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Development of Learning Media Moodle-Based on Static Fluids

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Abstract: The purpose of this study was to develop a physics learning media Moodle-based with a scientific approach to static fluid that is feasible to use in the learning process. Previous research found that the media developed did not contain simulations which are very necessary in learning physics. Therefore, it is necessary to develop media that supports simulating physics practicums, especially in static fluids, and interactive. This study used the research and development (RnD) method, with the model ADDIE. However, because the goal was only to get the feasibility of the media, the steps were limited to three stages, which were Analyze, Design, and Development. This media is equipped with simulations using PhET and another Virtual Laboratory which can be accessed online through belajarsains-uns.com. The result is that the physics learning media Moodle-based on static fluids was successfully developed with very good criteria based on the assessments from expert validators, peer reviewers, and reviewers around 1364 of 1476. Meanwhile, during trials, some errors are found in the spelling of sentences. After revising, an increased score of the pre-test and post-test showed that learning media was effectively used and the questionnaire result met very good criteria, 5728 of 6840.

Keywords: Learning media; Moodle; Static fluids

Introduction

Everyone has the right to get proper education so the government continues to improve the quality of education both at the primary and secondary levels. The quality of education determines the quality of graduates who aim to obtain quality human resources (Alifah, 2021). In Indonesia, one of the government's efforts to improve human resources is carried out by promoting 12-year compulsory education (Lestari, 2018). The role of technology is to realize the right of Indonesian citizens to get access to proper education in a more equitable manner which previously could not be achieved conventionally (Suhada, 2017).

In education, the result of the rapid development of science is the development of technology (Lestari, 2018). According to Tondeur et al. education utilizes digital technology to support learning as a tool to access information and support learning activities (Selwyn, 2011). Preparation of learning media by utilizing technology can attract students' interest so it is very effective and efficient for success in achieving learning goals (Lestari, 2018). In addition, according to Unik and Niar (2021), the role of technology in developing learning media is that technology can build collaborative communication between teachers, students, and learning resources. This development makes students responsible for learning and improves independent and interdependent learning skills (Priyakanth et al., 2021). However, the implementation of instructional media is still rarely applied in teaching and learning activities, one of which is in learning physics. In SMAN 1 Surakarta, several media are used in the learning process such as printed books provided by the school library, media presentations using PowerPoint, and learning videos accessed via YouTube. The learning media used is only one way and has not utilized interactive learning media.

Learning media makes it easier for teachers to present real information to students (Zulhafizh, 2021). With the development of technology, the Internet can be used as a learning medium in the form of web learning

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and e-learning (Lestari, 2018; Sumarwati et al., 2020). With the internet, students can access the information sources needed for learning activities comfortably in terms of time and place using supported devices such as laptops or smartphones (Fitria et al., 2023). According to Suminar (2019), Indriana et al. (2023), and Cholik (2017), the benefits of technology in developing learning media are improving the quality of student learning outcomes after using media and learning systems that are more active so that the learning atmosphere becomes more meaningful. Teachers become more productive by creating interactive e-learning courses that contain all the necessary teaching aids and support, as well as tests that can be applied in the classroom (Krasnova & Shurygin, 2019).

E-learning is an information and communication technology that can build student enthusiasm for learning anytime and anywhere (Fauzi, 2020). One of the e-learning platforms is the Learning Management System (LMS) which automates and describes the teaching and learning process through electronic media (Anggriawan, 2019). A learning management system is a web-based application consisting of a server that provides basic functions and a user interface that is accessed by people to organize and manage the course of knowledge transfer and present certain materials (Bojiah, 2022; Turnbull et al., 2020). The use of electronic learning media can facilitate teachers in developing learning concepts that are more systematic, and directed, and have effective results to make learning in schools more quality and meaningful. E-learning can contain multimedia content that presents teaching materials that are more interesting and easy to disseminate (Setianingrum et al., 2022).

Moodle is a Learning Management System and stands for "Modular Object-Oriented Dynamic Learning Environment", a software package designed to help educators create quality online learning (Suartama et al., 2019). Moodle is an e-learning system designed to support learning activities (online courses), and learning materials, and provide interactive activities including forums, wikis, assignments, surveys or quizzes, lessons, chats, and peer-to-peer activities (Al-Fraihat et al., 2020; Schweighofer et al., 2019; Sulistyorini & Anistyasari, 2020). Moodle has many options for testing that include drag and drop, calculation, multiple choice, and numerical tasks (Khatser & Khatser, 2022). There is also a forum feature for discussion that supports interaction between teachers and students, as well as between students so that learning is more interactive. Moodle helps students assimilate the information provided and develop skills in personalizing the virtual educational environment (Gomez et al., 2022). As a learning platform, Moodle is designed to provide educators, administrators, and students with a powerful, secure, and integrated system for creating customized learning environments (Anggraeni & Sole, 2022). Moodle implements student-centered learning, which encourages students to actively participate in learning activities. Research has proven that using Moodle LMS can improve learning outside the classroom and have a positive influence on students thinking and innovation abilities (Chootongchai & Songkram, 2018; Ismawati & Marwiyah, 2022; Lakoriha et al., 2018). In the needs analysis, it was found that the use of learning media in schools was not maximal in utilizing technological developments such as the use of PowerPoint and printed books as well as animated videos via YouTube. Therefore, it is necessary to develop learning media that optimally utilize technological developments.

