JPPIPA 9(10) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

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

Development of PBL Modul-El to Improve Problem Solving Students of Physics Education Program

Ragil Saputri[1*], Insih Wilujeng[1], Jumadi Jumadi[1], Sabar Nurohman[1], Aditya Yoga Purnama[2]

[1] Magister of Science Education Department, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia.
[2] Physics Education Department, Universitas Sarjanawiyata Tamansiswa, Yogyakarta, Indonesia.

Received: June 3, 2023
Revised: September 12, 2023
Accepted: October 25, 2023
Published: October 31, 2023

Corresponding Author:
Ragil Saputri
ragilsaputri.2022@student.uny.ac.id

DOI: 10.29303/jppipa.v9i10.4092

Abstract: Electronic modules are teaching materials that are systematically arranged to achieve learning objectives in electronic form with which includes writing, animation, video, and navigation that makes learning more interesting, interactive, active, and motivating which can facilitate students' problem solving skills. This study aims to see whether there is an increase in students' problem solving skills after using PBL-based el-modules. The method in this research is research and development, which is a research method used to produce and test the feasibility of certain products. The subjects of this study were second semester students who were taking basic physics courses. This research was conducted at the Physics Education Study Program of Sarjanawiyata Tamansiswa University with the subject matter of "Effort and Energy". This research used pre-test and post-test one group design. The results of this study indicate that the science el-module PBL model can improve students' problem solving skills as shown by the results of the normalized gain test of 0.70. It was concluded that there was a significant increase in the post-test results which indicated that the el-modulemade could be used to improve problem solving skills.

Keywords: El-module; PBL model; Problem solving skills

Introduction

One of the sciences that studies natural phenomena and is interesting to study is physics. Physics is part of the natural sciences. This universe still has many mysteries that have not been solved by humans. This research will focus on science education itself. Science education with pure science has differences. In the realm of education it is required to develop various models, methods, instruments, and teaching materials that can be used by students to be able to understand lessons. The learning process is very important in the world of education because in it there is a process of mutual interaction between educators and students and their environment (Islahiyah et al., 2021).

The application of learning using electronics in fact still has many pros and cons, there are deficiencies in its effective utilization, less attractive appearance and usage procedures so that it can cause students to be less enthusiastic (Yodha et al., 2019). In addition, another weakness of the electronic module is that not all students can use this electronic module due to limited facilities, but the electronic module also has advantages as stated by Puspitasari (2019) can be integrated with the internet, if using a supporting application, and can directly play videos and music in the application. In the research place, it is not influenced by limited facilities because all research subjects already have supporting facilities such as laptops and gadgets.

Other problems are also found in student problem-solving skills which are still low, such as research conducted by Silalahi (2022). The results of his research show that problem solving skills can be improved by using problem-based learning models and student worksheets. Problem solving ability is one of the higher-level skills needed by students, especially in the 21st century (Ramdani et al., 2019). In addition, it was also found that science learning is only centered on educators without independent learning from the students themselves (Dewi et al., 2017). Students tend to have

How to Cite:
Saputri, R., Wilujeng, I., Jumadi, J., Nurohman, S., & Purnama, A. Y. (2023). Development of PBL Modul-El to Improve Problem Solving Students of Physics Education Program. *Jurnal Penelitian Pendidikan IPA*, *9*(10), 8376–8382. https://doi.org/10.29303/jppipa.v9i10.4092

difficulty in abstract concepts (Gunawan et al., 2014). In this study, researchers chose work and energy material in basic physics courses. One of the keys to success in learning physics is to like physics and can be started in basic physics courses in the early semesters (Mussani et al., 2015).

Research related to physics learning at the university level on work and energy materials has been carried out, one of which is by (Batlolona et al., 2021). This research uses a multi-representational approach in learning physics to instill an understanding of the material concepts of work and energy. In addition, researchers Kassiavera et al. (2019) also conducted a survey of students' critical thinking skills in the subject matter of effort and energy. The results show that students' critical thinking skills are still very low. Another research conducted by Taqwa et al. (2020) related to the development of an instrument to test students' problem solving abilities on the topic of business and energy has been carried out. The results of his research indicate that the instrument that has been made is very feasible to use. Based on the research that has been described previously, there is still little that discusses research on the development of el-modules on business and energy materials. Therefore, this study has the opportunity to conduct PBL-based el-module development research to improve student problem solving in physics education study programs.

