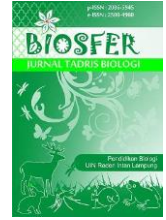




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Development of Integrated Interactive Modules Education for Sustainable Development (ESD) Global Warming Material Junior High School Muhammadiyah Pekanbaru

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ABSTRACT

This study aims to describe the development of ESD integrated interactive modules. The population of this study was grade VII students of SMP Muhammadiyah Pekanbaru with a sample of 35 people who were given learning using ESD integrated interactive modules. The method used is research development (Research and Development) with the ADDIE development model. The instruments used in this study were validation sheets for material experts and media experts to see the feasibility level of interactive modules, practicality test questionnaires and questionnaires of student responses to the use of interactive modules developed. The results showed that the feasibility of interactive modules based on the results of material expert validation was 75.5% with feasible criteria. Meanwhile, the results of media expert validation obtained a percentage of 81.4% with very feasible criteria. The results of the practicality test questionnaire showed a value of 94.6%, which means that it is very practical to use and the student response questionnaire with an average of 89.74% and the category is very interesting.

Pengembangan Modul Interaktif Terintegrasi Education for Sustainable Development (ESD) Materi Pemanasan Global SMP Muhammadiyah Pekanbaru

ABSTRAK: Penelitian ini bertujuan dalam upaya mendeskripsikan pengembangan modul interaktif terintegrasi ESD. Populasi penelitian ini adalah peserta didik kelas VII SMP Muhammadiyah Pekanbaru dengan sampel sebanyak 35 orang yang diberikan pembelajaran menggunakan modul interaktif terintegrasi ESD. Metode yang digunakan yaitu penelitian pengembangan (Research and Development) dengan model pengembangan ADDIE. Instrumen yang digunakan dalam penelitian ini adalah lembar validasi ahli materi dan ahli media untuk melihat tingkat kelayakan modul interaktif, angket uji praktikalitas serta angket respon peserta didik terhadap penggunaan modul interaktif yang dikembangkan. Hasil penelitian menunjukkan bahwa kelayakan modul interaktif berdasarkan hasil validasi ahli materi sebesar 75,5% dengan kriteria layak. Sedangkan hasil validasi ahli media memperoleh persentase 81,4% dengan kriteria sangat layak. Hasil angket uji praktikalitas menunjukkan nilai 94,6% yang artinya sangat praktis digunakan dan angket respon peserta didik dengan rata-rata 89,74% dan kategori sangat menarik.

INTRODUCTION

Education has the main function in implementing changes and progress of the nation (Sumadi & Ma'ruf 2020). The educational mechanism cannot be separated from the mechanism itself (Yuliani & Hartanto 2016). Law Number 20 of 2003 concerning SISPENDIKNAS reveals that education is a conscious and systematic act in order to achieve an atmosphere and learning process, so that students have intelligence, personality, so that students actively so that they have their potential in spiritual strength for the community, nation and state (Haka et al., 2020).

The development of the 21st century in the 4.0 revolution which makes changes to information systems and technology that is very rapid makes opportunities to improve the quality of education, as a place to improve the quality of education, the latest innovations can be carried out by educators adapted to the current era of globalization (Pratiwi, 2021);(Ratama et al., 2021). Educators as guidelines as informants are important in providing experience and creating skills for students, as well as educators as containers, motivators and companions in achieving changes in learning (Hamka & Purwanto, 2021);(Allanta & Puspita 2021). According to Purwati and Ouahi in (Sari, 2023) pedagogic competence is a competence that must be possessed by educators in managing learning conditions in the classroom, including, at least including understanding, insight, or basic education, understanding of students, curriculum development, lesson planning, implementation and dialogical learning education, the use of technology learning, evaluation of learning outcomes, and the development of students to self-actualize various potentials. Explanatory learning is also still widely carried out in schools, this explanatory method demands more teacher activity than the students themselves, so that in the learning process students become

passive and less active (Neng, 2020);(Du, Chaaban, Sabah, Al-Thani, & Wang, 2020).

