JPPIPA 10(11) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Effectiveness of Biology E-Module Teaching Materials Based on Flip Pdf Professional Application to Improve Learning Outcomes and Critical Thinking Skills

Eka Fitria Purnamasari[1*], Elsje T. Maasawet[1], Yusak Hudiyono[2], Lambang Subagiyo[3], Herliani[1], Akhmad[1]

[1] Magister Pendidikan Biologi, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Mulawarman, Samarinda, Indonesia.
[2] Magister Pendidikan Bahasa Indonesia, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Mulawarman, Samarinda, Indonesia.
[3] Program Pendidikan Fisika, Universitas Mulawarman, Samarinda, Indonesia.

Received: June 10, 2024
Revised: September 12, 2024
Accepted: November 25, 2024
Published: November 30, 2024

Corresponding Author:
Eka Fitria Purnamasari
ekafitria.purnamasari@gmail.com

DOI: 10.29303/jppipa.v10i11.9147

Abstract: This study aims to develop e-module teaching materials that can be used by teachers and students both in school and outside school by developing one of the Plip Pdf Professional applications as an innovation media in a fun learning process. The type of research used is research and development (R&D). The sample in this study were biology teachers and students of SMA Negeri 5 Samarinda and SMA Negeri 11 Samarinda. The results of the expert validation of the teaching materials produced were very good with an average score of 3 validators of 91.33% with the category (very valid). The practicality of the teaching materials assessment from the teacher showed a result of 95.31% (very practical), while the assessment from students got a score of 89.06% (very practical). The effectiveness of the teaching materials produced was able to provide an increase in cognitive learning outcomes with a gain score index of 0.83 (high) and the percentage value of students' critical thinking skills was 88.8%. The results of the effectiveness test using the paired sample t-test showed that there was an influence of the use of e-module teaching materials based on the Plip Pdf Professional application in improving the biology learning outcomes of students at SMA Negeri 5 and SMA Negeri 11 Samarinda on the Human Respiratory System material.

Keywords: Critical thinking skills; E-modules; Flip Pdf professional; Learning outcomes; Teaching materials

Introduction

Information and Communication Technology (ICT) has spread widely so that it has greatly influenced various areas of life. This is in accordance with the 21st century learning curriculum, namely educational practices are used to build a curriculum according to the goals and abilities of students in schools (González-pérez et al., 2022; Meyer et al., 2020; Wrahatnolo et al., 2018).

E-learning is currently the modern learning of the 21st century and can be interpreted as a learning media that does not use paper as its material so that in the development of technology, information and communication can be used as a paradigm of modern education (Aulakh et al., 2023; Barteit et al., 2020; Farhan et al., 2019; Ongor et al., 2023; Stecuła et al., 2022). This learning concept makes it easier for students and teachers to obtain learning resources with easy access (Sahlani, 2020). Teaching materials include all types of materials used to help educators or instructors in conducting teaching and learning activities in the classroom. These materials can be printed or electronic teaching materials (Rahmatina et al., 2020).

How to Cite:
Purnamasari, E. F., Maasawet, E. T., Hudiyono, Y., Subagiyo, L., Herliani, & Akhmad. (2024). Effectiveness of Biology E-Module Teaching Materials Based on Flip Pdf Professional Application to Improve Learning Outcomes and Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, *10*(11), 8892–8898. https://doi.org/10.29303/jppipa.v10i11.9147

One example of electronic teaching materials is the use of e-modules. The use of e-modules can make the learning process interesting (Syahrial et al., 2019). E-modules are written materials that present scientific knowledge from the author's thoughts. E-modules are also equipped with assignments, exercises, or evaluation materials, as well as other supporting resources to support the learning process in certain subjects (Kuncahyono, 2018). The e-module display is presented in electronic format, in which there are animations, audio, navigation that make users more interactive with the program (Marcelina et al., 2022).

E-module is a modification of conventional module by combining the use of information technology so that e-module is more interesting and interactive (Putri et al., 2015). The use of e-module can help solve the problem of time constraints during the learning process. Teachers can conduct learning not only in the classroom with limited time but can also conduct learning for students who are already outside the school (Aftiani et al., 2021).

