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Development of Interactive Physics Learning Website Based on STEAM Approach to Increase Student Learning Motivation in Optics Chapter

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ABSTRACT

Objective: *Changing times and technological advances influence the world of education. Therefore, prospective educators are required to be able to utilize existing technology in classroom learning activities. This research aims to produce Physics learning media by applying the STEAM approach to increase student learning motivation on optics. The learning media developed is an interactive Physics learning website based on the STEAM approach.* ***Method:*** *The type of research conducted is the development of learning media. The media development model used is the ADDIE model. The learning media trial was conducted at SMAN 1 Gedangan with a research sample of 10 students. The instrument used in this study was a student response questionnaire. The data analysis technique used was quantitative descriptive analysis.* ***Results:*** *The results showed that the effectiveness of learning media in increasing student learning motivation had a score of 90.4% with very positive criteria. The developed learning media is effectively used in learning physics on optics. Based on the results of data analysis, it can be concluded that the interactive physics learning website based on the STEAM approach is feasible (very effective) in increasing student learning motivation.* ***Novelty:*** *Integrating the STEAM approach in this learning media provides a learning experience that combines theory with creativity, art, and problem-solving. Unlike conventional methods, the website features interactive tools to explore physics concepts through simulation and visualization, thus increasing student motivation and engagement.*

INTRODUCTION

The changing times and technological advances are triggers for education development in Indonesia. Education reviewed in the Industrial Revolution 4.0 will involve Information and Communication Technology (ICT) so students can access digital-based information in classroom learning. Applying ICT in the Industrial Revolution 4.0 era will give learners abundant information sources (Sina et al., 2023). Open access to these information sources will provide convenience and efficiency for students and teachers in classroom learning activities. Based on the research results conducted by Tenzin (2022), using ICT in the teaching and learning process makes learning more interesting, effective, and meaningful. In addition, emphasized that e-learning, as a form of ICT application, can increase student interaction and participation in learning (Rusli et al., 2020). Learning innovations through digital platforms and social media can increase students' learning motivation (Harsanto, 2017) . In this case, ICT involvement will undoubtedly impact how students learn and motivate in the classroom, especially in physics learning.

Physics is a science based on experimental observations and quantitative measurements. It aims to discover the fundamental laws that govern natural phenomena and use them to develop theories in the future (Serevina et al., 2020). In

Indonesia, students tend to think that physics is complex. According to the results, it was found that there were students who had an interest in learning physics in the unfavorable category (Aldila et al., 2020). This shows that some students have a low interest in studying physics. Student learning outcomes in physics subjects will also be affected due to low motivation to learn physics. The higher the interest and motivation of students to learn, the higher the physics learning outcomes of students (Nawahdani, et al., 2022). Thus, teachers need to use an approach to increase student learning motivation and support the implementation of ICT.

In line with this, increasing student motivation in learning physics can be done by using the Science, Technology, Engineering, Art, and Mathematics (STEAM) approach. STEAM approach has integrated comprehensive science and provides insight that the material previously learned is science that is close and needed in everyday life (Kartika et al., 2022). In physics learning, using a STEAM-based approach teaches students about a topic from various perspectives. Applying the STEAM approach to physics learning also makes students more active in class and can train students' critical thinking skills. Implementing STEAM in physics learning can overcome student learning difficulties (Widarti & Roshayanti, 2021). Another study was conducted by Hariandi (2023), where the results stated an increase in students' science process skills on temperature and expansion after applying the STEAM approach.

Besides the many advantages of applying STEAM in physics learning, this approach has drawbacks, such as the lack of physics learning media based on the STEAM approach. Learning media is a means that can visualize the learning process in physics learning (Rohmadi & Septiana, 2023). Learning media also has an attraction to increase student learning motivation. Therefore, efforts to increase student motivation to learn physics are by modifying the learning process to be more interesting, such as using interactive physics learning website media with the STEAM approach. With the website-based physics learning media, students will not be easily bored and more enthusiastic to learn physics, so the material presented by the teacher can be understood more easily.

RESEARCH METHOD

The research method used is the Research and Development (R&D) type. The type of R&D research is used to produce a particular product and test its effectiveness (Sugiyono, 2013). This study's resulting product is learning media through a website on physics subjects based on the STEAM approach. The development design model used in this research is ADDIE. The selection of this design model is based on the consideration that ADDIE is a systematic design model and consists of five steps: analysis, design, development, implementation, and evaluation.