Research on the development of Moodle-based learning media has been conducted by Setiyorini et al. (2017) with the title "Development of Moodle Learning Media". The media in this study contained descriptions of temperature and heat in various file formats (word, PDF, PPT, and SWF), simulations, and material that could be linked to other websites. The results of this study show that the developed media obtains an average score of 86.8175% in the very appropriate category as a learning medium based on the assessments of experts, practitioners, and respondents. The research carried out has not yet reached the stage of measuring understanding with evaluation questions but is only limited to decomposing and presenting the content of temperature and heat to students. Another study entitled "Development of Moodle Learning Management System (LMS) Learning Media on Building Space Materials" was conducted by Eja Rahmada Pratama (2018). The results of the research show that the learning media developed are suitable for use and contain learning materials, questions, and chat forums. However, the research conducted by Eja Pratama only contained several features for delivering questions, learning materials, and a discussion forum. The research entitled "Development of E-Learning Media with Moodle as a Supplement to Learning Physics Concepts of Work and Energy" was conducted by Wulan Diah Puspitasari (2018) and included media content in the form of pictures and videos that had to be downloaded before being used as learning resources.

In competency-based learning, which was later developed into the 2013 curriculum that combines attitudes, skills, and knowledge, the Ministry advised that a scientific approach be applied to create interactive learning (Pahrudin & Pratiwi, 2019). The scientific approach is a learning process that is structured so that students can actively construct concepts, laws, or principles through the stages of observing, asking, trying, processing data, presenting data, and then analyzing and drawing conclusions (Alamsyah, 2016).

Learning in the scientific process is a learning process that requires students to think scientifically (structured and critically) to solve a problem whose solution is implied (Barringer et al., 2010). The implementation of a scientific approach is to assist teachers in providing a forum for developing students' self-potential which can help students obtain maximum learning outcomes through more varied learning activities (Siahaan & Pane, 2021). Based on the results of the analysis of needs in schools, it was found that few learning media applied a scientific approach to learning. This makes students' scientific thinking processes not optimally honed so it is necessary to develop competency-based learning media that apply a scientific approach to the learning process.

Many concepts of physics are applied in life, educators must be able to make students not only memorize and know about these concepts but also make students able to understand and connect these concepts with real life (Fauza et al., 2023; Herayanti et al., 2022; Nurhaisa et al., 2023). Harefa (2019) said that the application of the concept of physics in life is the concept of optics and light such as the use of concave lenses for people with nearsightedness (myopia) and convex lenses for people with farsightedness (hyperopia). The utilization of other physics concepts in measurement activities is the use of rulers and calipers. Physics is a branch of science that underlies the development of science and technology and is part of science that examines natural phenomena physically through scientific stages (Darwis, 2018; Maghfiroh et al., 2023). This scientific process reflects the application of a scientific approach in physics learning activities. This makes physics important to be learned by students, especially at the high school level.

Physics is considered one of the subjects that are quite difficult and challenging for students (Azizah et al., 2015; Basri & Akhmad, 2022; Santoso, 2017). Static fluid is one of the materials in physics that is difficult to understand which causes students' mastery of concepts (Dyah et al., 2019). Some of the reasons for developing Moodle-based learning media on static fluid material are that learning is still teacher-centered, lack of use of varied models in the learning process, students tend to be required to sharpen memory aspects without being invited to think, there are no activities that contextualize teaching materials, low interaction between students, and also teachers give assignments without giving examples first while there are too many sub-materials that must be studied (Nurmayani et al., 2018; Pamungkas et al., 2017). Apart from that, low student learning motivation also influences student learning outcomes (Nurkhaeroni & Ripaiyah, 2022). This is the background to the importance of developing learning media and media settings that support more interactive learning, especially on Static Fluid material. The development of learning media is carried out by utilizing technological developments using the Moodle Learning Management System (LMS) on Static Fluid material.

Method

The method of research used is Research and Development (R&D). The ADDIE model consists of five stages, that is Analyze, Design, Develop, Implement, and Evaluate (Branch, 2009). However, because the goal is only getting the feasibility of learning media, the steps are limited to Analyze, Design, and Develop. In the analysis stage, learning needs are analyzed by distributing questionnaires to teachers and students. The aim is to collect information about the conditions, problems, and needs of learning media in schools. Furthermore, at the design stage, design planning, media storyboard preparation, media preparation, and testing strategy development are carried out. Then, at the development stage, the development of a product draft is carried out based on the assessment of expert validators, peer reviewers, reviewers, and student trials. The following is the research flow in Figure 1.