Problem Based Learning (PBL) is a constructivism learning model that involves students in solving (real) contextual problems and encourages students to learn. PBL is a problem-oriented learning model so that students can build (construct) their own knowledge (Arend, 2012). PBL as a learning model also has characteristics including involving students as leaders in solving problems, organizing a curriculum that has holistic problems that allow students to associate and connect problem-solving efforts, creating a learning environment where the teacher is only a facilitator for students to think and guide investigation to gain understanding (Tosun et al., 2013).

The current millennial generation is unique in the learning process, including mostly using the internet as self-taught and most students cannot carry out their daily activities without the internet (Setiawan, 2021). As done by Ismail et al. (2023) who uses technology in learning and has been proven to help learning become more optimal. This shows that the use of technology is suitable for use by today's students. At the same time, excessive use or misuse of technology can have a negative impact on students (Setiawan, 2021). However, technological developments also have a positive impact on students' lives (Jamaluddin et al., 2019). It is important for educators to first understand the methods, media or teaching materials that are suitable for today's students.

One of the teaching materials that can be developed by educators is electronic modules (el-modules). El-modules are modules in electronic or digital form that are designed using software that can be read by computers or gadgets (Elvarita et al., 2020). The el-module was chosen because it has self-instruction and self-contained characteristics so that students are trained independently to manage their study time and understand the subject matter (Lestari et al., 2020; Maryani et al., 2021). This statement is supported by Adhelacahya et al. (2023) which states that electronic modules based on problem based learning are able to improve students' 21st century skills. The use of el-modules is an alternative learning in order to provide interaction facilities for lecturers and students so that learning becomes interesting, interactive, active and motivates learning (Syuzita et al., 2023).

Based on this description, this study aims to see whether or not there is an increase in students' problem solving skills after using the PBL model.

Method

The development model in this study is research and development (Research and Development), which is a research method used to produce and test the feasibility of certain products. Sugiyono, (2014) explains that research and development is a type of research that produces products by testing the effectiveness of these products. The research and development model used is 4-D conducted by Thiagarajan and Semmel (Trianto, 2013). This model has stages namely Define, Design, Develop, and Disseminate as shown in Figure 1.

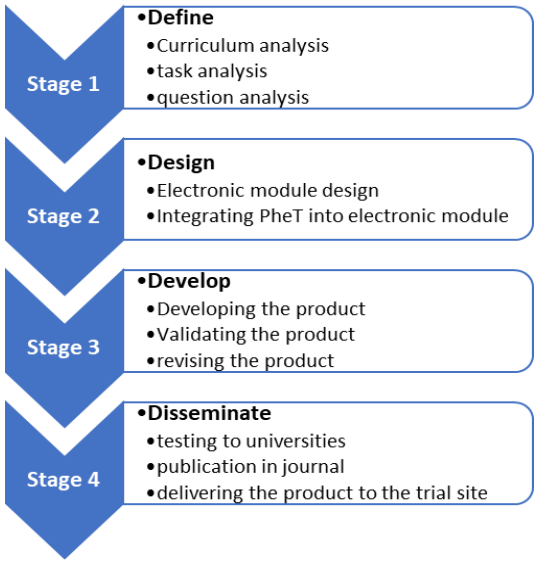

Figure 1. 4D Development procedure in this study it was limited only to the develop stage

This research model is used to develop products in the form of PBL-based el-modules to improve problem-solving skills in physics education study program students. The development design carried out in this study follows the 4D research stages according to Thiagarajan and Semmel (Trianto, 2013).

This research is a PBL-based research and development el-module to improve problem solving skills for students of physics education study program on the material "Work and Energy" which is intended for students of physics education study program. The research design used is 4-D namely Define, Design, Develop, and Disseminate. The el-modules that have been developed are validated by material experts and media development experts for product improvement. Subsequent trials were carried out on students of Physics Education Study Program of Sarjanawiyata Tamansiswa University who were taking basic physics courses. The sampling technique used is cluster random sampling because it is assumed that students have the same abilities. The subjects in this study were 10 physics education study program students. There are 2 data collected in this study, namely qualitative data and quantitative data.