The use of technology as a learning resource is an effort to solve learning problems (Pratama et al., 2020). One of the learning resources that is in accordance with the current era of globalization is an interactive module, Interactive modules are self-study packages and detailed to assist learners in achieving learning goals (Aryawan et al., 2018);(Rasmi et al., 2023). Interactive modules can be integrated with ESD (Education for Sustainable Development) as a learning resource for the era of globalization or utilizing current technology because it contains sustainable development goals (Duarte et al., 2020);(Cebrián et al., 2020). Learning is the process by which a person acquires a completely new change in behavior as a result of his own actions of experience in interacting with his environment (Suwatra et al., 2018);(Glavič, 2020). According to Vilmala et al. (2022) and Wilhelm et al. (2019) stated that ESD is the latest vision in the world of education to create empowered and responsible humans in developing a sustainable future.

ESD integrated science learning can train students in finding out their own problems in the surrounding environment, designing and providing solutions to problems, making solutions to problems and communicating solutions (Hidayati & Siswanto, 2020);(Sinakou et al., 2019). The development of the ESD PjBL model aims to explore the potential for creativity and instill awareness and sensitivity to the environment of sustainable development in participants (Kagawa et al., 2006);(Agbedahin, 2019).

The results of an interview that has been conducted to one of the educators in the field of science at Muhammadiyah Pekanbaru Junior High School, stated that learning in schools is still explanatory, ESD has not been applied or inserted in learning materials and has not used interactive teaching materials.

Fitria & Hamdu (2021) stated that the use of interactive modules is very effective for use in learning something, interactive modules can be easily used in learning without space and time limits and there are videos in the material will have a positive impact on users and progress in the world of education. Then, the results of the research conducted by Haka et al. (2020) showed that the module was suitable for use in the learning process. Biology educators responded very positively to the teaching module products.

Therefore, the researchers aims to find out whether the development of an interactive module by adding the integration of Education for sustainable development (ESD) where there are quizzes and project assignments about the sustainability of ESD itself, specifically on global warming material is suitable for use.

METHOD

This type of research is research development or Research and development (R & D), by following the ADDIE model which includes five stages of the process, namely analysis, design, development, implementation, and evaluation. The product developed in this study is an interactive module with ESD integration. Research and development is a research method used to produce certain products and test the effectiveness of these products (Raihan, 2017).

In this study, the population is 35 students in grade VII of Muhammadiyah Pekanbaru Junior High School who will use interactive modules. The sampling technique used is a non-probability sampling technique, namely purposive sampling. Non-probability sampling is a sampling technique that does not provide equal opportunities or opportunities for members or samples that are not selected in the trial.

This research was conducted at Muhammadiyah Pekanbaru Junior High School as a sample analysis of product needs. This research will be conducted in 2023.

Product trials will be carried out in class VII in the even semester of the 2022/2023 academic year.

Data collection techniques in this study are non-test techniques using questionnaires consisting of material expert validation questionnaires, media expert validation questionnaires, practicality test questionnaires, and student response questionnaires. Data obtained from validation sheets and questionnaires were further analyzed using Likert scales.

The number of scores obtained in the questionnaire is then analyzed to determine the percentage value obtained using the formula:

$$\text{Presentase} = \frac{\text{Number of scores obtained}}{\text{Maximum number of scores}} \times 100\%$$

In this study to present data obtained from the validation results of material experts and media experts and questionnaires testing practicality and student responses are converted into the following value categories:

Tabel 1. Eligibility Criteria

Valuation (%)	Criterion
81 ≤ P ≤ 100	Very Worth It
61 ≤ P < 81	Proper
41 ≤ P < 61	Pretty Decent
21 ≤ P < 41	Not Worth It
0 ≤ P < 21	Very Unworthy

Source: (Riyanti, 2014)

Tabel 2. Practicality Test Criteria

Valuation (%)	Criterion
81 ≤ P ≤ 100	Very Practical
61 ≤ P < 81	Practical
41 ≤ P < 61	Quite Practical
21 ≤ P < 41	Less Practical
0 ≤ P < 21	Very impractical

Source: (Oktapianti, 2021)

Tabel 3. Student Response Results Criteria

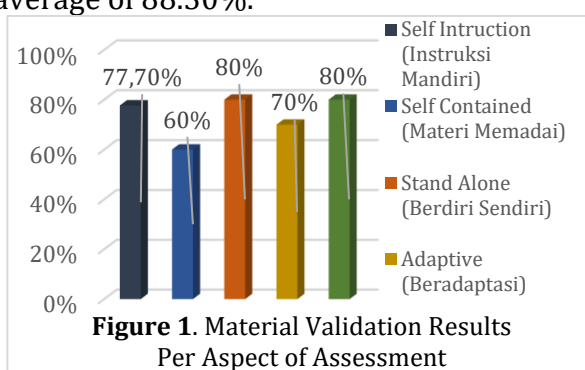
Valuation (%)	Criterion
81 ≤ P ≤ 100	Very interesting
61 ≤ P < 81	Pull
41 ≤ P < 61	Quite Interesting
21 ≤ P < 41	Less Attractive
0 ≤ P < 21	Very unattractive