This is in line with Sofyan et al. (2023), that technology in education gives rise to new methods that can facilitate the learning process of students in schools. With technology, methods are created that attract students' attention in learning and make it easier to understand the material.

This professional flip pdf application makes e-modules as interactive media, because not only reading text but also learning videos and interactive quizzes that help in the learning process. Students can receive and understand learning, especially in abstract biology material. So, Biology learning becomes more interesting and not monotonous (Seruni et al., 2020).

Based on the results of a pre-research survey in several public high schools in Samarinda (SMAN 1, SMAN 3, SMAN 5, SMAN 8, SMAN 9, SMAN 10, SMAN 11, SMAN 12, and SMAN 13), biology teachers in these schools generally have known and used e-modules with a percentage of 38.5%, while 61.5% of these teachers have not created and developed e-modules independently using the plif pdf professional application. Teachers only search the internet and download them as their own reference. In addition, most teachers still use conventional learning media such as implementing learning media in the form of word, pdf and ppt which are only in writing. Another problem is the limited time in delivering the material so that it is less than optimal, especially by using a demonstration method that is not interactive, which causes students to not understand the material presented. More interesting and innovative learning resources are needed to be able to explain the function, working principles, and applications in accordance with 21st century learning and the industrial revolution 4.0.

The weakness of this printed module is the unattractive appearance and is rarely carried by students because it has a heavy weight and large size (Rusmiati et al., 2013). One solution that has a good impact on learning is to develop teaching materials in the form of e-modules based on flip pdf professional. The flip pdf professional application has many advantages, namely it is easy to use because it can be operated by beginners who do not know the HTML programming language (Hamid et al., 2021).

The use of e-modules can help solve the problem of time constraints during the learning process. Teachers can conduct learning not only in class with limited time but can also conduct learning for students who are already outside of school, namely using e-modules. Schools need attention by providing training in making e-modules to all teachers, so that students in the future are responsive to technology and ready to compete in the era of the industrial revolution 4.0 (Fatimah et al., 2024; Liana et al., 2024; Rusni et al., 2023).

Referring to the background that has been described, the researcher is interested in developing teaching materials for respiratory system biology based on the professional flip pdf application to improve learning outcomes and critical thinking skills of grade XI high school students in Samarinda.

Method

The type of research used in this study is the development of Research and Development (R&D) using the Borg and Goal development model. This method is used to adjust the research objectives, namely designing the development of e-modules and testing their feasibility, practicality, and effectiveness. As stated by Sugiyono (2018), that Research and Development (R&D) research is a research method used to produce certain products and test the effectiveness of these products.

The data obtained from this development research are qualitative data and quantitative data. Data collection techniques in this study using validation questionnaires, response questionnaires and tests. The validation and response questionnaires are then calculated in percentage and substituted into qualitative criteria. While the results of the test method will be used for the t-test.

The R&D research steps are based on the Borg and Gall development procedure) as seen in Figure 1 (Sugiyono, 2018).

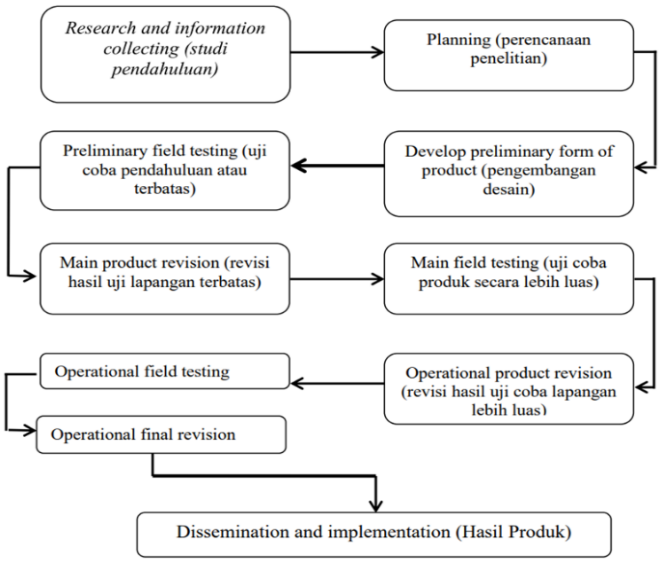

Figure 1. Steps for using the research and development (R&D) method according to Borg and Gall