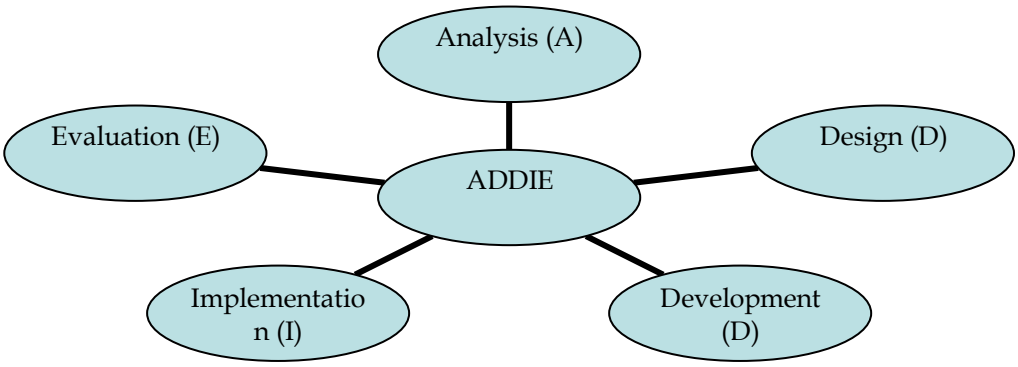


Figure 1. ADDIE model research flow chart

The research location used as a product trial site is one of the high schools in Sidoarjo, with the implementation of the trial conducted in one meeting. The subjects involved in this study were grade XI students. The instrument used in this study was a student response questionnaire instrument. The data analysis technique used in this study describes the participants' responses from the questionnaire instrument sheet.

The data from the student response questionnaire will be converted into quantitative data according to the Likert calculation score. Furthermore, the percentage results are converted based on the following student response level interpretation Table 1.

Table 1. Student response interpretation

Student Response Percentage	Criteria	Conversion
80% - 100%	Very Positive	Very Effective
60% - 79.99%	Positive	Effective
40% – 59.99%	Neutral	Neutral
20% - 39.99%	Less Positive	Ineffective
0% - 19.99%	Not Positive	Very Ineffective

RESULTS AND DISCUSSION

Results

The website-based learning media developed is an interactive Physics learning website based on the STEAM approach to increase student learning motivation on optical materials. The following is the appearance of web-based learning mediaThe website-based learning media developed is an interactive Physics learning website based on the STEAM approach to increase student motivation for learning optical materials. The following is the appearance of web-based learning media.

Main Page

The main page is the first display that students see when they access the website. It has several main menus that students can access by clicking on them.

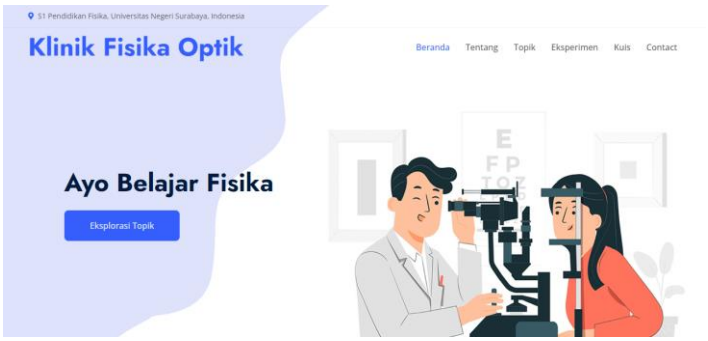


Figure 2. Main page display

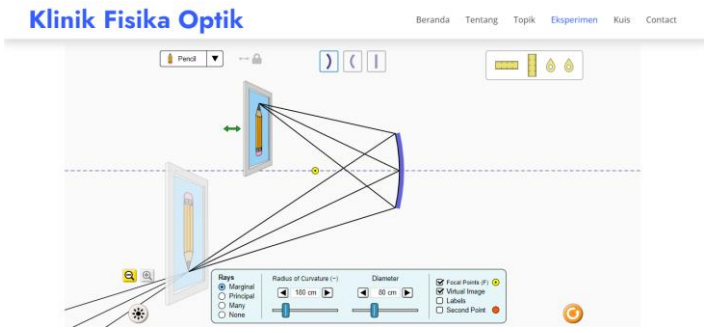
Topic Page

When students click on the topic menu on the previous home page, the topic page appears. On this page, students can find various materials related to optics.

Figure 3. Topic page display

Experiment Page

This experiment page aims to test students' critical thinking skills and abilities in experiments. On the experiment page, students can design experiments by formulating hypotheses to determine the variables to be used. Furthermore, students can design the steps of the experiment and create an experiment data table.



Figuer 4. Experiment page display

Quiz Page

The quiz page aims to conduct a self-evaluation of students. On this page, students are directed to create an account first. Next, students log in to the user account, which is then directed to the Dashboard page as shown above, and can choose a quiz to do.