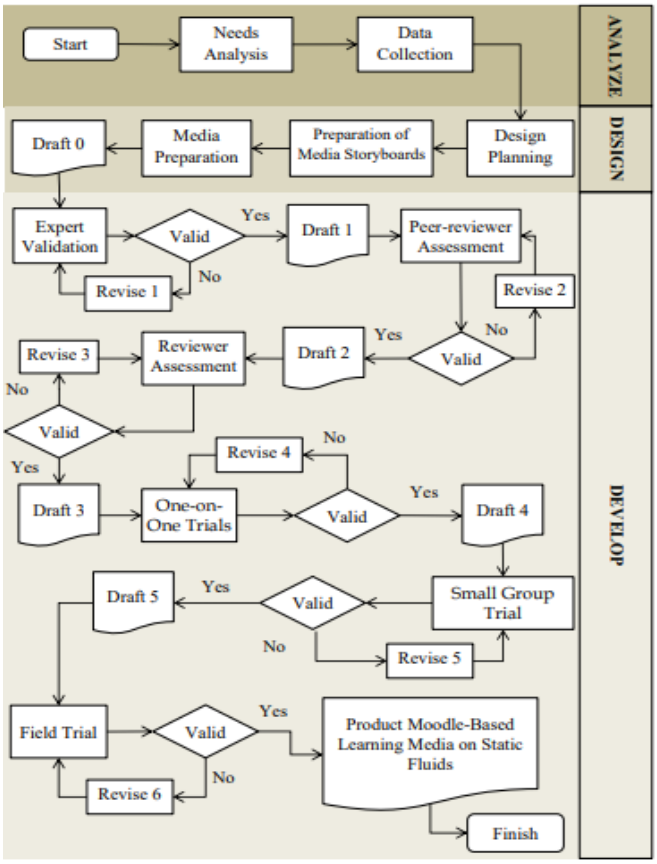


Figure 1. Research flow

This research was conducted in three schools in Surakarta, SMAN 1 Surakarta, SMAN 5 Surakarta, and

SMAN 8 Surakarta. The data obtained are quantitative and qualitative data using a questionnaire distributed to 3 expert validators, 3 peer reviewers, 3 reviewers, and 102 students (3 students for one-on-one trial, 9 students for small group trial, and 90 students for field trial). For the analysis stage, the research instrument was a questionnaire using the Guttman scale with an alternative answer of "yes" with a value of 1 and "no" with a value of 0. During the development, the instrument research included a validation questionnaire, pre-test and post-test questions, and a students' questionnaire. All the questionnaires used a Likert scale with four alternative answers, number 1 (not good or not appropriate), 2 (good enough or quite appropriate), 3 (good or appropriate), and 4 (suitable). The determination of the criteria for evaluating the developed media is based on quantitative analysis by converting the average score according to Azwar (2010) in Table 1 and Table 2.

Table 1. Validation Assessment Category

Score Intervals	Category
$1199 < x$	Very Good
$1015 < x \leq 1199$	Good
$830 < x \leq 1015$	Enough
$646 < x \leq 830$	Not Enough
$x \leq 646$	Very Less

Table 2. Field Trial Assessment Category

Score Intervals	Category
$5557 < x$	Very Good
$4702 < x \leq 5557$	Good
$3847 < x \leq 4702$	Enough
$2992 < x \leq 3847$	Not Enough
$x \leq 2992$	Very Less

Result and Discussion

Analysis Stage

The stages of analysis were carried out through literature studies and distributing questionnaires to analyze the needs of teachers and students during the physics learning process. From the distribution of needs analysis questionnaires at SMAN 1 Surakarta, SMAN 5 Surakarta, and SMAN 8 Surakarta, it is known that students experience difficulties in learning physics such as difficult material to understand, too many sub-materials being studied, and lack of physics practicum because they had to go to the physics laboratory. In the learning process, learning media that have been used include pictures, videos, PowerPoint, modules, simulations, and written on the blackboard. As many as 99.44% of students use the internet to find references about physics lessons. All students said that it was necessary to visualize physics concepts in the form of pictures, videos, animations, and simulations in learning physics. The results of the teacher need analysis stated that they agreed if Moodle-based learning media were developed. As many as 97.78% of students have easy access to laptops or smartphones and 66.67% of students admit that the internet network available at school is sufficient and all students agree that learning is presented using media that is easily accessible. Based on the results of the analysis, it can be concluded that it is necessary to develop Moodle-based physics learning media on Static Fluid material.

Design Stage

The design stage is carried out by designing and designing learning media products that are developed based on the results of the analysis in the previous stage. Media development is designed in the Moodle web application which can be accessed online on search engines so there is no need to download additional applications on laptops or smartphones. There are two steps at this stage, media design and media production.

Media design by compiling media designs starting from designing learning activities in Moodle including core competencies, basic competencies, learning indicators, learning objectives, student worksheets, material summaries, practice questions, and evaluation questions. All drafts that have been made are consulted first with the supervising lecturer and then revised according to the directions and input that have been given.

Making learning media is done on the Moodle web page belajarsains-uns.com. In addition, for the creation of supporting features such as writing material content made in Microsoft Word, images created using the Canva application and the InShot application are used for video editing of the Static Fluid phenomenon material which will then be uploaded via YouTube and then the video link will be posted on the Moodle page. Through Moodle, administrators can take advantage of various features that support the creation of more interactive learning media such as discussion forums. In addition, there is an H5P Interactive Content feature for editing content such as student worksheets to be more varied, and other features that can be used to make learning media more interesting.

Development Stage

The development stage is the stage of validating the learning media draft by expert validators, peer reviewers, and reviewers. Expert validators are three lecturers who are experts in media development, peer reviewers are fellow students who are also developing instructional media and the reviewers are three physics teachers at three schools where research is being held. Learning media validation is carried out on three aspects

including learning design aspects, media aspects, and language aspects. After validation, the learning media will be tested on students through one-on-one trials, small-group trials, and field trials.

The media assessment is aimed at assessing three aspects of learning design aspects, media aspects, and language aspects. Validation of the three aspects used a Likert scale questionnaire with 21 items on the learning design aspect, 11 items on the media aspect, and 9 items on the language aspect. The following is a summary and overall assessment in Table 3.

