Journal of Innovative Physics Teaching
Volume 2, Issue 2 December 2024, 148 -157
ISSN: 3021-8551 (Online)
Doi: https://doi.org/10.24036/jipt/vol2-iss2/48
https://jipt.ppj.unp.ac.id/index.php/jipt

Implementation of the PBL Model Integrated E-Module with Learning Differentiated to Promote Student's Collaboration Skills

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Article Info

Article history:

Received June 16, 2024
Revised December 17, 2024
Accepted December 20, 2024

Keywords:

Competence
Collaboration skills
Learning Differentiated
The 21st century education
Problem Based Learning (PBL)

ABSTRACT

Education is currently trying to make students able to master the skills of the 21st century. This study aims to determine the effect of applying the integrated e-module PBL model with differentiated learning on students' mastery of concepts and collaboration skills. The research design used in this research is classroom action research. The data collection instrument consists of two parts, namely the collaboration skills observation sheet and the writing test. Based on the results of data analysis, the results of increasing the average value of each indicator of collaboration skills in cycle I and cycle II due to the application of the integrated e-module PBL model with differentiated learning are: I1 = 13.19%, I2 = 8.33 %, I3 = 6.02%, I4 = 11.11%, I5 = 11.1%. While the increase in student knowledge aspect learning outcomes is 15.5%. Based on the research results, it is known that the application of the integrated e-module PBL model with differentiated learning can improve students' collaboration skills and mastery of concepts, which are skills needed in 21st century education.

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INTRODUCTION

Twenty-first-century education is demanding balance between technology and learning. Expected learning that is innovative, creative, and collaborative, as well as centered on participant students (Sugiyarti et al., 2018). One of the solutions in response to demands in the 21st century is designing quality education in Indonesia and doing evaluation as well as developing the curriculum (Nursurila et al., 2018). Indonesia's education minister has changed the curriculum to produce relevant graduates with 21st-century skills (Asrizal et al., 2018). In the 21st century, students must own comprehensive competency, skills, experience, and attitudes (Asrizal et al., 2019). Setiawati & Rusman (2018) stated that the 21st century requires abilities and skills in so-called learning and innovation with 4C. Skills learning the 4C includes skills in critical thinking, creative thinking, collaborating, and communicating. With this, learning in the 21st century demands students be capable of adapting to changing

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times with one method through control of 4C competencies.

Collaboration is an important ability to master for students learning in the 21st century. According to Ahmad (2018), Da Fonte & Barton-Arwood (2017), Davis et al. (2018), and Dooley & Sexton-Finck (2017), skills collaboration is skills work. The same between two or more students is to finish something, with shared, not quite enough responsibility, accountability, organization, and role for reaching understanding together about problems and solutions. Likewise, Tuti & Mawardi (2019) stated that skills collaboration is a learning process in which each group member donates information, experience, ideas, attitudes, opinions, abilities, and skills they have. In a way, together, they increase understanding all over the members. Skills collaboration is the ability to swap thoughts or ideas and feelings between students at the same level (Lelasari et al., 2017). Collaboration is a method of life; someone related with attitude is responsible for answering on the action, including the ability to learn from each other, appreciate, and give support to his group.

Collaborative learning can help students in study in a way that is social so that it can increase social skills in students (Le et al., 2018). Besides that, learning collaboratively can prioritize something: the ability of social students to develop knowledge and understanding (Dewantara et al., 2020). In this matter, this student needs to be given possible insight to help in work in a way that is collaborative so that they can have mutual respect, responsibility, tolerance, and others (Anantyarta & Sari, 2017). Apriono (2013) stated that the importance of one's own skills in collaboration with participants is especially important in the learning process. Superiority learning with objective end collaboration is practice distribution effective work, improve character, bear it answer students, and merge information from various source knowledge, perspective, experience, and solidarity (Ulhusna et al., 2020). Skills collaboration is very important for owned everyone as a liaison between theoretical knowledge and practice, for example, in activity practicum, activity field, or activity outside field (Kundariati et al., 2019). With this, teachers need to master capable learning strategies and apply collaborative learning to it to build competence in collaboration so that knowledge and understanding develop in students.

