

Development of Physics Edutainment Website to Improve Students' Critical Thinking Skills During the Covid-19 Pandemic

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Abstract

During the Covid-19 pandemic that swept the world including Indonesia, and to improve students' critical thinking skills, it is necessary to have supporting media in the learning process as an edutainment website. This study intends to determine the validity of the edutainment website developed in physics lessons to improve student's critical thinking skills. The research method used is development research with the DDD-E model. This research was only limited to media development, and no practicality and effectiveness tests were carried out. In this study, the validity data were obtained from the results of validation by expert and were analyzed by descriptive quantitative using the category of Likert scale percentage. If the percentage of each aspect is $\geq 61\%$, then the edutainment website developed can be declared valid. The results of this study are the percentage of validity in the learning aspect of 90.30%, the material aspect of 90.56%, the media aspect of 88.65%, and the critical thinking aspect of 84.70%. Based on this, it can be concluded that the edutainment website is very valid so that it can be used as a physics learning media to improve students' critical thinking skills. The edutainment website can be an alternative learning media by utilizing information technology and hopefully in further research, it can apply edutainment website and perform practicality and effectiveness tests for learning both in class and distance learning.

Keyword: Edutainment website, Critical thinking skills, Learning media

Abstrak

Masa pandemi Covid-19 yang melanda dunia termasuk Indonesia seperti sekarang ini, serta untuk meningkatkan kemampuan berpikir kritis siswa, maka diperlukan adanya media penunjang dalam proses pembelajaran seperti adanya media web berbasis edutainment. Penelitian ini bertujuan untuk mengetahui validitas media web edutainment yang dikembangkan pada pelajaran fisika untuk meningkatkan keterampilan berpikir kritis siswa. Metode penelitian yang digunakan yaitu penelitian pengembangan dengan model DDD-E. Penelitian ini hanya sebatas pengembangan media dan tidak dilakukan uji kepraktisan dan keefektifan. Dalam penelitian ini, data validitas diperoleh dari hasil validasi oleh dosen ahli dan dianalisis dengan cara kuantitatif deskriptif menggunakan kategori persentase skor skala likert. Jika persentase setiap aspek $\geq 61\%$, maka web edutainment yang dikembangkan dapat dinyatakan valid. Hasil penelitian ini yaitu persentase validitas pada aspek pembelajaran sebesar 90,30%, aspek materi sebesar 90,56%, aspek media sebesar 88,65% dan aspek berpikir kritis sebesar 84,70%. Berdasarkan hal ini dapat disimpulkan bahwa media web edutainment sangat valid sehingga dapat digunakan sebagai media pembelajaran fisika untuk meningkatkan keterampilan berpikir kritis siswa. Web edutainment dapat menjadi alternatif media pembelajaran dengan memanfaatkan teknologi informasi dan pada penelitian selanjutnya diharapkan dapat menerapkan media web edutainment serta melakukan uji kepraktisan dan keefektifan untuk pembelajaran baik di kelas maupun pembelajaran jarak jauh.

Keyword: Web Edutainment, Kemampuan Berpikir Kritis, Media Pembelajaran

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1. Introduction

Critical thinking skills are crucial to train students as self-development from learning in schools and from learning independently to prepare students to develop and flourish in facing the challenges of the 21st century. This is following the learning objectives in Permendikbud Number 20 of 2016 concerning Competency Standards for Primary Education Graduates and Intermediate that is facing the challenges of the 21st century, students must have critical thinking skills, be independent, collaborative, productive, communicative and act creatively through a scientific approach [1]. However, there are obstacles to achieving these goals, such as not developing students' critical thinking skills in solving problems in essays because the students tend to imitate what is taught by the teacher, so they are less able to understand, design, solve and interpret solutions independently [2]. Besides, there are also obstacles in learning during the Covid-19 pandemic that swept in Indonesia today, like learning cannot be done directly in the class but must be online. Online learning can be done by utilizing learning media as support so that the teaching and learning process can still run optimally [3]. The way to overcome these obstacles can be done by utilizing technology that has developed as a learning medium such as edutainment-based websites.