The data collection instrument used in this study was in the form of problem-solving skills test questions for the pre-test and post-test. The question is in the form of multiple choice of 10 items. Problem solving skills questions are prepared based on aspects that have been studied including understanding and identifying problems, identifying various related solutions, applying appropriate solutions, and evaluating the results obtained from solving problems.

The data analysis technique used to improve problem solving skills is a normalized gain score with the formula:

$$\langle g \rangle = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score} \quad (1)$$

After getting the data, then categorized with the following table 1 guide.

Table 1. Criteria for Improving Problem Solving Skills

Interval	Category
$g \geq 0.70$	High
$0.30 \leq g < 0.70$	Medium
$g < 0.30$	Low

Result and Discussion

The research was conducted in one class using the PBL el-module model. electronic module based on problem based learning which was developed using the syntax of researchers' synthesis based on Arends (2012), including: problem orientation, organization for learning, guiding investigations, presenting data and presentations, analysis, evaluation and reflection. Each syntax in this E-module also contains activities to improve students' problem solving abilities in accordance with indicators of problem solving abilities that have been synthesized from research by Sanggara et al. (2018) and Bahtiar et al. (2022). Problem solving indicators used include, among others understand and indentify problem, indentify various solutions, apply the right solution, evaluate the results obtained from problem solving.

The research implementation began with giving a pretest with pretest results below standard. After completing the pretest, students carry out learning using the PBL model el-module. After completing the entire series of learning activities, students carry out a posttest to determine the extent to which students' problem solving abilities have improved. Research by providing pre-tests and post-tests has been carried out by many previous researchers, including Licorish et al. (2018), Kim (2020), Pather et al. (2020), and was successful in finding out the extent of the increase in ability to be achieved. Problem solving skills questions include aspects of understanding and identifying problems, identifying related solutions, implementing appropriate solutions, and evaluating the results obtained from solving problems. The results of the pre-test and post-test problem solving skills can be seen in table 2.

Table 2. Results of Pre-Test and Post-Test of Problem Solving Skills

Description	Pretest	Posttest
Test results before and after being given treatment	50	85

Based on table 2, it shows that the pretest score is still below standard. On average, students only got a pretest score of 50, after learning using the electronic module the posttest result was 85. Like research conducted by Malik et al. (2023) who used electronic modules, the posttest score increased. Pictures of the differences between pretest and posttest can be seen in Figure 2.

Figure 2 shows that the average pretest and posttest scores are different. The posttest score in the problem solving aspect is higher than the pretest score. The students' posttest results were higher than the pretest because they were given a PBL model e-module which contained problems that existed around the students and were related to material on work and energy. The problems chosen are based on real life around students so that they are easy to understand and interesting for students as done by (Siagian et al., 2019).

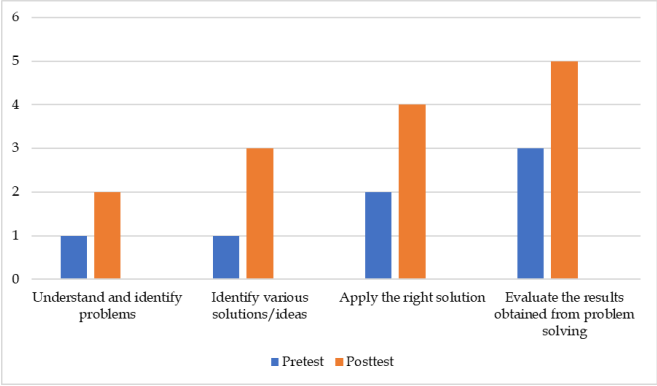

Figure 2. Differences in pretest and posttest scores

The aspect of understanding and identifying problems on the posttest is higher than the pretest because it contains everyday problems then students are asked to analyze the problem. As explained by Puspitasari et al. (2018), Simamora et al. (2018), Dwijayani (2019), and Kenedi et al. (2019) that problems in everyday life can make students understand and identify problems more easily. After conducting discussions in analyzing the problem, students are asked to provide ideas/solutions from the problems that have been analyzed. After that, students are asked to be able to conduct experiments in order to apply the solutions that have been chosen. Experiments according to some experts such as Puspitasari et al. (2018), Ratminingsih et al. (2018), Zhao et al. (2020), Supena et al. (2021) are also used to prove the truth of a theory. The next stage is to analyze the results of the experiment and evaluate then reflect. Reflection is also used to understand students' responses in learning or delivering material (Kim, 2020; Licorish et al., 2018; Pather et al., 2020). The results of students' problem solving ability scores can be seen in table 3.