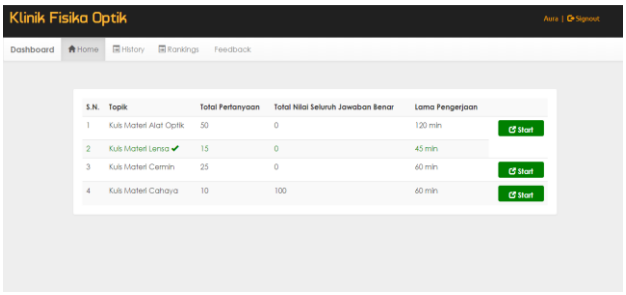


Figure 5. Quiz page display

The student's learning motivation

In this study, the analysis was carried out by providing website-based physics learning media on optical materials to 10 students of SMAN 1 Gedangan. After students learn the learning materials on the website, students are asked to fill out a questionnaire that has been made. This aims to see the students' physics learning motivation on optical material at SMAN 1 Gedangan.

Table 2. Learning motivation results

No	Questions	%	Criteria
1	Physics learning website has an attractive appearance	92	Very Positive
2	The existence of this physics learning website makes me want to study the subject of optics	88	Very Positive
3	The existence of this physics learning website makes me not easily bored to study the subject of optics	86	Very Positive
4	This physics learning website supports me to understand the concepts on the subject of optics	88	Very Positive
5	This physics learning website presents interactive simulations that help me to understand the concepts on the subject of optics	92	Very Positive
6	The presentation of material in this physics learning website has a relation to daily life	92	Very Positive
7	The material presented in this physics learning website is easy for me to understand	94	Very Positive
8	The experiments presented on this website give me the opportunity to be creative in data collection	92	Very Positive
9	This physics learning website contains evaluations that can test my knowledge of the subject matter of optics	92	Very Positive
10	In my opinion, this physics learning website can increase learning motivation towards physics subjects	88	Very Positive

The results of the analysis of student learning motivation in physics learning on optics at SMAN 1 Gedangan have a media effectiveness value of 90.4% in increasing student learning motivation. Based on students' interpretation, an interactive physics learning website based on the STEAM approach to optics at SMAN 1 Gedangan is included in the category of being very effective in increasing students' learning motivation.

Discussion

Based on the results of research at SMAN 1 Gedangan, implementing digital learning media, such as websites, contributed significantly to the increase in students' motivation to learn physics. One of the key factors driving this increase is the attractive and interactive media display, which creates a fun learning experience and motivates students to engage more actively. This aligns with the research of Solihudin (2018), which revealed that physics learning technology can visualize abstract physical phenomena, making the material easier to understand while attracting students' attention. Thus, technology facilitates understanding of physics concepts and stimulates students' interest in learning through a visual and interactive approach. In addition, confirmed that e-learning media has an important role in helping students understand physics concepts more effectively (Bakri et al., 2018) . This media serves as a learning aid and a means to strengthen understanding through independent exploration and interaction with the material presented. In the context of faith-based schools, the application of digital learning media, especially websites, also positively impacts students' learning motivation. This reinforces the view that digital media, such as websites, have the flexibility to be applied in different types of schools and student backgrounds, making it an inclusive learning tool.

Furthermore, research by Lumembang and Bandari (2024) strengthens this argument by stating that the provision of a Learning Management System (LMS) and PhET-based simulation can create a pleasant learning atmosphere while making it easier for students to understand physics material. The website-based LMS provides structured access to learning materials, assignments, and evaluations, while PhET allows students to explore physics concepts independently through interactive simulations. The combination not only increases students' motivation but also positively impacts their learning outcomes. Overall, the implementation of digital learning media through websites shows great potential in overcoming the challenges of physics learning, especially related to concept abstraction. It captures students' attention through visualization and interactivity and increases their engagement in the learning process. With various supporting evidence, it can be seen that digital learning media plays an important role in increasing students' learning motivation, creating compelling, innovative learning experiences, and supporting the achievement of physics learning objectives holistically.

CONCLUSION

Fundamental Finding: Based on the results of research that has been carried out on students at SMAN 1 Gedangan, it can be concluded that the interactive physics learning website based on the STEAM approach on the subject of optics has met the category of very effective in increasing learning motivation in physics subjects with student responses to the effectiveness of the media which is 90.4%. **Implication:** Using the STEAM approach in developing this learning website not only increases student learning motivation in physics subjects but also encourages the integration of science, technology, art, and creativity in the learning process, thus creating a more interesting and meaningful learning experience. **Limitation:** This study was only conducted in one school with a limited sample, so the generalization of the results may not fully represent a broader population of students. In addition, the study only focused on optical materials, so the effectiveness of the media for other physics materials cannot be ascertained. **Future Research:** Expanding the sample coverage by involving various schools in different locations is recommended. In addition, the development of similar websites on other physics materials can be carried out to test the consistency of the effectiveness of the STEAM approach in physics learning.