Result and Discussion

This development research uses the Research and Development (R&D) method (Sugiyono, 2018). The initial step of this method is to identify problems and potentials with the following results, 61.5% of teachers have not created and developed e-modules independently using the professional plif pdf application. Teachers are accustomed to downloading e-modules without being able to create them themselves. Moreover, there are still many teachers who use printed modules which are considered inefficient at this time. In today's era, students are more interested in reading material through gadgets than through books. Students absorb knowledge that is shared in audio-visual form faster.

The researcher tried to create a design of teaching materials, namely e-modules using the Flip Pdf Professional application on the biology subject of the "Respiratory System" material in class XI, which was then used as teaching materials in two senior high school education units, namely SMAN 5 Samarinda and SMAN 11 Samarinda. Reviewed from the general condition of the two SMANs which have accreditation equivalent to category A (superior). So it can be concluded, the Flip pdf Professional application on the biology subject of the "Respiratory System" material can be done at school or independently outside of school.

The product is made using hardware and software devices. The software devices used are Lenovo laptops, mice and smartphones, while the software devices used are YouTube, Live Work Sheet, Google Search, Google Drive, Google Form, and QR Code Generator applications. After the product is finished, the product is tested limited to 10 students of SMAN 5 Samarinda, then after the assessment is carried out, revisions will be made according to comments and suggestions from teachers and students, after that the product is tested more widely in the same school but using more students, namely 36 students. After there are no comments and suggestions, the following product development results are obtained.

The following is the final product display of the e-module based on the Flip Pdf Professional application on the topic of "Respiratory System" for class XI SMA.