According to Sternberg in [4], critical thinking is the ability to think reasonably in solving a problem and making decisions that can be trusted to be true. Critical thinking skills are skills to think rationally which require systematic reasoning, creative ideas, and proper analysis in a learning process or problem-solving. In this case, students must be able to recognize problems and find ways to solve these problems, more open minds in any angle to find relevant sources in argumentation, and look for other alternatives if their solutions are not correct [5].

To improve student's critical thinking skills can be done by utilizing technology in the learning process, such as using the internet. Because with the internet, educators and students can access various information as teaching materials and learning resources [6]. Based on the results of a survey by the Indonesian Internet Service Providers Association (APJII) 2019-2020, about 196.71 million internet users in Indonesia, consisting of aged 10-75 years and over. Internet users are most often used by students [7]. This means that physics learning can be done by utilizing the internet such as edutainment-based websites as a learning media. Website-based edutainment is a learning media that is designed by combining education and entertainment applications such as games and scientific experiments so that learning is more enjoyable so that students feel calm and comfortable while studying [8].

The use of the website can make it easier for students to understand the material, find various information for learning, practice problem-solving exercises and do a repetition of material in difficult parts [9]. The use of websites in learning has been carried out by Sakti [10] by developing a website-based e-learning application as a medium for learning physics at Ngraho Public Senior High School 1. The purpose of developing this application is to make it easier for teachers and students in the online teaching and learning process. Furthermore, Rahayu [11] have developed a hybrid learning website media that is very feasible to use and has received a positive response from students. The purpose of the development of the website is to improve students' digital literacy skills in learning physics. The novelty of the research to be carried out is the development of a physics edutainment website to train students' critical thinking skills.

Based on the research of Saraswati [12], developing website-based e-learning media on dynamic fluid material is very suitable for use and suitable for use in learning physics in schools. In another research [6], the development of a web-enhanced course that aims to foster student's interest in learning materials on physics quantities and their units are suitable for use as a medium for learning physics. The difference in this study is that the material to be developed in physics edutainment website is static fluid.

Based on the description above, to improve students' critical thinking skills in distance learning can be done by utilizing learning media in the form of a physics edutainment website which provides various facilities to facilitate problem-solving. Because problem-solving is an indicator of critical thinking in students [13]. Therefore, research aimed to determine the validity of edutainment website media to train students' critical thinking skills in learning physics.

2. Methods

This research is development research which is only limited to media development to determine its validity without implementation, so the researcher uses the DDD-E research model (Decide, Design, Develop, and Evaluate) [14]. The research steps with the DDD-E model were carried out as shown in Figure 1.

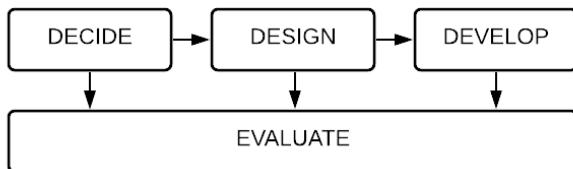


Figure 1. Steps DDD-E Steps [14]

The first stage in this research, namely decide (planning), is carried out by setting interactional goals and material in media products by paying attention to the efficiency of using the web as a learning medium, the suitability of the material with the 2013 Curriculum, and the effectiveness of web development in training students' critical thinking skills. Besides, it also determines software for website creation as a learning medium to be developed.

The second stage is the design which is done by designing the initial design of the website and the instruments for validating the media being developed. The results obtained at this stage are in the form of a flow chart that shows the activity process of the website being developed and a storyboard that shows the display design for each menu on the website. The resulting validation instrument is in the form of a validated questionnaire for learning aspects, material aspects, media aspects, and critical thinking skill aspects.

The third stage is development, which is the stage of making media components such as material content in the form of text, images, videos, Phet simulations, practice questions, and games. Then these components are combined using WordPress as software for website creation so that it becomes integrated. Evaluation in this research was carried out at each stage, namely by ensuring that the media that had been made were following the initial plan. Evaluation of the results of the development is only carried out to test the validity of the media, without testing the practicality and effectiveness. To find out the validity of the media that has been developed, 3 expert lecturers were validating the validation instrument.