RESULTS AND DISCUSSION

The results of material expert validation and media expert validation are carried out before the interactive module is used. The purpose of to find out whether the

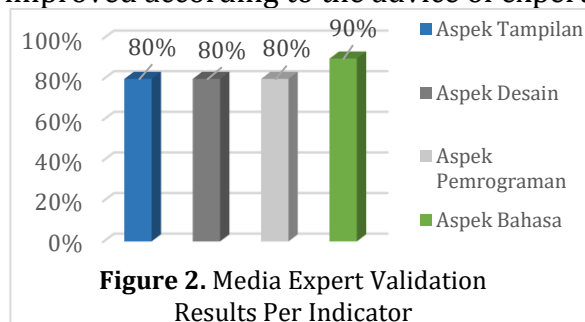
development of an interactive module by adding the integration of Education for sustainable development (ESD) where there are quizzes and project assignments about the sustainability of ESD itself, specifically on global warming material is suitable for use.

The results of the validation of the ESD integrated interactive module of class VII global warming material, obtained a percentage of 75.50% of the results of the validation of material experts in the Decent category and obtained a value of 81.40% of the results of media expert validation in the Very Feasible category. This is in line with research Saryadi & Sulisworo (2023) on the data analysis technique used in this study is a qualitative analysis technique consisting of data reduction, data presentation and data inference. The results of the study based on the assessment of material experts obtained an average of 70,00%. The results of the media expert assessment obtained an average of 88.30%.



Based on the graph above, the percentage gain in the aspect of Self Instrument assessment obtained a value of 77.70% of the Feasible criteria. The Self Contained assessment aspect obtained a value of 60% with the criteria of Decent Enough, this aspect has suggestions by validators in the form of the concept map section is still difficult to understand. While in the Stand Alone aspect, it gets a score with a percentage of 80%, which is included in the Eligible criteria. Obtained a score of 70% on the Adaptive aspect with the Feasible criteria. User Friendly is the last aspect of the assessment, this aspect gets a value of 80% where the criteria is Feasible. Hasairin et al. (2023) said that module that have been

declared high by the validator must still be improved according to the advice of experts.



The display aspect of the ESD integrated interactive module obtained a percentage value of 80%, which means that this aspect obtained the Eligible criteria. In the design aspect, the score is 80% with the Feasible criteria. The acquisition of a percentage value of 80% is obtained in the aspect of programming where the criteria are Eligible. While in the language aspect, the percentage value is higher than other aspects, namely 90% with a Very Decent percentage. Wulandari and Nofina (2022) argues that modules can explore students' creative ideas through informative product presentations. Then the presentation of interesting images or illustrations using beautiful colors will stimulate student activeness in learning (Saragih & Tanjung, 2023).

The results of the practicality test are carried out in order to see the practicality of ESD integrated interactive modules that have been used or during use in the learning process. Here are the results of practicality tests by educators:

Tabel 4. Practicality Test Results by Educators

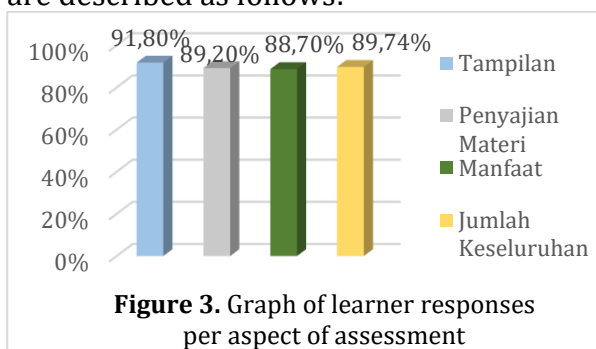
Assessment Aspect	Expert Value	Max Value	%	Ket
Ease of Use	19	20	95	Very Practical
Attraction	30	30	100	Very Practical
Benefit	22	25	88	Very Practical
Sum	71	75	94,6	Very Practical

The results of the practicality test by educators as a whole obtained a percentage value of 94.6% with Very Practical criteria. Educators really appreciate this very innovative product to be implemented to students and get a positive impression. This

is in line with research Handayani et al. (2023) on "Development of E-Module Based on Problem Based Learning Assisted with Scratch Applications to Improve Students Computational Thinking Skills" that responses from school teachers regarding the use of e-modules obtained from teachers obtained an average total score of 93.52% or can be categorized as very practical. It can be concluded that e-modules are very practical and can be used in the learning process in schools.