Home Page

Figure 2. Appearance of the e-module home page

Display of Learning Materials

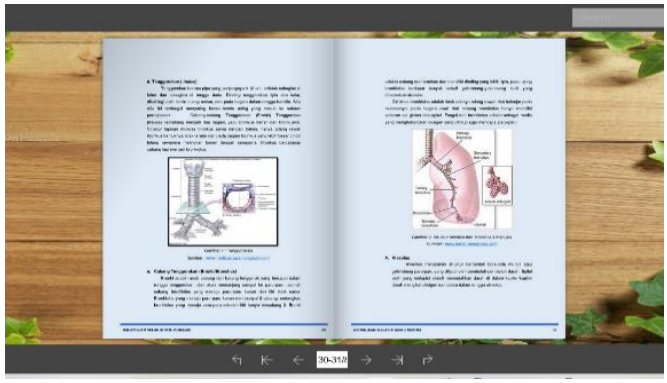

Figure 3. Display of the material menu in the e-module

Task Menu

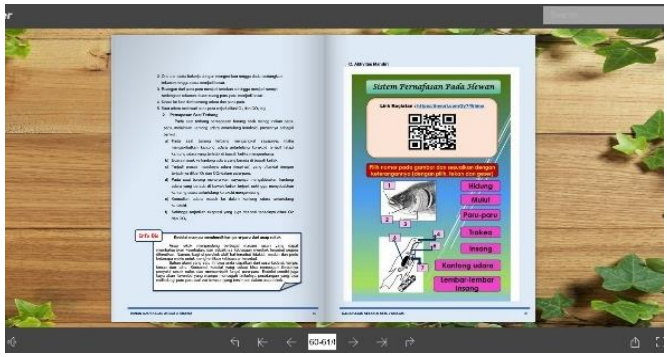

Figure 4. E-module task menu display

Learning Activity Menu

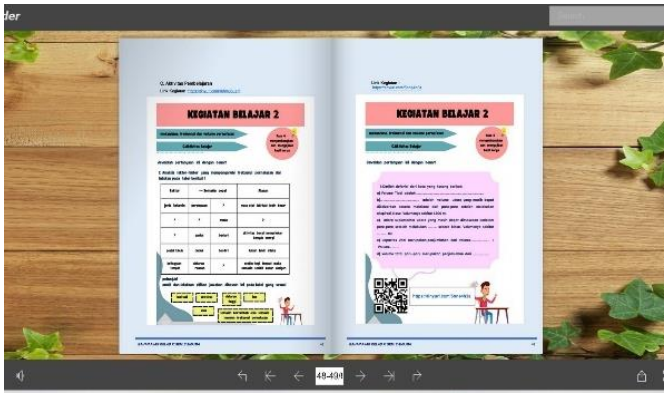

Figure 5. Learning activity menu display

Guide Menu

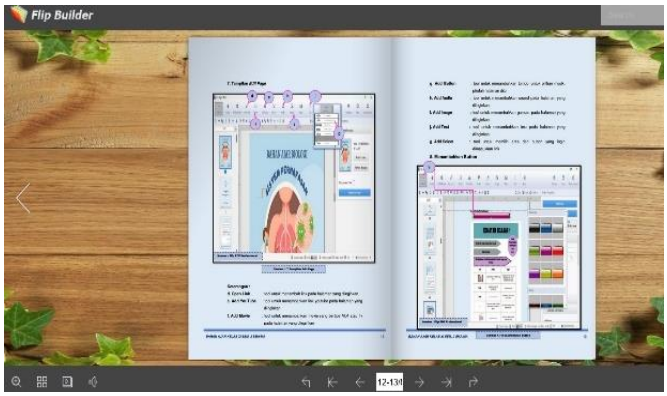

Figure 6. Guide page for the e-module

In this research and development, a feasibility test, practicality test and effectiveness test were carried out. The final validation results by learning media experts reached a feasibility value of 90.67% with a very feasible interpretation criterion. Based on this, the teaching materials based on the plif pdf professional application are classified as very good and very suitable for use in learning activities. Meanwhile, media experts have provided several suggestions for improving the initial validation, namely the caption text in the video is not clear, so the magnification is added to make it look clearer, the presentation composition to be more focused, the presentation framework to be made in 3 dimensions. After going through the final product improvement steps, this plif pdf professional application-based learning media is of good quality and can be used for learning with the hope of providing maximum material. Learning media acts as a technology to convey material or topics in learning (Hamid et al., 2021).

The final validation of the material expert's eligibility data with interpretation criteria obtained a feasibility value of 92.0% with a very feasible category. Based on these results, teaching materials based on the professional flip pdf application can be used for learning. The material expert provided several suggestions for improvement during the initial validation, including adding font size so that it is clearly legible and improving several parts of the instrument so that the questions are more specific, for example, questions about curriculum suitability must mention the current curriculum, not the general curriculum. After making improvements to the final product, the material expert did not provide any suggestions for improvement. So the learning media based on the professional plif pdf application has very good material quality and is very feasible for learning activities.

E-module teaching materials can be categorized as practical if the media is able to provide benefits and explain the learning material in its entirety so that it can increase intelligence and make learning easier (Maslahah et al., 2019). The data from the teacher's review results obtained a value of 80.00% of teacher responses in the small class trial, while 82.50% in the large class trial, and in the experimental class of 95%. From these results, it shows that along with improvements through suggestions and input from teachers during the small class trial and the expert team, the quality of the media has increased during the large class trial.

After improvements were made based on suggestions from the expert team, student response questionnaires were given to students during small and large class trials to see improvements in media quality to the final product after improvements were made based on suggestions from the expert team. In the student response questionnaire. Contains several indicators that will be questionnaire questions, namely: material, presentation media, and language. From the student questionnaire. The student response value during the small class trial was 89.79% so that the e-module teaching material was declared practical, then when the final product in the large class was 91.61% after experiencing improvements in media quality, it was declared very practical. From the results of the study which showed an increase in student responses as the product improved, so that the results obtained experienced a significant increase besides that it was also influenced by differences in students' learning abilities, namely the ability of students who tend to understand learning through video visualization, there are also those who can only read and understand the meaning of the material. This explains that after experiencing improvements based on suggestions for improvements from the expert team, the quality of the media has increased. Thus, the e-module teaching material based on the plif PDF professional application on the human respiratory system can be used in learning activities with

very practical interpretation criteria so that students are able to understand the learning material.