The validation process in this study is by using validation instruments on learning aspects, material aspects, media aspects, and critical thinking aspects. The validity measurement was carried out using categories from the Likert scale with a score range of 1 to 4. Score 1 for the very bad category, score 2 for the bad category, score 3 for the good category and score 4 for the very good category. To calculate the percentage of eligibility for each aspect, equation (1) is used as follows:

$$\text{Percentage} (\%) = \frac{\text{Total score from data collection}}{\text{Criteria score}} \times 100\% \quad (1)$$

To determine the validity of each aspect, a quantitative descriptive analysis can be carried out using the percentage category of the Likert scale score [15]. The media developed can be declared valid if the percentage of each component is $\geq 61\%$. The following is a table of the percentage category score on the Likert scale, shows on [Table 1](#).

Table 1. Category Percentage of the Likert Scale Score

No	Presentage Average Score	Category
1	0 - 20%	Very Invalid
2	21% - 40%	Invalid
3	41% - 60%	Quite Valid
4	61% - 80%	Valid
5	81% -100%	Very Valid

3. Result and Discussion

This study focuses on developing edutainment website media to train students' critical thinking skills in learning physics during the Covid 19 pandemic. In this study, a website has been developed on static fluid material that can be accessed via laptops or smartphones. The website has provided various menus designed in such a way as to attract students' attention in learning and practicing solving problems with creative ideas so that students' critical thinking skills can improve. The menu in the edutainment website media that has been developed consists of:

- The homepage is the first page that will appear when the website is accessed. On the homepage, there are menu options available on the website. The homepage view is shown in [Figure 2](#).



Figure 2. Homepage view on the website

- The material menu contains static fluids which are presented interactively in the form of text and images following the core competencies and basic competencies of the applicable curriculum. The display of the material menu is shown in [Figure 3](#).



Figure 3. Display from the material menu

- c. The phenomenon menu contains videos of static fluid phenomena in everyday life along with explanations that are made to make it easier for students to know some activities that involve the concept of static fluids. The phenomenon menu display is shown in Figure 4.

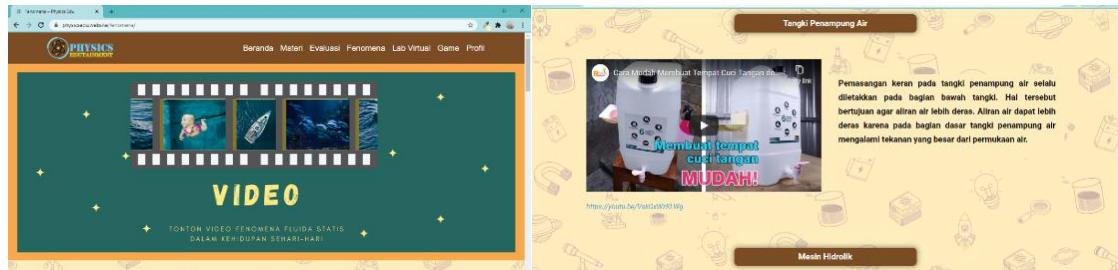


Figure 4. Display from the phenomenon menu

- d. The evaluation menu contains submenu options for multiple-choice questions and sub-menu questions for essays as shown in Figure 5. Multiple choice questions and essay questions are designed with a problem orientation to training students' skills in critical thinking. The display of the multiple-choice question submenu and the essay question submenu is shown in Figure 6.



Figure 5. Display from the evaluation menu



Figure 6. Display of the MCQs submenu and essay questions submenu

e. The virtual laboratory menu contains static fluid experiments using Phet simulation and is equipped with student activity sheets. The virtual laboratory menu display is shown in Figure 7.



Figure 7. Display from the virtual laboratory menu

f. The game menu contains educational games related to static fluids. With the game, it is expected that students will be more enthusiastic about learning physics. The game menu display is shown in Figure 8.



Figure 8. Display from the game menu

g. The profile menu which contains a brief profile of the author is shown in Figure 9.



Figure 9. Display from the profile menu

The edutainment website developed has been validated by 3 expert lecturers. Validation is done by using a validation sheet consisting of learning aspects, material aspects, media aspects, and critical thinking skills aspects. The results of the validation on the learning aspects are presented in Figure 10.