Table 3. Normalized Gain N Test Results for the Value of Problem Solving Skills

Result	Boundary	Category
0.70	g ≥ 0.7	High

Based on table 1 data, it shows that the results of problem solving skills with the n-gain test are in the high category with a result of 0.70, then H0 is rejected. Therefore, it can be concluded that there are differences in students' problem solving skills before and after using the PBL model el-modules. The next analysis is to determine the effectiveness of the PBL el-module model to improve student problem solving skills, a score of 0.70 is obtained with the high category so that it can be said that the PBL e-model module has a significant increase in improving student problem solving skills. The results of this study are in line with what has been done by (Putri et al., 2020) which states that web modules can improve problem solving skills. Another study also conducted by Miswami et al. (2020) states that web modules can improve problem solving skills.

The PBL model el-modules are effective in improving problem-solving skills because learning activities are structured by learning steps with the PBL model (Aufa et al., 2021; Evendi et al., 2021). The steps of the PBL model used are orienting and identifying problems, organizing for learning, designing investigations to select problem-solving strategies, presenting data and presentations, as well as evaluating and reflecting. The el-module helps students engage in active learning activities starting from discussions in identifying problems then being given the opportunity to choose a solution that is appropriate to the problem then applying the solution and finally evaluating and reflecting so that problem solving skills can appear in learning activities (Ghezzi et al., 2021). The PBL model el-module also provides facilities for students to explore solutions in solving problems effectively and efficiently (Kirschner et al., 2006).

In problem-based learning, the lecturer acts as a facilitator who monitors student performance and also directs students if they experience difficulties (Puti et al., 2015). Thus, in the application of problem solving learning activities, students can be invited to learn from various points of view, especially regarding the impact of science, very rapid technological advances, and also problems that occur in the real world (Sadhu et al., 2018). Students who use the PBL model el-module are more active and interested in learning activities so that it shows that there is an increase in problem solving skills before and after using the e-module.

Conclusion

The product developed in this study is an electronic module based on problem-based learning (PBL) integrated with PhET that has been successfully developed by researchers. The results showed that the posttest scores achieved by students were higher than the pretest scores because students were given PBL model el-modules that contained problems that were around students and related to the material of effort and energy. The average student pretest score was 50, while the average student posttest score was 85. Based on the results of this study, it can be concluded that the PBL model science el-module can improve students' problem solving skills with the results of the normalized gain test obtained a value of 0.70 so that the PBL model science el-module has a high influence in improving students' problem solving skills. The results of this study can be used by lecturers to improve student problem solving skills in learning activities.

Acknowledgments
Thank you to Universitas Negeri Yogyakarta and Universitas Sarjanawiyata Tamansiswa for giving us the opportunity to conduct this research.

Author Contributions
Conceptualization, R.S, I.W.; methodology, J.J, S.N.; software, A.Y.P.; validation, R.S, I.W.; investigation, R.S, A.Y.P.; writing—original draft preparation, R.S, I.W writing—review and editing, R.S, A.Y.P.

Funding
Funding for this research was carried out by the author independently.

Conflicts of Interest
The authors declare that there is no conflict of interest regarding the publication of this paper.

References

Adhelacahya, K., Sukarmin, S., & Sarwanto, S. (2023). Impact of Problem-Based Learning Electronics Module Integrated with STEM on Students' Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, *9*(7), 4869–4878. https://doi.org/10.29303/jppipa.v9i7.3931

Arend, R. I. (2012). *Learning to Teach* (ninth edit). McGraw-Hill.