Reality found in the field not yet describe the expected conditions. This matter is seen from the results of internal evaluation classes that have been held at SMAN 3 Padang. Based on results from Test Daily (UH) 1, the odd semester of 2022/2023 class XE 9 shows that 58% or as many as 21 students get a value below 80, which is the minimum criteria (KKTP) point lesson in Physics. Results of observations made in the learning process are already showing existing collaboration between students; however, there still exist a number of problems that are in discussion. There are a number of cool students who play alone so that students are not focused enough on learning. There are also students who are too stand out in his group; however, they are busy with tasks alone and forget to collaborate. This matter is possibly caused by division member conventional groups by teachers only based on order name in roll call. Ilma et al. (2022) and Santoso et al. (2021a) which found that the level of students' collaboration skills was still low. This is also in line with research by Ilma et al. (2022) and Santoso et al. (2021a) which found that the level of students' collaboration skills was still low. The other problem is that learning is still teacher-centered, because teachers are lacking in space and opportunity for discussion in building concepts and understanding students, so students in the learning process are not enough maximum.

Based on the exposure problem, the cause of the ability to collaborate with students is still not yet empowered, and results are expected to be learned but not yet achieved. One of the solution alternatives for increasing skills collaboration among students can be done by implementing an e-module integrated problem-based learning (PBL) model with differentiated learning so that it can increase skills collaboration among students. The implementation of e-modules integrated with the Problem-Based Learning (PBL) model with

learning differentiated expectations can overcome the problem about the ability of current students to collaborate, which has not yet developed well. Therefore, that problem is important for research.

This study uses an integrated PBL model of e-modules with differentiated learning. In e-modules, interactive material is served in the form of text and images being equipped with animation and video, making it easier for students to understand the material taught. With the presence of this electronic module, a learning process that should be more involved is carried out with the support of effective and efficient interactions between educators and students so that students can understand the learning design and experience an increase in their learning outcomes (Imansari & Sunaryantiningsih, 2017). Different from modules in general are the usual ones served to participants, educating them in hardcopy form or e-modules. This design is used in electronic format so that you can use it through various devices like computers, laptops, or smartphones. SMAN 3 Padang is a school that allows its students to use smartphones at school. This will of course make it easier for teachers to share teaching materials available for students to study. Besides, the use of e-modules is also useful. For limit usage paper.

Electronic modules (e-modules) are innovative media that can increase student interest in learning through video displays, audio, quizzes, etc. (Jaenudin et al., 2017; Sari et al., 2019; Suryadie, 2014). E-modules can be used to improve various student skills such as critical thinking skills, creative thinking skills, collaboration skills, and communication skills (Asrizal et al., 2022; Thornhill-Miller et al., 2023). Study participants educate because the content contained in the e-module is packed in a way that is neat with objectives, making it easier for participants to educate themselves in understanding the material lesson. Besides that, the use of interactive e-modules is also purposeful. For explaining material in a way that is conceptual so that it increases understanding as well as the power to remember the material. Using e-modules enhances students' understanding of drafting lessons. In development, e-modules are designed in a way that is concise, not long-winded, and suggestive to the core of the discussion, as well as customized according to the method of thinking of the student so that no student is bored when reading it (Nufus et al., 2020). With the use of e-modules, learning is no longer teacher-centered.

E-modules are packaged with integrated and differentiated learning. According to Ki Hajar Dewantara (Noventari, 2020), educators must serve children with the spirit of humanism among the system that must be put forward so that there are nuances to educate no an order just. Learning differentiation is business. For adapting the learning process in class, for fulfilling the need, study individual every participant's education (Tomlinson & Moon, 2013). With integrated learning differentiated in the e-module, the learning process is structured as form application for accommodating need. Study different students as well as diverse.

This study is using the PBL learning model. Problem: ongoing learning is centered on teachers in need of handling the PBL learning model. Problem-based learning is seen as a complex teaching method that combines skills in critical thinking, problem solving, socializing, and communicating with students through electronic modules (Suwastini, 2012). Because the essence of learning-based problems is the use of 'problems' in the learning process, teachers are required to determine the level of problems discussed in class. Through learning like that, a student can build intelligence in the 21st century.