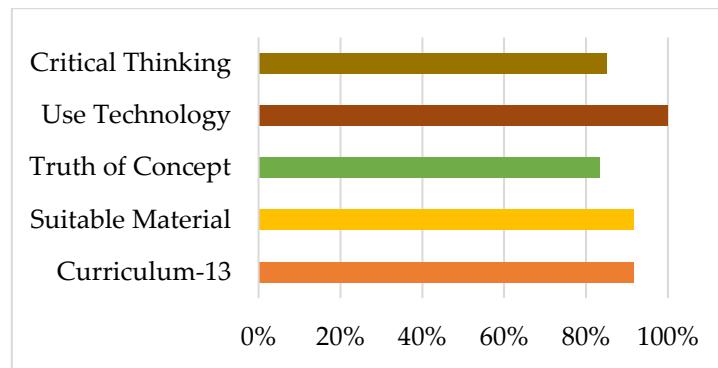


Figure 10. The percentage of the validity of the learning aspects

Based on Figure 10, the percentage of the validity of each component in the learning aspect is obtained, namely the validity of the edutainment website with Core Competencies and Basic Competencies in the Curriculum-13 of 91.67%, the compatibility between static fluid material and material on the edutainment website is 91.67%, the truth of the concept is 83.3%, the use of technology to increase efficiency in learning by 100% and critical thinking by 84.7%. The average percentage in the learning aspect is 90.3% which is categorized as very valid.

Based on Figure 11a, there are 17 components in the material aspect consisting of 4 components in the material formulation with a validity percentage of 93.75%, 8 components in the content with a validity percentage of 89.58%, and 5 components in language with a validity percentage of 88.3%. Then after the average obtained a percentage of 90.56% which is categorized as very valid. It can be concluded that the experts assess the edutainment website as suitable teaching material for use in static fluid subjects.

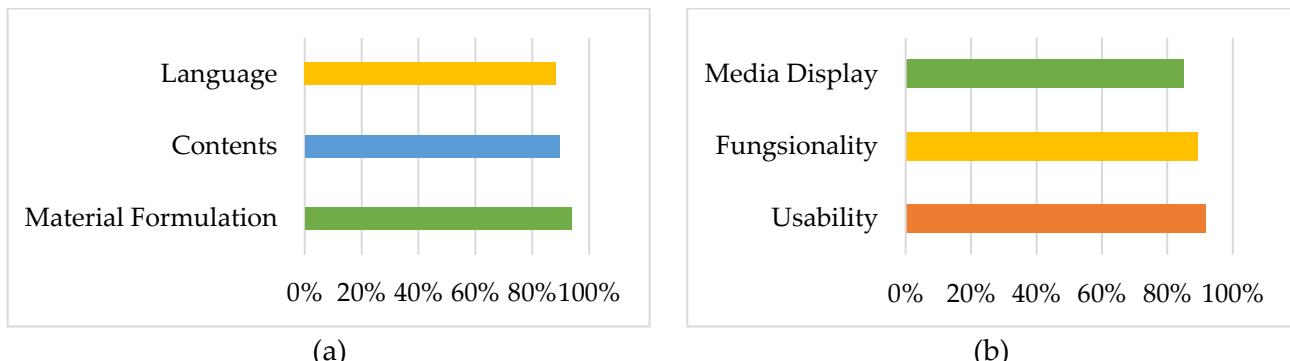


Figure 11. (a) The percentage of the validity of the material aspects; **(b)** The percentage of the validity of the media aspects

Based on Figure 11b, the results obtained for each component in the media aspect are the usability component with a percentage value of 91.67%, the functional component with a percentage value of 89.28%, and the media display component with a percentage value of 85%. The result of the average percentage of validity in the media aspect is 88.65% which is categorized as very valid. It can be concluded that the experts assess the edutainment website as very feasible to be developed as a learning media.

According to Facione in [16], the essence of critical thinking is interpretation (explaining meaning), analysis (examining arguments), evaluation (assessing arguments), inference (rendering a conclusion), explanation (exhibiting argumentation), and self-regulation (self-investigation). In this study, validity was carried out by experts on 5 indicators of critical thinking including interpretation, analysis, conclusions, evaluation, and explanation. The results of the validity of the validation instrument on the aspect of critical thinking skills by expert lecturers are presented in Figure 12.