Aufa, M. N., Rusmansyah, R., Hasbie, M., Jaidie, A., & Yunita, A. (2021). The Effect of Using e-module Model Problem Based Learning (PBL) Based on Wetland Environment on Critical Thinking Skills and Environmental Care Attitudes. *Jurnal Penelitian Pendidikan IPA*, *7*(3), 401–407. https://doi.org/10.29303/jppipa.v7i3.732

Bahtiar, B., Ibrahim, I., & Maimun, M. (2022). Profile of Student Problem Solving Skills Using Discovery Learning Model with Cognitive Conflict Approach. *Jurnal Penelitian Pendidikan IPA*, *8*(3), 1340–1349. https://doi.org/10.29303/jppipa.v8i3.1657

Batlolona, J. R., Nenohai, A. J. W. T., Wenno, I. H., Wartono, & Yurdabakan, I. (2021). Merry go round technique and students' physics cognitive learning outcomes on work and energy topic. *Jurnal Pendidikan IPA Indonesia*, *10*(2), 178–186. https://doi.org/10.15294/jpii.v10i2.22964

Dewi, V. P., Doyan, A., & Soeprianto, H. (2017). Pengaruh Model Penemuan Terbimbing Terhadap Keterampilan Proses Sains Ditinjau Dari Sikap Ilmiah Pada Pembelajaran Ipa. *Jurnal Penelitian Pendidikan IPA*, *3*(1). https://doi.org/10.29303/jppipa.v3i1.102

Dwijayani, N. M. (2019). Development of circle learning media to improve student learning outcomes. *Journal of Physics: Conference Series*, *1321*(2). https://doi.org/10.1088/1742-6596/1321/2/022099

Evendi, E., & Verawati, N. N. S. P. (2021). Evaluation of Student Learning Outcomes in Problem-Based Learning: Study of Its Implementation and Reflection of Successful Factors. *Jurnal Penelitian Pendidikan IPA*, *7*(SpecialIssue), 69–76. https://doi.org/10.29303/jppipa.v7ispecialissue.1099

Ghezzi, J. F. S. A., Higa, E. de F. R., Lemes, M. A., & Marin, M. J. S. (2021). Strategies of active learning methodologies in nursing education: an integrative literature review. *Revista Brasileira de Enfermagem*, *74*(1), 1–10. https://doi.org/10.1590/0034-7167-2020-0130

Gunawan, G., Harjono, A., Sahidu, H., & Sutrio, S. (2014). Penggunaan Multimedia Interaktif Dalam Pembelajaran Fisika Dan Implikasinya Pada Penguasaan Konsep Mahasiswa. *Jurnal Pijar Mipa*, *9*(1), 15–19. https://doi.org/10.29303/jpm.v9i1.38

Islahiyah, I., Pujiastuti, H., & Mutaqin, A. (2021). Pengembangan E-Modul Dengan Model Pembelajaran Berbasis Masalah Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(4), 2107. https://doi.org/10.24127/ajpm.v10i4.3908

Ismail, M., Zubair, M., Alqadri, B., & Basariah, B. (2023). Integration of Technological Pedagogical and Content Knowledge in 21st Century Learning. *Jurnal Penelitian Pendidikan IPA*, *9*(5), 2363–2367. https://doi.org/10.29303/jppipa.v9i5.3732

Jamaluddin, J., Jufri, A. W., Ramdani, A., & Azizah, A. (2019). Profil Literasi Sains dan Keterampilan Berpikir Kritis Pendidik IPA SMP. *Jurnal Penelitian Pendidikan IPA*, *5*(1). https://doi.org/10.29303/jppipa.v5i1.185

Kassiavera, S., Suparmi, A., Cari, C., & Sukarmin, S. (2019). Survei Keterampilan Berpikir Kritis Mahasiswa pada Materi Usaha dan Energi. *Prosiding SNFA (Seminar Nasional Fisika Dan Aplikasinya)*, *4*, 162. https://doi.org/10.20961/prosidingsnfa.v4i0.35928

Kenedi, A. K., Helsa, Y., Ariani, Y., Zainil, M., & Hendri, S. (2019). Mathematical connection of elementary school students to solve mathematical problems. *Journal on Mathematics Education*, *10*(1), 69–79. https://doi.org/10.22342/jme.10.1.5416.69-80