The PBL model with differentiated learning can be one solution to the problems that have been described. The application of the integrated PBL model with differentiated learning can solve learning problems. The application of the integrated PBL model with differentiated learning is intended to improve students' collaboration skills. On this basis, researchers are interested in implementing this e-module in physics learning. The purpose of this study was

to determine the effect of the integrated e-module of the PBL model with differentiated learning on improving students' collaboration skills.

METHODS

Type of this study is classroom action research. According to Arikunto (2007), research action class is something discernible to activity. Study form an action, which is deliberate, appeared and occurred in a class in a way together. Study action class aim repair quality practice classroom learning (Arikunto, 2006). The research design used is Kemmis and Taggart. This model is also a known spiral model consisting of four components, namely: planning, implementation, observation, and reflection.

Each component in the cycle consists of a number of activities. On planning consists of analyzing achievements, learning, and goals; learning class X high school physics; understanding phases of the PBL learning model; and preparing device learning. Physics class X, such as ATP, teaching modules, and e-modules, integrated differentiated learning. Activities in implementation are implementing e-modules with phases of an integrated PBL learning model, learning differentiated in activity introduction, main activities, and activities closing. Activity observation done for observing the implementation of e-modules integrated with the PBL model with differentiated learning. Activity reflection done after implementing the e-module integrated PBL model with learning differentiated for evaluating strengths and weaknesses discovered during observation.

This research is a collaborative collaboration between lecturers and physics teachers at SMA Negeri 3 Padang. Implementation study taking place for two cycles. Every cycle consists of two meetings. Every meeting taking place for 3 hours of lessons. Means total number of meetings for the second cycle, there are 4 meetings outside the test daily. The number of students involved in the implementation of e-modules integrated with the PBL model with differentiated learning is 36 people.

Students in class XE 9 are generally almost the same as other students. Every student owns different and unique characters. Based on data from school, profile/style study student class XE 9 consists of 25 people profiled for visual learning, 6 people profiled for audio-visual learning, and 5 people profiled for kinesthetic study. In the three-year final admission process, students at SMAN 3 Padang are the same as students at other schools that are track zoning. Label SMAN 3 as one school that excels in the city field. No Again applies, including in class XE 9. Therefore, that ability, beginning students in the class also vary; students with ability low until ability tall is inside XE class 9.

The data collection instrument consists of two parts, namely the collaboration skills observation sheet and the writing test. Observation sheet used for getting skills data for collaboration with students during the implementation of e-modules integrated with the PBL model with differentiated learning. Temporary that, test written used for knowing aspect knowledge student after cycle I and cycle II. Written tests are used in essay form.

Research data analyzed with descriptive statistics. Statistics descriptive used for describing data groups from aspects of skills, collaboration, and aspects of knowledge. Descriptions from groups of data are displayed in the form of tables and graphs. Assessment rubric Skills collaboration use rubric Rahmawati (2019), then categorized as using the rating scale from Green (2002), consisting of: super (85-100), ok (68-84), development (51-67), cannot really (34-50), risk (17-33), and not yet (0-16). For help with calculation analysis, Microsoft Excel 2016 was used.

RESULTS AND DISCUSSION

Results

Skills Collaboration Students

Evaluation of the aspect of skills students assessed during the implementation of e-modules integrated with the PBL model with differentiated learning. Aspect assessed skills is skills collaboration. There are five indicators from the aspect of skills collaboration that are assessed, namely: contributing in a way that is active (I1), working in a way that is productive (I2), providing responsible answers (I3), showing flexibility (I4), and showing respect for others (I5). Data from every indicator of skills collaboration was analyzed with descriptive statistics. The average value of every indicator of skills collaboration in cycle I and cycle II is shown in Figure 1.