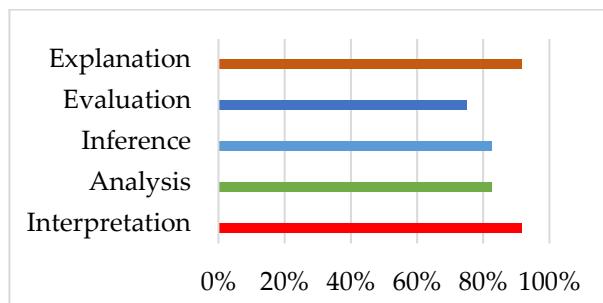


Figure 13. The percentage of the validity of the critical thinking skills aspects

Based on Figure 13, the percentage results of each indicator of critical thinking are obtained, namely, the explained indicator of 91.75%, the evaluation indicator of 75%, the conclusion indicator of 82.50%, the indicator of analysis of 82.50%, and the indicator of interpretation of 91.75%. The average percentage of the validity of the validation instrument by experts in the critical thinking aspect is 84.7% which is included in the very valid category. Based on this, it means that expert lecturers assess that the ability to interpret, analyze, conclude, evaluate and explain as indicators of students' critical thinking skills can be trained in learning physics through the edutainment website media.

Physics edutainment website can train critical thinking skills through several situations. Interpretation ability can be formed by understanding the application of physics concept in the phenomena of everyday life. Evaluation can be trained by solving questions related to problems in everyday life that are on the evaluation menu. Analysis can be trained by analyzing experimental data from a Phet Simulation in the virtual laboratory menu. Inference can be practiced by concluding the experiment in the virtual laboratory menu in a logical manner. Explanations can be trained by presenting arguments when solving essay questions on the evaluation menu. Thinking activities with in-depth reasoning in physics learning can be an approach to developing students' critical thinking skills [17].

This research has succeeded in developing a physics edutainment website learning media to train students' critical thinking skills on the static fluid material. The results gained are in line with the research of Purmadi & Surjono [18] which states that website-based teaching materials based on student learning styles are suitable for use as a medium for learning physics and can improve student learning outcomes. According to Aryani's research [19], problem-oriented website learning media can help teachers and students in learning physics because it can be accessed anywhere and anytime. The development of a website-based business and energy module is stated to be suitable for use as learning materials to help students learn independently and can motivate students to learn physics [20]. Also, based on Budiarti's research [21] produced web-centric course media with a very suitable category for use in optical material and can attract students' interest in learning physics because the website is implemented with various interactive features. According to research conducted by Fitriyati [22], who has developed a student activity sheet in the form of a website using the Blogspot site, it is stated that it can increase student motivation in learning physics and obtained validation results that are suitable for use as an alternative to physics teaching materials for grade 10 semesters 2. Website development in research previously had the aim of improving student learning outcomes, motivating students in learning, attracting students' interest in learning, and making it easier for teachers or students during the learning process. However, in this study, the website developed aims to train students' critical thinking skills in learning physics during the Covid-19 pandemic.

Subsequent research is the development of learning tools in the form of syllabus, lesson plans, handouts, and student activity sheets based on edutainment-based problem solving with the results of getting a positive response from students, effective for training students' creativity in static fluid

material and declared as a learning tool with a valid category [23]. According to Adam the use of "Beboo" as a medium for learning physics has received a positive response from students because with "Beboo" media students can simulate static fluid experiments [24]. Based on Yuniar & Suprapto research, the application of Scrapbook media has received a good response from students and is proven to be used as a medium for practicing scientific literacy on static fluid material [25]. Besides, the research of Marwanti has also succeeded in developing physics learning media with static fluids material, namely the visual literacy-based Comic Of Physics (Coopy) media that is suitable for use in the teaching and learning process [26]. In previous research, static fluids material has been applied in various media including edutainment-based worksheets, Beboo, Scrapbook, and Coopy based on visual literacy. In contrast to this research, static fluid material is applied in the edutainment website learning media