Based on the results of the pre-test and post-test, it shows that the e-module teaching materials based on the plif PDF professional application are categorized as effective in improving cognitive learning outcomes in students' critical thinking skills.

In the small class and large class trials, each showed results that there was an influence on the effectiveness of the use of e-module teaching materials based on the plif pdf professional application with a t-value of 0.000> small from 0.05. In the effectiveness test on the use of media using the gain score index, it was categorized as high with a value of 0.24 (low) in the small class test at the large class test stage as a result of the effectiveness test, a gain score index of 0.79 (high category) was obtained. At the implementation test stage in one school, the results showed 0.83 at SMA Negeri 5 Samarinda. This proves that the e-module teaching materials based on the plif pdf professional application that were developed have proven to be effective in their use in the learning process. Comparison of the gain index at each stage can also be seen that there is an increase in the gain score. This is because it proves that from the revision and evaluation, the effectiveness of the media developed is improving along with the improving quality of the media. This is evidenced by the results of the media feasibility analysis, especially from teacher reviews and student responses.

The results of the large class independent t-test conducted showed that biology teaching materials based on the flip pdf professional application were effective in improving student learning outcomes and critical thinking skills of students as evidenced by a significance value of 0.000 <0.05, and based on the N-gain score value in the treatment class, namely 0.79 with a high category and the control class with an N-gain score of 0.64 in the medium category. The results of the comparison between small and large classes, where the N-gain score value was obtained 0.68 in the medium category in the small class, namely class XI MIPA 1 SMA Negeri 5 Samarinda. The N-gain result was 0.83 in the high category in the large class, namely class XI MIPA 2 SMA Negeri 5 Samarinda. The final result that can be concluded is that the N-gain score shows a high category and the teaching materials developed, namely teaching materials based on plif pdf professional, can improve cognitive learning outcomes.

Conclusion

Based on the description and discussion, it can be concluded that the e-module teaching material based on the plif pdf professional application on the "Respiratory System" material uses the Research and Development (R&D) development model. Based on research data and discussion, it can be concluded that the feasibility of the plif pdf professional application-based teaching material is very high with an average score of 91.33 (very feasible) given by the three validators. The practicality of the plif pdf professional application-based teaching material shows a teacher's rating of 82.5 (very practical) and a student response of 96.1 (very practical). The effectiveness of the plif pdf professional application-based teaching material obtained can improve cognitive learning outcomes with a gain score of 0.79 (high), so that the plif pdf professional application-based teaching material shows that it is effective for use in learning. The results of the comparison between small and large classes are N-gain score 0.68 medium category in small class XI MIPA 1. N-gain result 0.83 high category in large class XI MIPA 2. The final result that can be concluded is that teaching materials based on plif pdf professional can improve students' cognitive learning outcomes. Through the pre-test and post-test of students from the five critical thinking indicators, the ability to provide a brief explanation has the highest value, namely the questionnaire value reaching 90% (Very Critical).

Acknowledgments

I would like to thank my supervisor and examiners, who have guided me in writing this article. I would also like to thank my family who have provided moral and material support during the process of writing this article.

Author Contributions

In this paper, the author has contributed to the following sections: conceptualization by Eka Fitria Purnamasari; research methodology by Lambang Subagio; software by Eka Fitria Purnamasari; supervision by Yusak Hudiyono and Elsje T Maasawet; formal analysis by Eka Fitria Purnamasari; data sources by Eka Fitria Purnamasari; data curation by Eka Fitria Purnamasari; original drafting by Eka Fitria Purnamasari; editing of the text by Yusak Hudiyono, Elsje T. Maasawet, Herliani, Akhmad and Lambang Subagiyo.

