.

## CONCLUSION

Based on the results of research conducted regarding the development of a PBL-based physics e-Module with the help of Heyzine flipbook on static fluid material, the following conclusions were obtained: 1) The PBL-based electronics physics module developed in this research by media experts was categorized as very valid by obtaining an average score of 85%, while the average assessment of material experts was 83.5%. From the data results it can be concluded that the module developed is very valid and worth testing. 2) According to students who have become research subjects, the Heyzine flipbook-based PBL e-Module is categorized as very practical, which can be seen in the score of 88% positive responses

from students. Meanwhile, the teacher's response received a score of 84% in the very, very practical category. This shows that this e-Module should be used by students. Although the results of the study indicate that the PBL-based physics e-module assisted by Heyzine Flipbook on the static fluid material is very valid and practical, this study has several limitations. One of the limitations is that the effectiveness of the e-module has not been tested in significantly improving student learning outcomes. Therefore, further research is highly recommended to test the effectiveness of a large-scale measurement of learning outcomes in classroom learning.

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