Mukhoyyaroh et al. (2022) said the material presented in the form of interesting media will stimulate and condition the growth of a sense of experience in students while learning. Then the illustrations created have an important value to facilitate understanding material (Lestari et al., 2022). Windari et al. (2023) also argues that the module should present material that is in accordance with learning principles in order to have readability appeal to students by making interest in the format and graphics in the module.

The response results were obtained from 35 students of grade VII 1 Muhammadiyah Pekanbaru Junior High School who were selected by the researcher as a class that uses interactive modules in the learning process. The results of the response are described as follows:



The display aspect of student responses obtained a percentage score of 91.80% which means it has Very Interesting criteria. While in the aspect of presenting the material obtained a percentage value of 89.20% so that it was included in the Very Attractive criteria. The last aspect is benefits, in this aspect the percentage value is 88.70% which

means it is included in the Very Attractive criteria. so that the overall percentage score is 89.74% with Very Attractive criteria. This is in line with research Meryastiti et al. (2023) on "Improving Critical Thinking Skills of Junior High School Students in Science Learning Using the Development of Interactive E-Module Based Macromedia Flash" that the category is medium and received a positive response from students with a percentage of 81.25% which is classified as a positive category, because the interactive module contains interesting videos, images and displays so as to get a good response by students. Saragih & Tanjung (2023) argue, the presentation of modules can provide positive facilities for improving student knowledge.

CONCLUSIONS AND SUGGESTIONS

Based on data analysis and discussion, it can be concluded that (1) the results of material expert validation obtained a percentage value of 75.5% with feasible criteria and the results of media validation obtained a value of 81.4% of the criteria are very feasible. So that interactive modules can be implemented. (2) The results of the practicality test by educators obtained a percentage value of 94.6% with very practical criteria, which means that this interactive module is very practical to use. While the overall student response results were 89.74% with very interesting criteria. (3) Suggestions for future research to be able to use other research methods.

REFERENCES

- Agbedahin, A. V. (2019). Sustainable development, Education for Sustainable Development, and the 2030 Agenda for Sustainable Development: Emergence, efficacy, eminence, and future. *Sustainable Development*, 27(4), 669–680. <https://doi.org/10.1002/sd.1931>
- Allanta, T. R., & Puspita, L. (2021). Analisis keterampilan berpikir kritis dan self efficacy peserta didik: Dampak PjBL-STEM pada materi ekosistem. *Jurnal*