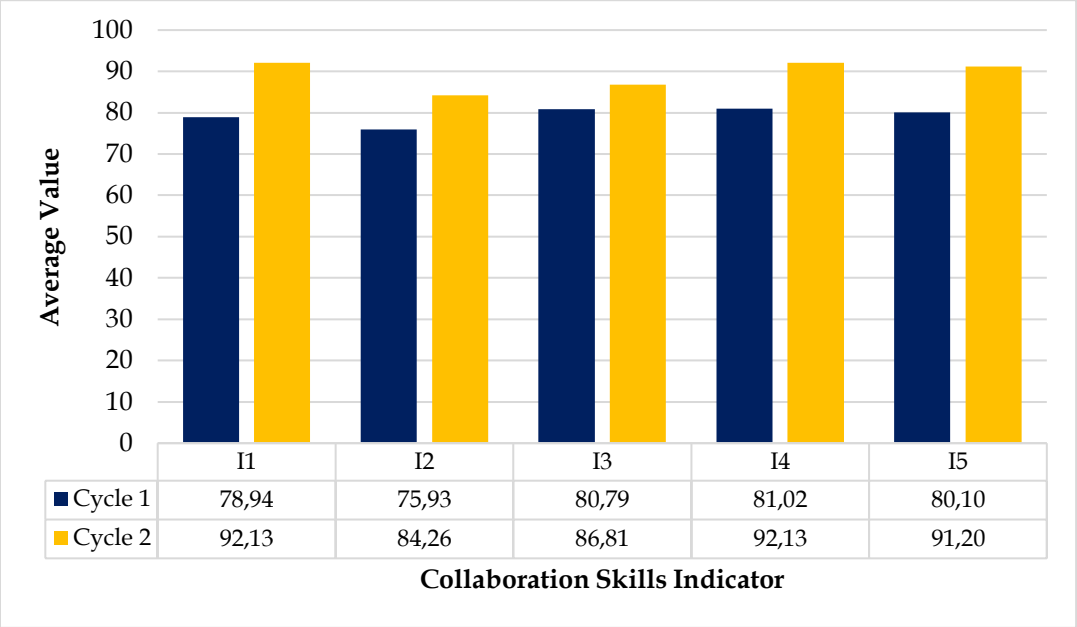

Figure 1. Improvement Skills Collaboration Cycle I and Cycle II

From data analysis in Figure 1, it can be seen that the average value of the indicator skills collaboration in cycle I varied between 75.93 and 81.02. On the application of e-modules, the integrated PBL model with learning differentiated all indicator skills collaboration is already in the ok category. The average value of the fifth indicator from the aspect of skills collaboration is 79. The average value of the aspect of skills collaboration for students in cycle I is still in the ok category. In cycle II, the average value of the indicators aspect of skills collaboration varies between 84.26 and 92.13. Indicators from skills existing collaboration are in the super category in cycle II four, viz. contribute in a way that is active, responsible, and answers; show flexibility and respect for others. One indicator still is in the ok category, namely, working in a productive way. The average value of the seventh indicator aspect, skills collaboration, in cycle II was 89, and this average value is in the super category. So, revised actions in cycle II can increase the average skill value of collaboration students from 79 to 89.

Learning Outcomes Students on Aspects Knowledge

Students were given a posttest after implementing the e-module integrating the PBL model in learning in cycle I. Weaknesses found in cycle I were revised and included in planning in cycle II. After applying the e-module, the integrated PBL model with learning differentiated with revision a post-test was also carried out in cycle II. Results data posttests in cycle I and cycle II were analyzed with appropriate statistics. Data analysis results from posttest cycle I and cycle II can be noted in Table 1.

Table 1. Comparison of Students' Understanding in Cycle I and Cycle II

Statistical Parameters Descriptive	Mark	
	Cycle I	Cycle II
N	36	36
Average	74.92	90.42
Median	83	92
Mode	90	100
Minimum	40	70
Maximum	100	100
Range	60	30

From the data in Table 1, it can be seen that the average aspect value knowledge of students in cycle I and cycle II is, respectively, 74.92 and 90.42. The average value of results learned first is in the ok category; in the first cycle of change, it becomes the super category in cycle II. The average value of results in the study aspect of knowledge for students in cycle II is taller than the results in the study aspect of knowledge for students in cycle I, with an increase of 15.5. There is a difference in the average value of results for students on aspects of knowledge. This indicated exists influence from revision actions taken in cycle II.