Kim, J. (2020). Learning and Teaching Online During Covid-19: Experiences of Student Teachers in an Early Childhood Education Practicum. *International Journal of Early Childhood*, *52*(2), 145–

158. https://doi.org/10.1007/s13158-020-00272-6

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, *41*(2), 75–86. https://doi.org/10.1207/s15326985ep4102_1

Lestari, N., Basri, K. I., Yusuf, S. M., Suciati, S., & Masykuri, M. (2020). Life skill integrated science-PBL module to improve critical thinking skills of secondary school students. *Universal Journal of Educational Research*, *8*(7), 3085–3096. https://doi.org/10.13189/ujer.2020.080737

Licorish, S. A., Owen, H. E., Daniel, B., & George, J. L. (2018). Students' perception of Kahoot!'s influence on teaching and learning. *Research and Practice in Technology Enhanced Learning*, *13*(1). https://doi.org/10.1186/s41039-018-0078-8

Malik, A., Al-Hanafi, M. A., Chusni, M. M., & Nugraha, A. R. (2023). Development of CORE-based Electronic-modules to Improve Students' Problem-Solving Skills. *Jurnal Penelitian Pendidikan IPA*, *9*(8), 6415–6424. https://doi.org/10.29303/jppipa.v9i8.3172

Maryani, M., Yuliana, Y., & Anggraeni, F. K. A. (2021). Physics event photo analysis module based on the STEM approach: An effort to enhance critical thinking. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, *10*(2), 251–264. https://doi.org/10.24042/jipfalbiruni.v10i2.8626

Miswami, A., & Nurcahyo, H. (2020). Science Web-Module Integrated with Tannery Waste as Local Potential to Improve Studentsâ€™ Problem Solving. *Journal.Unnes.Ac.Id*, *12*(3), 393–400. https://doi.org/10.15294/biosaintifika.v12i3.24356

Mussani, M., Susilawati, S., & Hadiwijaya, A. S. (2015). Pengembangan Bahan Ajar Fisika Sma Berbasis Learning Cycle (Lc) 3E Pada Materi Pokok Teori Kinetik Gas Dan Termodinamika. *Jurnal Penelitian Pendidikan IPA*, *1*(1), 102–122. https://doi.org/10.29303/jppipa.v1i1.10

Pather, N., Blyth, P., Chapman, J. A., Dayal, M. R., Flack, N. A. M. S., Fogg, Q. A., Green, R. A., Hulme, A. K., Johnson, I. P., Meyer, A. J., Morley, J. W., Shortland, P. J., Štrkalj, G., Štrkalj, M., Valter, K., Webb, A. L., Woodley, S. J., & Lazarus, M. D. (2020). Forced Disruption of Anatomy Education in Australia and New Zealand: An Acute Response to the Covid-19 Pandemic. *Anatomical Sciences Education*, *13*(3), 284–300. https://doi.org/10.1002/ase.1968

Puspitasari, A. D. (2019). Penerapan Media Pembelajaran Fisika Menggunakan Modul Cetak dan Modul Elektronik Pada Siswa SMA. *Jurnal Pendidikan Fisika*, *7*(1), 17–25. https://doi.org/10.24252/jpf.v7i1.7155

Puspitasari, L., In'am, A., & Syaifuddin, M. (2018). Analysis of Students' Creative Thinking in Solving Arithmetic Problems. *International Electronic Journal of Mathematics Education*, *14*(1), 49–60. https://doi.org/10.12973/iejme/3962

Puti, S., & Jumadi. (2015). Pengembangan Modul IPA SMP Berbasis Guided Inquiry untuk Meningkatkan Keterampilan Proses dan Sikap Ilmiah. *Jurnal Pendidikan Matematika Dan Sains*, *3*(1), 79–90. https://doi.org/10.21831/jpms.v5i1.7239

Putri, A. S., & Aznam, N. (2020). Web Modul Ipa Berbasis Inkuiri Terbimbing Untuk Meningkatkan Thinking Skill. *Edusains*, *12*(1), 47–53. https://doi.org/10.15408/es.v12i1.11034