- Inovasi Pendidikan IPA*, 7(2), 158–170.
<https://doi.org/10.21831/jipi.v7i2.42441>
- Aryawan, R., Sudatha, I. G. S., & Sukmana, A. I. W. I. Y. (2018). Pengembangan E-modul Interaktif Mata Pelajaran IPS di SMP Negeri 1 Singaraja. *Jurnal EDUTECH Universitas Pedidikan Ganesha*, 6(2), 180–191.
- Cebrián, G., Palau, R., & Mogas, J. (2020). The smart classroom as a means to the development of ESD methodologies. *Sustainability (Switzerland)*, 12(7), 2005–2014.
<https://doi.org/10.3390/su12073010>
- Du, X., Chaaban, Y., Sabah, S., Al-Thani, A. M., & Wang, L. (2020). Active learning engagement in teacher preparation programmes - A comparative study from Qatar, Lebanon and China. *Asia Pacific Journal of Education*, 40(3), 283–298.
<https://doi.org/10.1080/02188791.2020.1717436>
- Duarte, A. J., Malheiro, B., Arno, E., Perat, I., Silva, M. F., Fuentes-Dura, P., ... Ferreira, P. (2020). Engineering Education for Sustainable Development: The European Project Semester Approach. *IEEE Transactions on Education*, 63(2), 108–117.
<https://doi.org/10.1109/TE.2019.2926944>
- Fitria, A., & Hamdu, G. (2021). Pengembangan Aplikasi Mobile Learning untuk Perangkat Pembelajaran Berbasis Education for Sustainable Development. *JINOTEP (Jurnal Inovasi Dan Teknologi Pembelajaran): Kajian Dan Riset Dalam Teknologi Pembelajaran*, 8(2), 134–145.
<https://doi.org/10.17977/um031v8i22021p134>
- Glavič, P. (2020). Identifying key issues of education for sustainable development. *Sustainability (Switzerland)*, 12(16).
<https://doi.org/10.3390/su12166500>
- Haka, N. B., Anggoro, B. S., Hamid, A., Novitasari, A., Handoko, A., & Puspita, L. (2020). The Development of Biology Module Based on Local Wisdom of West Lampung: Study of Ecosystem Material. *Journal of Physics: Conference Series*, 1467(1).
<https://doi.org/10.1088/1742-6596/1467/1/012013>
- Hamka, D., & Purwanto, H. (2021). Strategi Everyone Is a Teacher Here (Eth) Untuk Meningkatkan Hasil Belajar Pemahaman Konsep Sains Fisika. *EduTeach: Jurnal Edukasi Dan Teknologi Pembelajaran*, 2(2), 51–58.
<https://doi.org/10.37859/eduteach.v2i2.2824>
- Handayani, F., Fitria, Y., Ahmad, S., & Zen, Z. (2023). Development of E-Module Based on Problem Based Learning Assisted with Scratch Applications to Improve Students Computational Thinking Skills. *Biosfer: Jurnal Tadris Biologi*, 9(2), 456–469.
- Hasairin, A., Hartono, A., & Hasim, H. (2023). Development of a Lichens Pocketbook in Low-Level Organism Taxonomy Course. *Biosfer: Jurnal Tadris Biologi*, 14(1), 01–09.
<https://doi.org/10.24042/biosfer.v14i1.16604>
- Kagawa, F., Selby, D., & Trier, C. (2006). Exploring students' perceptions of interactive pedagogies in education for sustainable development. *Planet*, 17(1), 53–56.
<https://doi.org/10.11120/plan.2006.00170053>
- Lestari, P. I., Nur, R. A., & Riyanti, R. (2022). Biology Teacher Creativity at SMKN Maros Regency in Solving Online Learning Problems by Utilizing E-Learning. *Biosfer: Jurnal Tadris Biologi*, 13(1), 117–124.
<https://doi.org/10.24042/biosfer.v13i1.11998>

- Meryastiti, V., Ridlo, Z. R., Supeno, S., & Rahayuningsih, R. (2023). Improving Critical Thinking Skills of Junior High School Students in Science Learning Using the Development of Interactive E-Module Based Macromedia Flash. *Journal of Innovative Science Education*, 12(2), 163-172.
- Mukhoyyaroh, Q., Miharja, J., Baldah, B., & Yuniarti, A. (2022). Development of P3D Learning Strategy Using Google Sites to Support 21st-Century Skills. *Biosfer: Jurnal Tadris Biologi*, 13(2), 135-147. <https://doi.org/10.24042/biosfer.v13i2.14164>
- Neng, S. (2020). Metode Belajar PQRS Berorientasi Model Pembelajaran Kooperatif Untuk Meningkatkan Hasil Belajar Kognitif Fisika Siswa SMA. *Journal of Education Informatic Technology and Science*, 2(3), 78-87. <https://doi.org/10.37859/jeits.v2i3.1980>
- Oktapianti, D. (2021). Pengembangan E-Modul Berbasis Problem Based Learning MATERI Sistem Organisasi Kehidupan Makhluk Hidup. *Paper Knowledge . Toward a Media History of Documents*, 3(2), 6.
- Pratama, R., Handoko, A., & Anwar, C. (2020). Association of physical body-kinesthetic (Multiple Intelligences) mobility with learning results biology in SMA negeri 2 bandar lampung. *Journal of Physics: Conference Series*, 1521(4), 0-7. <https://doi.org/10.1088/1742-6596/1521/4/042001>
- Pramudiyanti, P., Pratiwi, W. O., Armansyah, A., Rohman, F., Putri, I. Y., & Ariani, D. (2023). PBL-Based Student Worksheet to Improve Critical Thinking Ability in Science Learning in Elementary Schools. *Indonesian Journal of Science and Mathematics Education*, 6(1), 109-124.
- Raihan (2017). *Metodologi Penelitian*. Jakarta : Universitas Islam Jakarta Press
- Rasmi, D. P., Hendri, M., & Azriyanti, R. (2023). Analysis of the Need for Development of Teaching Materials in the Form of STEM-Based Electronic Modules. *Jurnal Penelitian Pendidikan IPA*, 9(6), 4135-4141. <https://doi.org/10.29303/jppipa.v9i6.2683>
- Ratama, I. P., Padmadewi, N. N., & Artini, L. P. (2021). Teaching the 21st Century Skills (4Cs) in English Literacy Activities. *Journal of Education Research and Evaluation*, 5(2), 223. <https://doi.org/10.23887/jere.v5i2.30849>
- Riyanti, R. (2014). Pengembangan Modul Ipa Berbasis Pendekatan Savi (Somatic, Auditory, Visual, Intellectual) Untuk Memberdayakan Literasi Sains Dan Sikap Ilmiah Peserta Didik Pada Materi Sistem Gerak Manusia Kelas Viii Di Smp/Mts Bandar Lampung. *Antimicrobial Agents and Chemotherapy*, 58(12), 7250-7257.
- Sari, R. S., Lufri, L., Darmansyah, D., & Purnamasari, L. (2023). An Implementation of Teacher Pedagogy on Students' Biology Learning Outcomes at SMAN Bukit Sundi, Solok District. *Biosfer: Jurnal Tadris Biologi*, 14(1), 43-52.
- Saragih, P. P., & Tanjung, I. F. (2023). Development of STEM-Based Environmental Change Module to Enhance Environmental Literacy. *Biosfer: Jurnal Tadris Biologi*, 14(1), 89-98. <https://doi.org/10.24042/biosfer.v14i1.17884>
- Saryadi, W., & Sulisworo, D. (2023). Development of E-Module Based on the Discovery Learning to Improve the Student Creative Thinking Skills. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, 7(1), 11.