The application e-module integrated the PBL model with differentiated learning, which has the capability to increase students' collaborative skills and also results in student learning, especially in the aspect of knowledge. This matter happens because of the characteristics of e-modules that have been applied in learning physics. Implementation of e-modules can happen enhancement understanding student to draft lesson. In development, e-modules are designed in a way that is concise, not long-and suggestive to the core of the discussion, as well as customized according to the method of thinking of the student so that no student is bored when reading it (Nufus et al., 2020). Learning model-based problem (PBL) is a learning model that uses real-world problems as context for student study about skills solution problems (Arends, 2007). The problems raised by teachers in PBL are related to problems with the real world and interesting for students trained to solve problem. In solving related problems with the real world, students can also develop the ability to collaborate with methods to discuss or work the same with friends and colleagues. This matter is in line with (Santoso et al., 2021b), who explains that collaboration is very important and effectively applied for sustainability learning because it can increase results. Study students help students in solving problems in a way together. Through collaboration, students capable of academic differences can each other collaborate in solving problems or assignments given by the teacher.

Tomlinson & Moon (2013) explains that diversity participants are educated from 3 different aspects, namely readiness learning, interests, and profile study. Learning fundamentally differentiates between elements in learning that can be done differently and existing diversity in participant education. It means that every element in learning (content, process, product, and environment) can be differentiated based on readiness learning, interests, and/or profile study participants different education with one another. Besides the learning, differentiated help teachers accept the differences between students and respond with hope that they will understand what they can do (Chamberlin & Powers, 2010).Based on the observer's observations, it showed that in cycle I the teacher was still implementing the e-module integrated PBL model with learning differentiated between aspect profile study with element process differentiation, while in cycle II, apart from differentiating aspect profile study with element learning process, the teacher also added element differentiation product. Students more capable of developing aspects of skills collaboration in cycle II through the product produced after learning. Products made by students in accordance with material

lessons and customized with profile learning (visual, audio, or kinesthetic).

Discussion

Research results show that learning using an e-module integrated PBL model with differentiated learning can increase skills in student collaboration. This is in accordance with what was stated (Drake, 2021): characteristics of important learning are creating development zones, proximal meaning, learning, and awakening various internal developmental processes that are just capable of operating when a child interacts with people in the environment and collaborates with friends and peers.

Skills collaboration: students can be empowered in learning with designing activity. Study students with prioritize development values character through interaction cooperation with students who are active and prioritize a sense of responsibility and tolerance (Handini & Soekirno, 2017; Santoso et al., 2021a). Collaboration is very important and effectively applied for sustainability learning because it can increase results. Study students as well as help students in solving problems in a way together. Through collaboration, students capable of academic differences can each other collaborate in solving problems or assignments given by the teacher (Santoso et al., 2021b).

Research result This is relevant to the results of the study by Hadi et al. (2022), which states that design learning differentiation charged Problem-Based Learning (PBL) provides a meaningful impact on student learning outcomes. In this study, the writer finds limitations in the study, i.e., in the use of e-modules. students must use the internet network, so students with smartphones No own internet network/data package; no capable use of e-module, and must request a hotspot; his friend's smartphone has an Internet network. For study, furthermore, expected in e-module creation, can use applications that can be accessed without the need for an Internet network.

CONCLUSION

The conclusion of the study obtained from the analysis of the data that has been done. From data analysis, you can state that application e-modules integrated with the PBL model with differentiated learning can increase skills in collaboration for students who have no direct experience and can also improve results. Study aspect knowledge student. In aspect collaboration, the average student score increased from 79 to 89, with the second average value changing from good category to super category. Average aspect value knowledge increased from 74.92 to 90.42. From the results, this can be recommended to the physics teacher for applying the e-module integrated PBL model with differentiated learning to increase skills in student collaboration.

REFERENCES

Ahmad, S. (2018). Meningkatkan Kemampuan Kolaborasi Siswa Kelas XI SMA Islam Al-Qodir Menggunakan Model TPS. *Simki-Techsain*, *2*(1), 70–76.