Table 3. Validation Assessment Result

Aspect	Maximum Score	Score
Learning Design	756	699
Media	396	358
Language	324	307
Total Score	1476	1364

Based on the summary of the results of the overall assessment of learning media presented in Table 3, it shows that all aspects of this learning media have very good criteria based on Table 1. The overall assessment shows that the learning media has a score of 1364 out of 1476 with an interval of more than 1199 (maximum score of 1476). There are several revisions as well as suggestions and input from the results of this validation which are then revised according to the suggestions.

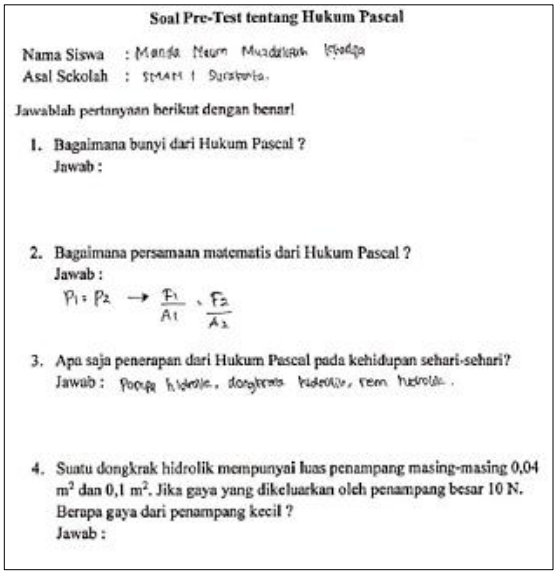
Trial Stage

This stage was carried out sequentially starting from one-on-one trials, small-group trials, and field trials. One-on-one trials were conducted for each student representative. Small group trials were conducted for three student representatives. Field trials were conducted for 30 students from each school where the study was conducted. Representatives of these students were randomly selected among class XI students who had studied Physics material about Static Fluids.

Analysis of one-on-one trial data was carried out qualitatively to find small errors in the learning media. At this stage, it was found that there was an error in the spelling of the sentence so improvements were made and other suggestions were made by adding practice questions to each sub-material.

Analysis of small group trial data was carried out to test the effectiveness of the media developed. Testing on the results of small group trials is carried out by comparing the results of the pre-test and post-test to determine the effectiveness of using instructional media in class. The following is a sample of the results from the pre-test and post-test in Figure 2 and Figure 3.

Based on the data, it is known from the sample that students answered two of the four questions provided in the pre-test and four questions answered in the post-test. This shows an increase in the results of trials conducted on students. The increase in pre-test and post-test results shows that the use of this learning media is effective to be used as a physics learning media in learning activities in class.



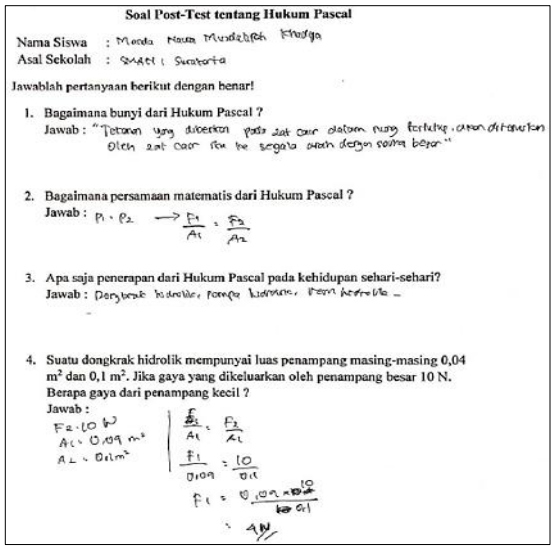
Soal Pre-Test tentang Hukum Pascal

Nama Siswa : Manda Nauri Mudzakiah Khadija
Asal Sekolah : SMAN 1 Surakarta

Jawablah pertanyaan berikut dengan benar!

1. Bagaimana bunyi dari Hukum Pascal ?
   Jawab :
2. Bagaimana persamaan matematis dari Hukum Pascal ?
   Jawab :
   $P_1 = P_2 \rightarrow \frac{F_1}{A_1} = \frac{F_2}{A_2}$
3. Apa saja penerapan dari Hukum Pascal pada kehidupan sehari-sehari?
   Jawab : Pompa hidrolik, dongkrak hidrolik, rem hidrolik.
4. Suatu dongkrak hidrolik mempunyai luas penampang masing-masing 0,04 m^2 dan 0,1 m^2. Jika gaya yang dikeluarkan oleh penampang besar 10 N. Berapa gaya dari penampang kecil ?
   Jawab :

Figure 2. Pre-test result



Soal Post-Test tentang Hukum Pascal

Nama Siswa : Manda Nauri Mudzakiah Khadija
Asal Sekolah : SMAN 1 Surakarta

Jawablah pertanyaan berikut dengan benar!