<https://doi.org/10.31764/jtam.v7i1.10185>

- Sinakou, E., Boeve-de Pauw, J., & Van Petegem, P. (2019). Exploring the concept of sustainable development within education for sustainable development: implications for ESD research and practice. *Environment, Development and Sustainability*, 21(1). <https://doi.org/10.1007/s10668-017-0032-8>
- Sumadi, S., & Ma'ruf, M. H. (2020). Implementation of the Concept and Theory of Management Functions in Efforts To Improve Quality. *International Journal of Economics, Business and Accounting Research (IJEBAR)*, 4(02), 353–360. <https://doi.org/10.29040/ijebar.v4i02.1114>
- Suwatra, W., Suyatna, A., & Rosidin, U. (2018). Development of Interactive E-Module for Global Warming to Grow of Critical Thinking Skills. *International Journal of Advanced Engineering, Management and Science*, 4(7), 543–549. <https://doi.org/10.22161/ijaems.4.7.7>
- Vilmala, B. K., Karniawati, I., Suhandi, A., Permanasari, A., & Khumalo, M. (2022). A Literature Review of Education for Sustainable Development (ESD) in Science Learning: What, Why, and How. *Journal of Natural Science and Integration*, 5(1), 35. <https://doi.org/10.24014/jnsi.v5i1.15342>
- Wilhelm, S., Förster, R., & Zimmermann, A. B. (2019). Implementing competence orientation: Towards constructively aligned education for sustainable development in university-level teaching-and-learning. *Sustainability (Switzerland)*, 11(7). <https://doi.org/10.3390/su11071891>
- Windari, M. R., Prihatin, J., & Fikri, K. (2023). The Effectiveness of Digital Textbooks on Brain-based Learning assisted by Animated Videos and Maze Chase-Wordwall on Science Literacy Skills and Student Learning Outcomes. *Biosfer: Jurnal Tadris Biologi*, 14(1), 79–88. <https://doi.org/10.24042/biosfer.v14i1.16891>
- Wulandari, R. W., & Nofina, M. (2022). The Development of POE-based (Predict, Observe, and Explain) E-Student Worksheet for Eleventh-Grade Plant Histology Subject. *Biosfer: Jurnal Tadris Biologi*, 13(1), 21–35. <https://doi.org/10.24042/biosfer.v13i1.11270>
- Yuliani, S., & Hartanto, D. (2016). Perceptions of Education Role in Developing Society: A Case Study at Riau, Indonesia. *Journal of Education and Learning*, 6(1), 143. <https://doi.org/10.5539/jel.v6n1p143>