REFERENCES

Aldila, F. T., Matondang, M. M., & Wicaksono, L. (2020). Identifikasi minat belajar siswa terhadap mata pelajaran fisika di SMAN 1 Muaro Jambi, *Journal of Science Education and Practice*, *4*(2), 22–31. https://doi.org/10.33751/jsep.v4i1.2827

Bakri, F., Fajriani, F., & Muliyati, D. (2018). Media e-learning berbasis CMS joomla: Pelengkap pembelajaran fisika SMA, *Jurnal Teknologi Pendidikan*, *21*(2), 99–110. https://doi.org/10.32550/teknodik.v21i2.346

Hariandi, J., Sitompul, S. S., & Habellia, R. C. (2023). Peningkatan keterampilan proses sains dengan menerapkan pendekatan STEAM, *JPF (Jurnal Pendidikan Fisika) FKIP UM Metro*, *11*(2), 157–169. http://dx.doi.org/10.24127/jpf.v11i2.7945

Harsanto, B. (2017). *Inovasi Pembelajaran Di Era Digital: Menggunakan Google Sites dan Media Sosial*. Bandung: UNPAD PRESS.

Kartika, I., Aroyandini, E. N., Maulana, S., & Fatimah, S. (2022). Analisis prinsip konstruktivisme dalam pembelajaran fisika berbasis Science, Technology, Engineering, Art, and Mathematics (STEAM), *Jurnal Pembangunan Pendidikan: Fondasi dan Aplikasi*, *10*(1), 23–33. https://doi.org/10.21831/jppfa.v10i1.46381

Lumembang, M. M., & Bandari, T. (2024). Utilitas platform digital pada pembelajaran fisika kelas X MAN Pinrang di masa endemi, *Al-Irsyad Journal of Physics Education*, *3*(1), 28–40. https://doi.org/10.58917/ijpe.v3i1.104

Nawahdani, A. M., Triani, E., Azzahra, M. Z., Maison, M., Kurniawan, D. A., & Melisa, D. (2022). Hubungan minat dan motivasi belajar siswa terhadap mata pelajaran

fisika, *Jurnal Penelitian dan Pengembangan Pendidikan*, *6*(1), 12–18. https://doi.org/10.23887/jppp.v6i1.41986

Rohmadi, M., & Septiana, N. (2023). Pengembangan majalah fisika pada materi usaha dan energi terintegrasi islam, *JIPFRI (Jurnal Inovasi Pendidikan Fisika dan Riset Ilmiah)*, *7*(2), 93–105. https://doi.org/10.30599/jipfri.v7i2.1207

Rusli, M., Hermawan, D., & Supuwiningsih, N. N. (2020). *Memahami E-Learning: Konsep, Teknologi, dan Arah Perkembangan*. Yogyakarta: Penerbit Andi.

Serevina, V., Raihanati., & Andriana, W. (2020). Development of website on general physics subject to increase analytical skills of students, *Journal of Physics: Conference Series*, *1481*(012081). https://doi.org/10.1088/1742-6596/1481/1/012081

Sina, S. A., Uloli, R., & Abdjul, T. (2023). Website development as a physics learning media on heat and its transfer materials, *Jurnal Penelitian Pendidikan IPA*, *9*(8), 5874–5883. https://doi.org/10.29303/jppipa.v9i8.4189

Solihudin JH, T. (2018). Pengembangan e-modul berbasis web untuk meningkatkan pencapaian kompetensi pengetahuan fisika pada materi listrik statis dan dinamis SMA, *Jurnal Wahana Pendidikan Fisika*, *3*(2), 51–61. https://doi.org/10.17509/wapfi.v3i2.13731

Sugiyono. (2013). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: ALFABETA.

Tenzin, S., Tendar, P., & Zangmo, N. (2022). Enhancing students' understanding of abstract concepts in physics by integrating ICT in teaching- learning process, *Asian Journal of Education and Social Studies*, *26*(2), 68–80. https://doi.org/10.9734/ajess/2022/v26i230624

Widarti, R., & Roshayanti, F. (2021). Potensi implementasi STEAM (Science, Technology, Engineering, Art and Mathematic) berorientasi ESD (Education for Sustainable Development) dalam pembelajaran fluida, *Unnes Physics Education Journal*, *10*(3), 290–295. https://doi.org/10.15294/upej.v10i3.55702

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