1. Bagaimana bunyi dari Hukum Pascal ?
   Jawab : "Tekanan yang diberikan pada zat cair dalam ruang tertutup akan diteruskan oleh zat cair itu ke segala arah dengan sama besar"
2. Bagaimana persamaan matematis dari Hukum Pascal ?
   Jawab : $P_1 = P_2 \rightarrow \frac{F_1}{A_1} = \frac{F_2}{A_2}$
3. Apa saja penerapan dari Hukum Pascal pada kehidupan sehari-sehari?
   Jawab : Dongkrak hidrolik, pompa hidrolik, rem hidrolik.
4. Suatu dongkrak hidrolik mempunyai luas penampang masing-masing 0,04 m^2 dan 0,1 m^2. Jika gaya yang dikeluarkan oleh penampang besar 10 N. Berapa gaya dari penampang kecil ?
   Jawab :
   $F_2 = 10$ N
   $A_1 = 0,04\ m^2$
   $A_2 = 0,1\ m^2$
   $\frac{F_1}{A_1} = \frac{F_2}{A_2}$
   $\frac{F_1}{0,04} = \frac{10}{0,1}$
   $F_1 = \frac{0,04 \times 10}{0,1}$
   $= 4$ N

Figure 3. Post-test result

The assessment questionnaire given to students consisted of 19 questions regarding aspects of learning design, media aspects, and language aspects in learning media developed using a Likert scale. The following is a summary of the field trial assessment data in Table 4.

Table 4. Field Trial Result

Aspect	Maximum Score	Score
Learning Design	3240	2706
Media	3240	2699
Language	360	323
Total Score	6840	5728

Based on the data from the field trial assessment results presented in Table 4, it shows that all aspects of this learning media have very good criteria based on Table 2. The assessment in the field trial shows that the learning media has a score of 5728 out of 6840 with an interval of more than 5557 (maximum score of 6840).

The final product of this learning media is a web application that can be accessed online at https://belajarsains-uns.com/. This learning media is equipped with several features and views, such as the appearance of the Static Fluid class containing information about the name of the teacher or class manager and a login button to enter the Static Fluid class. Login page where the user is asked to fill in the username and password that has been registered by the administrator. Introductory menu which has several menus such as general information (contains explanations of the parts of the learning media and also media creators), instructions for using learning media (contains how to use media and use buttons on learning media), Core Competencies, Basic Competencies, learning indicators and concept maps of Static Fluid material. The Static Fluid Material Menu contains various content such as pictures, videos, student worksheets equipped with practicum/Virtual Lab simulations, material reinforcement, exercises, and discussion of questions. The Evaluation page contains ten multiple choice questions equipped with duration of work and automatic score results as well as answer keys. The bibliography and Glossary pages contain material source references and a list of terms in learning media. The features in Moodle help users understand learning. Some of the features used by researchers are assignments for collecting assignments, forums for discussing, quizzes for conducting evaluations, the H5P feature to make worksheets more interactive, and other features that support the smooth learning process (Fitriani, 2020).

The research and development that has been carried out produces a Moodle-based physics learning media with a scientific approach to Static Fluids material. The stages in the scientific approach displayed in this Moodle-based learning media are observing activities are displayed at the beginning of each sub-material such as observing physical phenomena that are in accordance with the sub-material discussed either through pictures or videos, questioning activities are displayed when students asked to complete the empty boxes and then fill them in according to the phenomena that have been observed and also provided a 'Let's Ask' menu which can be used as a discussion column by the teacher and students, the activity of collecting information or data is displayed when students collect data through PhET Colorado simulations, the Ministry of Education and Culture's Virtual Home Learning Lab or information through videos that are presented which are then filled in in the available student worksheets, associating activities are displayed when students asked to analyze the data that had been collected at the previous stage on the student worksheet by answering the available questions so that further conclusions could be drawn, communicating activities were displayed when students were asked to draw conclusions based on the data analysis that had been carried out which was then filled in available columns. The activities contained in this media are the stages of learning activities using a scientific approach proposed by Bermawi et al. (2016) starting from observing, asking questions, gathering information, associating, and communicating.

Data analysis from the assessment of learning media meets very good criteria starting from validation by expert validators, peer reviewers, reviewers, and test results by students. This media has good criteria by the opinion of Supriyono (2018), where the criteria for good learning media are assessed and included in the assessment questionnaire and trials such as clear and easy-to-understand media for students. This criterion was put forward through a questionnaire and four other criteria were also included in the criteria for evaluating good media through an assessment questionnaire and trials.

This Moodle-based physics learning media was developed to be able to overcome deficiencies in previous research by Setiyorini et al. (2017) by adding evaluation questions, student worksheets, and material reinforcement to be able to measure student understanding. This study also added the H5P Interactive Content feature for working on student worksheets which could be filled in directly on Moodle, features practice questions and discussion, and added virtual simulations to overcome the limitations in Eja Rahmada Pratama's research (2018). Meanwhile, for novelty in previous research conducted by Wulan Diah Puspitasari (2018), the media content displayed can be played directly on Moodle without having to download it first. In this study, learning media with more complete facilities have been developed.

During the research, several obstacles limited the research, including that this research only reached the development stage and that the research subjects were limited to three schools. This development research also has limitations on products that only contain one Basic Competency, this media still requires an internet connection to access it. The Moodle display used is still not "pro" so the default theme cannot be changed.

Conclusion

Based on the results of the research and discussion the specifications of the Moodle-based physics learning

media with a scientific approach to Static Fluid material have several menus, including an introduction menu that consists of General Information, Instructions for Use, Core Competencies, Basic Competencies and Learning Indicators and Concept Maps from Static Fluid material; Static Fluid Material Menu which consists of physical phenomena, discussion forums, and questions and answers, student worksheets, reinforcement of material and practice questions and discussion; Pages of Evaluation Questions, Bibliography and Glossary. This media is equipped with simulations using PhET and the Ministry of Education and Culture's Virtual Laboratory which can be accessed online using a laptop or smartphone. The results of the assessment of Moodle-based physics learning media with a scientific approach to Static Fluids material meet very good criteria based on assessments from expert validators, peer reviewers, and reviewers. The results of one-on-one trials found errors in the spelling of sentences. In the small group trials, an increase in the results of the pre-test and post-test answers showed that learning media was effectively used in learning activities in class. In the field trial assessment obtained very good criteria with an interval of more than 5557 with a maximum score of 6840. Furthermore, teachers can implement Moodle-based learning media as learning media in the classroom learning process or can be used independently by students. Class learning is carried out in groups, this is to overcome if some students do not have an Android-based smartphone.