Ramdani, A., Jufri, A. W., Gunawan, G., Hadisaputra, S., & Zulkifli, L. (2019). Pengembangan Alat Evaluasi Pembelajaran Ipa Yang Mendukung Keterampilan Abad 21. *Jurnal Penelitian Pendidikan IPA*, *5*(1). https://doi.org/10.29303/jppipa.v5i1.221

Ratminingsih, N. M., Marhaeni, A. A. I. N., & Vigayanti, L. P. D. (2018). Self-Assessment: The effect on students' independence and writing competence. *International Journal of Instruction*, *11*(3), 277–290. https://doi.org/10.12973/iji.2018.11320a

Sadhu, S., & Laksono, E. W. (2018). Development and validation of an integrated assessment for measuring critical thinking and chemical literacy in chemical equilibrium. *International Journal of Instruction*, *11*(3), 557–572. https://doi.org/10.12973/iji.2018.11338a

Siagian, M. V., Saragih, S., & Sinaga, B. (2019). Development of Learning Materials Oriented on Problem-Based Learning Model to Improve Students' Mathematical Problem Solving Ability and Metacognition Ability. *International Electronic Journal of Mathematics Education*, *14*(2), 331–340. https://doi.org/10.29333/iejme/5717

Silalahi, S. M. (2022). Kemampuan Pemecahan Masalah Mahasiswa dalam Penyampaian Materi Menggunakan Lembar Kerja Mahasiswa. *Mosharafa: Jurnal Pendidikan Matematika*, *11*(2), 215–226. https://doi.org/10.31980/mosharafa.v11i2.1311

Simamora, R. E., Saragih, S., & Hasratuddin, H. (2018). Improving Students' Mathematical PrSimamora, R. E., Saragih, S., & Hasratuddin, H. (2018). Improving Students' Mathematical Problem Solving Ability and Self-Efficacy through Guided Discovery Learning in Local Culture Context.

International Electronic Jour. *International Electronic Journal of Mathematics Education*, *14*(1), 61–72. https://doi.org/10.12973/iejme/3966

Sugiyono. (2014). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, dan R&D*. Alfabeta.

Supena, I., Darmuki, A., & Hariyadi, A. (2021). The Influence of Learning Model on Students' Learning Outcomes. *International Journal of Instruction*, *14*(3), 873–892. https://doi.org/10.29333/iji.2021.14351a

Syuzita, A., Susilawati, S., & Sukarso, A. (2023). Validation of E-Module Based on Argument-Driven Inquiry using 3D Page Flip Professional to Improve Students' Generic Science, Critical Thinking and Scientific Argumentation Abilities. *Jurnal Penelitian Pendidikan IPA*, *9*(8), 6272–6277. https://doi.org/10.29303/jppipa.v9i8.4947

Taqwa, M. R. A., Purwaningsih, E., & Sulur, S. (2020). Pengembangan Instrumen Tes Kemampuan Pemecahan Masalah Mahasiswa pada Topik Usaha dan Energi. *Jurnal Penelitian Pembelajaran Fisika*, *11*(2), 149–156. https://doi.org/10.26877/jp2f.v11i2.6239

Tosun, C., & Taskesenligil, Y. (2013). The effect of problem-based learning on undergraduate students' learning about solutions and their physical properties and scientific processing skills. *Chemistry Education Research and Practice*, *14*(1), 36–50. https://doi.org/10.1039/c2rp20060k

Trianto. (2013). *Model Pembelajaran Terpadu. Jakarta: Bumi Aksara*. Bumi Aksara.

Yodha, S., Abidin, Z., & Adi, E. (2019). Persepsi Mahasiswa Terhadap Pelaksanaan E-Learning Dalam Mata Kuliah Manajemen Sistem Informasi Mahasiswa Jurusan Teknologi Pendidikan Universitas Negeri Malang. *Jurnal Kajian Teknologi Pendidikan*, *2*(3), 181–187. https://doi.org/10.17977/um038v2i32019p181

Zhao, S., Lau, T., Luo, J., Chang, E. I. C., & Xu, Y. (2020). Unsupervised 3D End-to-End Medical Image Registration with Volume Tweening Network. *IEEE Journal of Biomedical and Health Informatics*, *24*(5), 1394–1404. https://doi.org/10.1109/JBHI.2019.2951024