Funding

This research did not receive any external funding and was conducted independently with the aim of providing information and findings that are fair to the research objectives.

Conflicts of Interest

In this article, the author confirms that there is no conflict of interest during the journal writing process. The author does not have the power to dictate policies implemented by the schools studied. There is no data manipulation by the author, and the schools studied are only used as sources of information, not actively participating in writing the research findings.

References

Aftiani, R. Y., Khairinal, K., & Suratno, S. (2021). Pengembangan Media Pembelajaran E-Book Berbasis Flip Pdf Professional Untuk Meningkatkan Kemandirian Belajar Dan Minat Belajar Siswa Pada Mata Pelajaran Ekonomi Siswa Kelas X IIS 1 SMA NEGERI 2 Kota Sungai Penuh. *Jurnal Manajemen Pendidikan Dan Ilmu Sosial*, *2*(1), 458–470. https://doi.org/10.38035/jmpis.v2i1.583

Aulakh, K., Roul, R. K., & Kaushal, M. (2023). E-learning enhancement through educational data mining with Covid-19 outbreak period in backdrop: A review. *International Journal of Educational Development*, *101*, 102814. https://doi.org/10.1016/j.ijedudev.2023.102814

Barteit, S., Guzek, D., Jahn, A., Bärnighausen, T., Jorge, M. M., & Neuhann, F. (2020). Evaluation of e-learning for medical education in low- and middle-income countries: A systematic review. *Computers & Education*, *145*, 103726. https://doi.org/10.1016/j.compedu.2019.103726

Farhan, W., Razmak, J., Demers, S., & Laflamme, S. (2019). E-learning systems versus instructional communication tools: Developing and testing a new e-learning user interface from the perspectives of teachers and students. *Technology in Society*, *59*, 101192. https://doi.org/10.1016/j.techsoc.2019.101192

Fatimah, F., & Muamar, M. R. (2024). Analysis of Students' Needs and Characteristics toward Science to Support Differentiated Learning of Kurikulum Merdeka. *Jurnal Penelitian Pendidikan IPA*, *10*(5). https://doi.org/10.29303/jppipa.v10i5.6731

González-pérez, L. I., & Ramírez-montoya, M. S. (2022). Components of Education 4.0 in 21st Century Skills Frameworks: Systematic Review. *Sustainability (Switzerland)*, *14*(3), 1–31. https://doi.org/10.3390/su14031493

Hamid, A., & Alberida, H. (2021). Pentingnya Mengembangkan E-Modul Interaktif Berbasis Flipbook di Sekolah Menengah Atas. *Edukatif: Jurnal Ilmu Pendidikan*, *3*(3), 911–918. https://doi.org/10.31004/edukatif.v3i3.452

Kuncahyono. (2018). Pengembangan E-Modul (Modul Digital) Dalam Pembelajaran Tematik Di Sekolah Dasar. *JMIE (Journal of Madrasah Ibtidaiyah Education)*, *2*(2), 219. https://doi.org/10.32934/jmie.v2i2.75

Liana, T., Djufri, Sarong, A., & Sofyan A. (2024). Development of Android-Based E-Modules in Biology Learning on Water Environmental Pollution to Enhance Science Literacy. *Jurnal Penelitian Pendidikan IPA*, *10*(9), 644–654. https://doi.org/10.29303/jppipa.v10i9.8097

Marcelina, S., Medriati, R., & Putri, D. H. (2022). Pengembangan E-Modul Berbantuan Simulasi Videoscribe. *Jurnal Ilmu Pembelajaran Fisika*, *2*(3), 122–127. Retrieved from https://ruangbacafkip.unib.ac.id/index.php?p=show_detail&id=7584

Maslahah, W., & Rofiah, L. (2019). Pengembangan Bahan Ajar (Modul) Sejarah Indonesia Berbasis Candi-Candi Di Blitar Untuk Meningkatkan Kesadaran Sejarah. *Agastya: Jurnal Sejarah Dan Pembelajarannya*, *9*(1), 32. https://doi.org/10.25273/ajsp.v9i1.3418