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Author Contributions
All authors have read and agree to the published version of the manuscript

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Conflicts of Interest
The authors declare no conflict of interest.

References

Al-Fraihat, D., Joy, M., Masa'deh, R., & Sinclair, J. (2020). Evaluating E-learning systems success: An empirical study. *Computers in Human Behavior*, *102*, 67–86. https://doi.org/10.1016/j.chb.2019.08.004

Alamsyah, N. (2016). Penerapan Pendekatan Saintifik Untuk Meningkatkan Kreativitas Dan Hasil Belajar Siswa Dalam Mata Pelajaran IPA. *Jurnal Pendidikan (Teori Dan Praktik)*, *1*(1), 81–88. https://doi.org/10.26740/jp.v1n1.p82-96

Alifah, S. (2021). Peningkatan Kualitas Pendidikan di Indonesia untuk Mengejar Ketertinggalan dari Negara Lain. *CERMIN: Jurnal Penelitian*, *5*(1), 113–123. https://doi.org/10.36841/cermin_unars.v5i1.968

Anggraeni, D. M., & Sole, F. B. (2022). Analysis of 4-C in Moodle-Based Online Learning in Science Learning Media Courses. *Jurnal Penelitian Pendidikan IPA*, *8*(3), 1612–1617. https://doi.org/10.29303/jppipa.v8i3.1818

Anggriawan, F. S. (2019). Pengembangan Learning Management System (LMS) Sebagai Media Pembelajaran Untuk Sekolah Menengah Sederajat. *Jurnal Tata Rias*, *9*(2), 1–10. https://doi.org/10.21009/9.2.1.2009

Azizah, R., Yuliati, L., & Latifah, E. (2015). Myxoedema ascites. *Jurnal Penelitian Fisika Dan Aplikasinya*, *5*(2), 44–50. https://doi.org/10.1136/pgmj.53.620.343

Azwar, S. (2010). *Media Penelitian*. Pustaka Pelajar.

Barringer, M.-D., Pohlman, C., & Robinson, M. (2010). *Schools For All Kinds Of Minds: Boosting Student Success By Embracing Learning Variation*. John Wiley & Sons Inc.

Basri, S., & Akhmad, N. A. (2022). Pengembangan Modul Fisika Berbasis Kearifan Lokal. *Jurnal Jendela Pendidikan*, *2*(02), 164–171. https://doi.org/10.57008/jjp.v2i02.181

Bermawi, Y., & Fauziah, T. (2016). Penerapan Pendekatan Saintifik dalam Pembelajaran di Sekolah Dasar Aceh Besar. *Pesona Dasar (Jurnal Pendidikan Dasar Dan Humaniora)*, *2*(4), 63–71. Retrieved from https://jurnal.unsyiah.ac.id/PEAR/article/view/7533

Bojiah, J. (2022). Effectiveness of Moodle in Teaching and Learning. *Journal of Hunan University Natural Sciences*, *49*(12), 320–328. https://doi.org/10.55463/issn.1674-2974.49.12.33

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springer Science+Business Media. https://doi.org/10.1007/978-0-387-09506-6

Cholik, C. A. (2017). Pemanfaatan Teknologi Informasi dan Komunikasi untuk Meningkatkan Pendidikan di Indonesia. *Syntax Literate: Jurnal Ilmiah Indonesia*, *2*(6), 21–30. Retrieved from https://www.jurnal.syntaxliterate.co.id/index.php/syntax-literate/article/view/130

Chootongchai, S., & Songkram, N. (2018). Design and development of SECI and Moodle online learning systems to enhance thinking and innovation skills for higher education learners. *International Journal of Emerging Technologies in Learning*, *13*(3), 154–172. https://doi.org/10.3991/ijet.v13i03.7991

Darwis. (2018). Meningkatkan Hasil Belajar Fisika Melalui Penerapan Model Pembelajaran Kontekstual dengan Metode Inkuiri. *Jurnal Pendidikan Fisika*, *6*(3), 324–334. https://doi.org/10.26618/jpf.v6i3.1512

Dyah, A. I., H, S. K., & Wisodo, H. (2019). Bagaimana Penguasaan Konsep Siswa pada Materi Fluida Statis. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *4*(8), 1030–1033. http://dx.doi.org/10.17977/jptpp.v4i8.12664

Fauza, N., Hermita, N., & Afriyani, E. (2023). Need Analysis to Develop a Physics Module Integrated Natural Disaster and Mitigation. *Jurnal Penelitian Pendidikan IPA*, *9*(3), 1024–1029. https://doi.org/10.29303/jppipa.v9i3.3170

Fauzi, A. (2020). E-Learning Berbasis Moodle Komunikasi Guna Mencegah Penyebaran Covid-19. *Jurnal Kajian Perempuan & Keislaman*, *13*(1), 28–39. https://doi.org/10.35719/annisa.v13i1.23