Furthermore, the development of e-learning to improve students' critical thinking skills by Safitri found that e-learning is an exciting and challenging learning medium. Besides, that students can also build critical thinking skills in applying e-learning [27]. The ensuing research is the applicability of blog website-based blended learning to improve the critical thinking skills of 11-science students by Batuthoh [28], with the results of students being more enthusiastic and interested in the learning process with a website-based blended learning model. In testing critical thinking skills in the website-based blended learning model, there are two classes including the control class and the trial class, the control class uses learning as usual and the trial class uses website-based blended learning and the results show that critical thinking skills in the trial class are higher than control class [28]. According to research conducted by Indriani & Kholid, learning tools designed with an ECT-based discussion model (E-book Critical Thinking) with a very accurate category and suitable for use in the teaching and learning process [29]. Based on the research of Christi, the development of the OASIS module on temperature and heat material is suitable for use in learning physics and can improve students' skills in critical thinking [30]. Similarly, a study from Ngurahrai is the development of mobile learning which is composed using the Inventor application which has been experimented on 10th-grade students which are proven to improve students' critical thinking skills on momentum and impulse material with an N-gain of 0.61 [31]. In previous research, the ability to think critically in physics learning has been successfully improved through e-learning media, blog websites, ECT, OASIS modules, and mobile learning. In this development research, students' critical thinking skills in physics learning are trained through the edutainment website media

In previous research, the edutainment website has been developed by Daud for a multimedia program for vocational students that contains material features, videos, glossaries, and exercises. The media has been tested and proven to increase students' interest in learning [32]. Also, Saputera & Yunita have also developed an edutainment website for Curup Public Senior High School 1. In this media, there are material features, exercises, announcements, news, and teacher biographies that have been designed with an interactive system so that students are more interested in learning by utilizing these media [33]. The two edutainment websites are different from the edutainment website that the researcher has developed, namely the features in this media are not only material, videos, and exercises but also virtual laboratories and games. The purpose of developing this edutainment website media is also different from the previous media, namely to train students' thinking skills in learning physics

4. Conclusion

According to the research results on the media development of physics edutainment website, it can be concluded that the edutainment website media is very valid and can be used as a direct physics learning media and online physics learning media to improve students' critical thinking skills. The validity percentage is 90.3% in the learning aspect, 90.56% in the material aspect, 88.65% in the media aspect, and 84.70% in the critical thinking aspect. Besides, it is hoped that further research can use the physics edutainment website media that has been developed by making applied research on students to test the effectiveness and practicality of physics edutainment website to improve students' critical thinking skills.

References

- [1] Mendikbud, "Lampiran Peraturan Menteri Pendidikan Dan Kebudayaan Nomor 20 Tahun 2016 Tentang Standar Kompetensi Lulusan Pendidikan Dasar Dan Menengah BAB. II," *Permendikbud*, vol. 9, p. 8, 2016.
- [2] D. Sudiantini and N. D. Shinta, "Pengaruh Media Pembelajaran Terhadap Kemampuan Berpikir Kreatif Dan Penalaran Matematis Siswa," *J. Penelit. dan Pembelajaran Mat.*, vol. 11, no. 1, pp. 177–186, 2018, doi: 10.30870/jppm.v11i1.2996.
- [3] B. Indiani, "Mengoptimalkan Proses Pembelajaran Dengan Media Daring Pada Masa Pandemi COVID-19," *J. Sipatokkong BPSDM Sulawesi Selatan*, vol. 1, no. 3, pp. 227–232, 2020.
- [4] S. R. Ariyanto, I. W. P. Lestari, S. U. Hasanah, L. Rahmah, and D. V. Purwanto, "Problem Based Learning dan Argumentation Sebagai Solusi dalam Meningkatkan Kemampuan Berpikir Kritis Siswa SMK," *J. Kependidikan J. Has. Penelit. dan Kaji. Kepustakaan di Bid. Pendidikan, Pengajaran dan Pembelajaran*, vol. 6, no. 2, p. 197, 2020, doi: 10.33394/jk.v6i2.2522.
- [5] J. Jamaluddin, A. W. Jufri, M. Muhlis, and I. Bachtiar, "Pengembangan Instrumen Keterampilan Berpikir Kritis Pada Pembelajaran IPA di SMP," *J. Pijar Mipa*, vol. 15, no. 1, p. 13, 2020, doi: 10.29303/jpm.v15i1.1296.
- [6] A. Shabrina and R. Diani, "Pengembangan Media Pembelajaran Fisika Berbasis Web Enhanced Course dengan Model Inkuiiri Terbimbing," *Indones. J. Sci. Math. Educ.*, vol. 2, no. 1, pp. 9–26, 2019, doi: 10.24042/ijsm.v2i1.3922.
- [7] A. W. Irawan, A. Yusufianto, D. Agustina, and R. Dean, "Laporan Survei Internet APJII 2019 – 2020," vol. 2020. Indonesia Survey Center, 2020.
- [8] M. I. Sa'ad, *Otodidak Web Programming: Membuat Website Edutainment*, 1st ed. Jakarta: PT Elex Media Komputindo, 2020.
- [9] A. Doyan and I. K. . Sukmantara, "Pengembangan Web Intranet Fisika Untuk Meningkatkan Penguasaan Konsep Dan Kemampuan Pemecahan Masalah Siswa Smk," *Indones. J. Phys. Educ.*, vol. 10, no. 2, pp. 117–127, 2014, doi: 10.15294/jpfi.v10i2.3447.
- [10] S. G. Sakti, N. R. Hidayati, and I. D. Kurniawati, "Aplikasi E-Learning Berbasis Web Pada Mata Pelajaran Fisika," *Semin. Nas. Teknol. Inf. dan Komun.*, pp. 435–442, 2020.
- [11] T. Rahayu, T. Mayasari, and F. Huriawati, "Pengembangan Media Website Hybrid Learning Berbasis Kemampuan Literasi Digital Dalam Pembelajaran Fisika," *JPF J. Pendidik. Fis. Univ. Muhammadiyah Metro*, vol. VII, no. 1, pp. 130–142, 2019.