Meyer, M. W., & Norman, D. (2020). Changing Design Education for the 21st Century. *She Ji: The Journal of Design, Economics, and Innovation*, *6*(1), 13–49. https://doi.org/10.1016/j.sheji.2019.12.002

Ongor, M., & Uslusoy, E. C. (2023). The effect of multimedia-based education in e-learning on nursing students' academic success and motivation: A randomised controlled study. *Nurse Education in Practice*, *71*, 103686. https://doi.org/10.1016/j.nepr.2023.103686

Putri, N., Sugihartini, N., Wirawan, M. A., & ... (2015). Pengembangan E-Modul Mata Pelajaran Komposisi Foto Digital (Paket Keahlian Multimedia Dengan Model Pembelajaran Task Karmapati). *E-Journal PGSD Universitas Pendidikan Ganesha*, *4*(5), 1–8. Retrieved from https://ejournal.undiksha.ac.id/index.php/KP/article/view/6620

Rahmatina, C. A., Jannah, M., & Annisa, F. (2020). Pengembangan Bahan Ajar Berbasis STEM (Science, Technology, Engineering, And Mathematics) DI SMA/MA. *Jurnal Phi; Jurnal Pendidikan Fisika Dan Fisika Terapan*, *1*(1), 20. https://doi.org/10.22373/p-jpft.v1i1.6531

Rusmiati, I. G. A., Santyasa, I. W., & Warpala, W. S. (2013). Pengembangan Modul Ipa Dengan Pendekatan Kontekstual Untuk Kelas V Sd Negeri 2 Semarapura Tengah. *E-Journal Program Pascasarjana Universitas Pendidikan Ganesha*, *3*, 1–10. https://doi.org/10.23887/jtpi.v3i1.899

Rusni, I., Fitria, Y., Ahmad, S., & Zen, Z. (2023). Development of E-Modules Oriented by A Science, Technology, Engineering, Art, and Mathematics (STEAM) Approach to Improve High Level Thinking Ability. *Jurnal Penelitian Pendidikan IPA*, *9*(9), 7179–7188. https://doi.org/10.29303/jppipa.v9i9.5345

Sahlani, L. (2020). Pemanfaatan kegiatan pembelajaran dalam jaringan (e-learning) dalam menghadapi masa pandemi covid-19 di madrasah aliyah negeri 2 bandung. *Jurnal Al-Ibanah*, *05*(02), 152–191.

Retrieved from http://ojs.jurnalalibanah.id/index.php/alibanah/article/view/11

Seruni, R., Munawaroh, S., Kurniadewi, F., & Nurjayadi, M. (2020). Implementation of e-module flip PDF professional to improve students' critical thinking skills through problem based learning. *Journal of Physics: Conference Series*, *1521*(4). https://doi.org/10.1088/1742-6596/1521/4/042085

Sofyan, A., & Hidayat, A. (2023). Dampak Perkembangan Teknologi Peningkatan Kualitas Pendidikan. *Jurnal Satya Informatika*, *7*(02), 16–24. https://doi.org/10.59134/jsk.v7i02.163

Stecuła, K., & Wolniak, R. (2022). Influence of COVID-19 Pandemic on Dissemination of Innovative E-Learning Tools in Higher Education in Poland. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(2), 89. https://doi.org/10.3390/joitmc8020089

Sugiyono. (2018). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R & D*. Bandung: Alfabeta.

Syahrial, A., Kurniawan, D. A., Chan, F., Septianingsih, R., & Perdana, R. (2019). Multimedia Innovation 4.0 in Education: E-Modul Ethnoconstructivism. *Universal Journal of Educational Research*, *7*(10), 2098–2107. https://doi.org/10.13189/ujer.2019.071007

Wrahatnolo, T., & Munoto. (2018). 21 st centuries skill implication on educational system. *IOP Conference Series: Materials Science and Engineering*, *296*, 012036. https://doi.org/10.1088/1757-899X/296/1/012036