Anantyarta, P., & Sari, R. L. I. (2017). Keterampilan Kolaboratif dan Metakognitif Melalui Multimedia Berbasis Means Ends Analysis Collaborative And Metakognitive Skills Through Multimedia Means Ends Analysis Based. *Jurnal Biologi Dan Pembelajaran Biologi*, *2*(2), 33–43.

Apriono, D. (2013). Pembelajaran Kolaboratif : Suatu Landasan untuk Membangun Kebersamaan dan Keterampilan Kerjasama. *Diklus*, *17*(1), 292–304.

Arends, R. (2007). *Learning to Teach*. Yogyakarta: Pustaka Pelajar.

Arikunto, S. (2006). *Prosedur Penelitian Suatu Pendekatan Praktik (VI)*. Jakarta: Rineka Cipta.

Arikunto, S. (2007). *Manajemen Penelitian*. Jakarta: Rineka Cipta.

Asrizal, A., Amran, A., Ananda, A., & Festiyed, F. (2018). Effectiveness of Adaptive Contextual Learning Model of Integrated Science by Integrating Digital Age Literacy on Grade VIII Students. *IOP Conference Series: Materials Science and Engineering*, *335*(1), 85–92.

Asrizal, Amran, A., Ananda, A., & Festiyed, F. (2019). Effects of Instructional Material of Natural Science with Literacy Skills of Our Respiratory and Excretory Health Theme on Academic Achievement of Students. *Journal of Physics: Conference Series*, *1317*(1), 1–7.

Asrizal, Yurnetti, & Usman, E. A. (2022). ICT Thematic Science Teaching Material With 5E Learning Cycle Model To Develop Students' 21St-Century Skills. *Jurnal Pendidikan IPA Indonesia*, *11*(1), 61–72.

Chamberlin, M., & Powers, R. (2010). The Promise of Differentiated Instruction for Enhancing The Mathematical Understandings of College Students. *Teaching Mathematics and Its Applications*, *29*(3), 113–139.

Da Fonte, M. A., & Barton-Arwood, S. M. (2017). Collaboration of General and Special Education Teachers: Perspectives and Strategies. *Intervention in School and Clinic*, *53*(2), 99–106.

Davis, K., Boss, J. A., & Meas, P. (2018). Playing in The Virtual Sandbox: Students' Collaborative Practices in Minecraft. *International Journal of Game-Based Learning*, *8*(3), 56–76.

Dewantara, D., Wati, M., Misbah, Mahtari, S., & Haryandi, S. (2020). *Blended Learning to Improve Learning Outcomes in Digital Electronics Courses*. *407*(Sbicsse 2019), 188–190.

Dooley, K., & Sexton-Finck, L. (2017). A Focus on Collaboration: Fostering Australian Screen Production Students' Teamwork Skills. *Journal of Teaching and Learning for Graduate Employability*, *8*(1), 74–105.

Drake, D. B. (2021). Rethinking Our Work with Leaders: Using Developmental Threshold Zones in Coaching. *Journal of Leadership Studies*, *14*(4), 50–59.

Green, R. (2002). *Better Thinking Learning an Introduction to Cognitive Education*. Western Cape Education Department.

Hadi, W., Prihasti Wuriyani, E., Yuhdi, A., & Agustina, R. (2022). Desain Pembelajaran Diferensiasi Bermuatan Problem Based Learning (Pbl) Mendukung Critical Thinking Skill Siswa Pada Era Kenormalan Baru Pascapandemi Covid-19. *Basastra*, *11*(1), 56.

Handini, O., & Soekirno, S. (2017). Penerapan Model Pembelajaran Kolaborasi Dengan Teknik "FIVE E" Untuk Meningkatkan Kemampuan Berwawasan Global Pada Mahasiswa PGSD FKIP Universitas Slamet Riyadi Surakarta Tahun 2016". *Research Fair Unisri 2017*, *1*(1), 73–82.

Ilma, S., Al-Muhdhar, M. H. I., Rohman, F., & Saptasari, M. (2022). Students Collaboration Skills in Science Learning. *Proceedings of the 2nd International Conference on Innovation in Education and Pedagogy (ICIEP 2020)*, *619*(Iciep 2020), 204–208.