Fitria, A. S., Ramdani, A., & Hadiprayitno, G. (2023). Keefektifan Pelaksanaan E-Learning Pada Mata Pelajaran Biologi. *Journal of Classroom Action Research, 5*(1), 265-270. Retrieved from https://www.jppipa.unram.ac.id/index.php/jcar/article/view/2868

Fitriani, Y. (2020). Analisa Pemanfaatan Learning Management System (Lms) Sebagai Media Pembelajaran Online Selama Pandemi Covid-19. *Journal of Information System, Informatics and Computing*, *4*(2), 1. https://doi.org/10.52362/jisicom.v4i2.312

Gomez, R. V. G., Balladares, A. D. O., Elena, T. B. S., Sánchez, L. C.-, Obando, K. E. R., Alejandro, R. L., & Gallardo, H. G. G. (2022). Learning Styles in Higher Education: The use of Moodle platform. *Journal of Positive Psychology and Wellbeing*, *6*(2), 1153–1164. Retrieved from https://www.journalppw.com/index.php/jppw/article/view/10052

Harefa, A. R. (2019). Peran ilmu fisika dalam kehidupan sehari-hari. *Jurnal Warta*, *13*(2), 1–10. https://doi.org/10.46576/wdw.v0i60

Herayanti, L., Habibi, H., & Sukroyanti, B. A. (2022). Development of Inquiry-Based Teaching Materials to Improve Physics Teacher's Conceptual Understanding. *Jurnal Penelitian Pendidikan IPA*, *8*(6), 3110–3116. https://doi.org/10.29303/jppipa.v8i6.2543

Indriana, R. A., & Kamaludin, A. (2023). Development of Interactive Electronic Module for Charged Reaction Rate Science Technology Engineering and Mathematics (STEM). *Jurnal Penelitian Pendidikan IPA*, *9*(3), 977–986. https://doi.org/10.29303/jppipa.v9i3.1788

Ismawati, F. C., & Marwiyah, M. (2022). Pengaruh Pembelajaran Daring Menggunakan Moodle Terhadap Hasil Belajar Pada Mata Pelajaran Tata Rias Wajah Panggung Di SMKN 3 Magelang. *Beauty and Beauty Health Education*, *11*(1), 20–30. https://doi.org/10.15294/bbhe.v11i1.54754

Khatser, G., & Khatser, M. (2022). Online Learning Through LMSs: Comparative Assessment of Canvas and Moodle. *International Journal of Emerging Technologies in Learning*, *17*(12), 184–200. https://doi.org/10.3991/ijet.v17i12.30999

Krasnova, L., & Shurygin, V. (2019). Blended learning of physics in the context of the professional development of teachers. *International Journal of Emerging Technologies in Learning*, *14*(23), 17–32. https://doi.org/10.3991/ijet.v14i23.11084

Lakoriha, R. P., Wowor, H. F., & Paturusi, S. D. E. (2018). Pengembangan Sistem Pengelolahan Pembelajaran Daring Untuk Sekolah Menengah Kejuruan. *Jurnal Teknik Informatika*, *13*(4), 1–6. https://doi.org/10.35793/jti.13.4.2018.28106

Lestari, S. (2018). Peran Teknologi dalam Pendidikan di Era Globalisasi. *Edureligia; Jurnal Pendidikan Agama Islam*, *2*(2), 94–100. https://doi.org/10.33650/edureligia.v2i2.459

Maghfiroh, S., Wilujeng, I., Jumadi, J., & Masyitha, D. (2023). Development of Physics E-Module Based on Discovery Learning to Improve Students' Scientific Literacy. *Jurnal Penelitian Pendidikan IPA*, *9*(2), 452–458. https://doi.org/10.29303/jppipa.v9i2.1733

Nurhaisa, N., Khaeruddin, K., & Jasruddin, J. (2023). Physics student worksheet based on science, technology, engineering, and mathematics (STEM) to practice creative thinking skill. *Jurnal Penelitian Pendidikan IPA*, *9*(3), 1451–1456. https://doi.org/10.29303/jppipa.v9i3.2303

Nurkhaeroni, U., & Ripaiyah. (2022). Sosialisasi Penggunaan Media Pembelajaran E-Learning Berbasis Model Problem Based Learning Dalam Meningkatkan Motivasi Belajar Dan Hasil Belajar Peserta Didik Di MA Putra Al-Islahuddiny Kediri Kabupaten Lombok Barat. *Jurnal Pengabdian Magister Pendidikan IPA*, *5*(2), 190–196. https://doi.org/10.29303/jpmpi.v5i2.1598

Nurmayani, L., Doyan, A., & Sedijani, P. (2018). Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Hasil Belajar Fisika Peserta Didik. *Jurnal Penelitian Pendidikan IPA*, *4*(2), 2–7. https://doi.org/10.29303/jppipa.v4i2.113

Pahrudin, A., & Pratiwi, D. D. (2019). *Pendekatan Saintifik Dalam Implementasi Kurikulum 2013 & Dampaknya Terhadap Kualitas Proses dan Hasil Pembelajaran*. Pustaka Ali Imron. Retrieved from https://repository.radenintan.ac.id/11440/1/PENDEKATAN%20SAINTIFIK.pdf

Pamungkas, A., Djudin, T., & Arsyid, S. B. (2017).