- [12] D. L. Saraswati *et al.*, "Development of web-based and e-learning media for physics learning materials in senior high school: a pilot study," *J. Phys. Conf. Ser.*, 2018, doi: 10.1088/1742-6596/1114/1/012025.
- [13] R. A. Septarini and A. Kholid, "Pengembangan Media Prest Untuk Meningkatkan Keterampilan Berpikir Kritis Peserta Didik SMA Pada Materi Momentum Dan Impuls," *IPF Inov. Pendidik. Fis.*, vol. 10, no. 1, pp. 32–38, 2021.
- [14] I. M. Tegeh, I. N. Jampel, and K. Pudjawan, *Model Penelitian Pengembangan*. Yogyakarta: Graha Ilmu, 2014.
- [15] M. B. A. Riduwan, *Skala Pengukuran Variabel-Variabel Penelitian*. Bandung: Alfabeta, 2015.
- [16] D. Tivani, T. Wibowo, and P. Nugraheni, "Analisis Berpikir Kritis Matematis Siswa SMA Dalam Penyelesaian Masalah Matematika," *Pros. Sendika*, vol. 5, no. 1, pp. 161–166, 2019.
- [17] R. A. Negoro, H. Hidayah, A. Rusilowati, and B. Subali, "Upaya Membangun Keterampilan Berpikir Kritis Menggunakan Peta Konsep Untuk Mereduksi Miskonsepsi Fisika," *J. Pendidik. (Teori dan Prakt.)*, vol. 3, no. 1, pp. 45–51, 2018.
- [18] A. Purmadi and H. D. Surjono, "Pengembangan Bahan Ajar Berbasis Web Berdasarkan Gaya Belajar Siswa Untuk Mata Pelajaran Fisika," *J. Inov. Teknol. Pendidik.*, vol. 3, no. 2, pp. 151–165, 2016.
- [19] D. R. Aryani, Azizahwati, and Zulirfan, "The Development of Physics Education Problem Based Learning Web as Physics Learning Media for Vocational High School," *J. Phys. Conf. Ser.*, 2019, doi: 10.1088/1742-6596/1351/1/012016.
- [20] F. A. Sari and N. Suseno, "Pengembangan Modul Fisika Online Berbasis Web pada Materi Usaha dan Energi," *JIPFRI (Jurnal Inov. Pendidik. Fis. dan Ris. Ilmiah)*, vol. 3, no. 2, pp. 129–135, 2019, doi: 10.30599/jipfri.v3i2.476.
- [21] E. N. Budiarti, R. Hariyadi, and D. R. Darman, "Pengembangan Web Centric Course Pada Materi Alat Optik," *Pros. Semin. Nas. Pendidik. Fis. Untirta*, vol. 3, no. 1, pp. 283–288, 2020.
- [22] Fitriyati, E. S. Kurniawan, and N. Ngazizah, "Pengembangan LKS Fisika SMA Kelas X Semester II dengan Website Online Berbasis Contextual Teaching Learning," *RADIASI J. Berk. Pendidik. Fis.*, vol. 3, no. 1, pp. 7–11, 2013.
- [23] M. A. Sofyan, Wasis, and M. Ibrahim, "Pengembangan Perangkat Pembelajaran Berdasarkan Masalah Berbasis Edutainment Untuk Melatihkan Kreativitas Siswa SMK Marwanti, K., Muchtar, Y. R. D., & Guntara, Y. (2019). Pengembangan Media Comic Of Physics Berbasis Literasi Visual Pada Materi Fluida Stat," *Pendidik. Sains Pascasarj. Univ. Negeri Surabaya*, vol. 7, no. 1, pp. 1431–1440, 2017.
- [24] A. S. Adam, N. Suprapto, A. Kholid, and H. Mubarok, "Students' responds in using Beboo to learn Static Fluid concept," *J. Phys. Conf. Ser.*, 2019, doi: 10.1088/1742-6596/1171/1/012039.
- [25] R. E. Yuniar and N. Suprapto, "The Implementation Of Scrapbook As A Media To Train Students' Science Literacy In Static Fluid," *IPF Inov. Pendidik. Fis.*, vol. 08, no. 02, pp. 686–688, 2019.
- [26] K. Marwanti, Y. R. D. Muchtar, and Y. Guntara, "Pengembangan Media Comic Of Physics Berbasis Literasi Visual Pada Materi Fluida Statis," *Pros. Semin. Nas. Pendidik. Fis. Untirta*, vol. 2, no. 1, pp. 157–162, 2019.