Remediasi kesulitan belajar fluida statis dengan model student facilitator and explaining di sman 8 pontianak. *Jurnal Pendidikan Dan Pembelajaran*, *6*(2), 1–10. https://dx.doi.org/10.26418/jppk.v6i2.18361

Pratama, E. R. (2018). *Pengembangan Media Pembelajaran Learning Management System (LMS) Moodle pada Materi Bangun Ruang*. Universitas Islam Negeri Raden Intan Lampung.

Priyakanth, R., Abburi, R., & Praveena, M. (2021). Design and impact of interactive video content for the improvement of student engagement and learning. *Journal of Engineering Education Transformations*, *34*(Special Issue), 518–523. https://doi.org/10.16920/jeet/2021/v34i0/157204

Puspitasari, W. D. (2018). *Pengembangan Media E-learning dengan Moodle sebagai Suplemen Pembelajaran Fisika pada Konsep Usaha dan Energi*. Universitas Islam Negeri Raden Intan Lampung.

Salsabila, U. H., & Agustian, N. (2021). Peran Teknologi Pendidikan dalam Pembelajaran. *Islamika: Jurnal Keislaman Dan Ilmu Pendidikan*, *3*(1), 123–133. https://doi.org/10.36088/islamika.v3i1.1047

Santoso, H. B., & Subagyo, S. (2017). Peningkatan Aktifitas Dan Hasil Belajar Dengan Metode Problem Basic Learning (PBL) Pada Mata Pelajaran Tune Up Motor Bensin Siswa Kelas XI Di SMK Insan Cendekia Turi Sleman Tahun Ajaran 2015/2016. *Jurnal Taman Vokasi, 5*(1), 40-45. https://doi.org/10.30738/jtv.v5i1.1428

Schweighofer, J., Taraghi, B., & Ebner, M. (2019). Development of a quiz: Implementation of a (self-) assessment tool and its integration in Moodle. *International Journal of Emerging Technologies in Learning*, *14*(23), 141–151. https://doi.org/10.3991/ijet.v14i23.11484

Selwyn, N. (2011). *Education and Technology Key Issues and Debates*. Replika Press Pvt Ltd.

Setianingrum, D. A., Ula, E. M., Pratiwi, S., & Jumadi, J. (2022). Development of Science Module based on Flipbook about Physics in the Respiratory System to Improve Students' Learning Independence. *Jurnal Penelitian Pendidikan IPA*, *8*(6), 2621–2628. https://doi.org/10.29303/jppipa.v8i6.1923

Setiyorini, S., Patonah, S., & Murniati, N. A. N. (2017). Pengembangan Media Pembelajaran Moodle. *Jurnal Penelitian Pembelajaran Fisika*, *7*(2), 156–160. https://doi.org/10.26877/jp2f.v7i2.1311

Siahaan, F. E., & Pane, E. P. (2021). Penerapan Pendekatan Saintifik Berbasis Model Pembelajaran Guided Inquiry untuk Meningkatkan Soft Skills Mahasiswa Pendidikan Fisika. *Jurnal Basicedu*, *5*(6), 5869–5876. https://doi.org/10.31004/basicedu.v5i4.1230

Suartama, I. K., Setyosari, P., Sulthoni, & Ulfa, S. (2019). Development of an instructional design model for mobile blended learning in higher education. *International Journal of Emerging Technologies in Learning*, *14*(16), 4–22. https://doi.org/10.3991/ijet.v14i16.10633

Suhada, S. (2017). Peranan Teknologi Pendidikan dalam Peningkatan Mutu Pendidikan. *Hikmah: Journal of Islamic Studies*, *13*(2), 49. https://doi.org/10.47466/hikmah.v13i2.152

Sulistyorini, L., & Anistyasari, Y. (2020). Studi Literatur Analisis Kelebihan dan Kekurangan LMS Terhadap Pembelajaran Berbasis Proyek pada Mata Pelajaran Pemrograman Web di SMK. *IT-Edu: Jurnal Information Technology and Education*, *5*(01), 171–181. Retrieved from https://ejournal.unesa.ac.id/index.php/it-edu/article/view/36692

Sumarwati, S., Fitriyani, H., Setiaji, F. M. A., Amiruddin, M. H., & Jalil, S. A. (2020). Developing mathematics learning media based on elearning using Moodle on geometry subject to improve students' higher order thinking skills. *International Journal of Interactive Mobile Technologies*, *14*(4), 182–191. https://doi.org/10.3991/IJIM.V14I04.12731

Suminar, D. (2019, May). Penerapan teknologi sebagai media pembelajaran pada mata pelajaran sosiologi. In *Prosiding Seminar Nasional Pendidikan FKIP* (Vol. 2, No. 1, pp. 774-783). Retrieved from https://jurnal.untirta.ac.id/index.php/psnp/article/view/5886

Supriyono. (2018). Pentingnya Media Pembelajaran Untuk Meningkatkan Minat Belajar Siswa SD. *Jurnal Pendidikan Dasar*, *2*(1), 43–48. https://doi.org/10.26740/eds.v2n1.p43-48

Turnbull, D., Chugh, R., & Luck, J. (2020). Learning Management Systems: An Overview. In A. Tatnall (Ed.), *Encyclopedia of Education and Information Technologies* (pp. 1052–1058). Springer Nature. https://doi.org/10.1007/978-3-030-10576-1

Zulhafizh, Z. (2021). Peran dan Mutu Pelaksanaan Pembelajaran oleh Guru di Satuan Pendidikan Tingkat Atas. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, *7*(2), 328. https://doi.org/10.33394/jk.v7i2.3344