- [27] H. Safitri, I. Hamidah, and W. Setiawan, "The preliminary study of learning interaction in physics concepts for developing e-learning to promote students' critical thinking," *J. Phys. Conf. Ser.*, 2019, doi: 10.1088/1742-6596/1157/3/032054.
- [28] F. I. Batuthoh, Wahidin, and I. R. Lesmanawati, "Penerapan Model Bleended Learning Berbasis Web Blog Untuk Meningkatkan Keterampilan Berpikir," *J. Penelit. Ilmu dan Pendidik. Biol.*, vol. 8, no. 1, pp. 1–10, 2020.
- [29] M. Indriani and A. Kholid, "Validitas Perangkat Pembelajaran Model Diskusi Berbasis ECT (E-Book Critical Thinking)," *IPF Inov. Pendidik. Fis.*, vol. 08, no. 03, pp. 895–897, 2019.
- [30] R. Y. D. Christi, J. Handhika, and A. C. Yusro, "Pengembangan Modul Fisika Berbasis Oasis Pada Materi Suhu dan Kalor Untuk Meningkatkan Kemampuan Berpikir Kritis," *RADIASI J. Berk. Pendidik. Fis.*, vol. 13, no. 2, pp. 55–60, 2020.
- [31] A. H. Ngurahrai, S. D. Farmaryanti, and Nurhidayati, "Pengembangan Media Pembelajaran Fisika Berbasis Mobile Learning Untuk Meningkatkan Kemampuan Berpikir Kritis Peserta Didik," *RADIASI J. Berk. Pendidik. Fis.*, vol. 12, no. 2, pp. 76–83, 2019.
- [32] J. Daud, I. Arfyanti, and A. A. Romadhon, *Membangun Aplikasi Edutainment Berbasis Web Pada Program Keahlian Multimedia SMKN 4 Samarinda*. Samarinda: STMIK Widya Cipta Dharma, 2017.
- [33] S. A. Saputera and E. Yunita, "Desain Sistem Edutainment Berbasis Web di Sekolah Menengah Atas," *JSAI J. Sci. Appl. Informatics*, vol. 2, no. 2, pp. 177–184, 2019, [Online]. Available: <http://www.jurnal.umb.ac.id/index.php/JSAI>.