Imansari, N., & Sunaryantiningsih, I. (2017). Pengaruh Penggunaan E-Modul Interaktif Terhadap Hasil Belajar Mahasiswa pada Materi Kesehatan dan Keselamatan Kerja. *VOLT : Jurnal Ilmiah Pendidikan Teknik Elektro*, *2*(1), 11.

Jaenudin, A., Baedhowi, P., & Murwaningsih, T. (2017). *The Effectiveness of the E-Module of*

Economics Learning on Problem-Based Learning used to Improve Students' Learning Outcomes. *158*(Ictte), 30–36.

Kundariati, M., Latifah, A. N., Laili, M. R., & Susilo, H. (2019). Peningkatan Keterampilan Kolaborasi Dan Literasi Digital Melalui Pembelajaran Biologi Berbasis Lesson Study Mahasiswa S1 Pendidikan Biologi Universitas Negeri Malang. *Prosiding Seminar Nasional Dan Workshop Biologi-IPA Dan Pembelajarannya Ke-4*, *December 2020*, 232–238.

Le, H., Janssen, J., & Wubbels, T. (2018). Collaborative Learning Practices: Teacher and Student Perceived Obstacles to Effective Student Collaboration. *Cambridge Journal of Education*, *48*(1), 103–122.

Lelasari, M., Setyosari, P., & Ulfa, S. (2017). Pemanfaatan Social Learning Network Dalam Mendukung Keterampilan Kolaborasi Siswa. *Prosiding TEP & PDs*, *3*(2), 167–172.

Noventari, W. (2020). Konsepsi Merdeka Belajar Dalam Sistem Among Menurut Pandangan Ki Hajar Dewantara. *PKn Progresif: Jurnal Pemikiran Dan Penelitian Kewarganegaraan*, *15*(1), 83–90.

Nufus, H., Susilawati, & Linda, R. (2020). Implementation of E-Module Stoiciometry Based on Kvisoft Flipbook Maker for Increasing Understanding Study Learning Concepts of Class X Senior High School. *Journal of Educational Sciences*, *4*(2), 261–272.

Nursurila, N., Darvina, Y., Hidayati, & Masril. (2018). Pembuatan LKS Berbasis Virtual Laboratory Melalui ICT Pada Materi Gelombang, Optik, dan Pemanasan Global Kelas XI SMA. *Pillar of Physics Education*, *11*(3), 193–200.

Rahmawati, A. (2019). Analisis Keterampilan Berkolaborasi Siswa SMA pada Pembelajaran Berbasis Proyek Daur Ulang Minyak Jelantah. *Jurnal Pendidikan Dan Pembelajaran Kimia*, *8*(2), 1–10.

Santoso, A. M., Primandiri, P. R., Zubaidah, S., & Amin, M. (2021a). Improving student collaboration and critical thinking skills through ASICC model learning. *Journal of Physics: Conference Series*, *1806*(1), 1–4.

Santoso, A. M., Primandiri, P. R., Zubaidah, S., & Amin, M. (2021b). The development of students' worksheets using project based learning (PjBL) in improving higher order thinking skills (HOTs) and time management skills of students. *Journal of Physics: Conference Series*, *1806*(1), 1–5.

Sari, Y. P., Sunaryo, Serevina, V., & Astra, I. M. (2019). Developing E-Module for Fluids Based on Problem-Based Learning (PBL) for Senior High School Students. *Journal of Physics: Conference Series*, *1185*(1), 1–7.

Setiawati, I., & Rusman. (2018). Profil Keterampilan 4C Siswa SMP: Studi Awal Pada Dua SMP Di Kabupaten Bandung Barat. *Prosiding Seminar Nasional Fisika (SINAFI) 2018*, 155–159.

Sugiyarti, L., Arif, A., & Mursalin. (2018). Pembelajaran Abad 21 di Sekolah Dasar. *Prosiding Seminar Dan Diskusi Pendidikan Dasar*, 1–10.

Suryadie. (2014). *Pengembangan Modul Elektronik IPA Terpadu Tipe Shared untuk Siswa Kelas VIII SMP/MTs.* Yogyakarta: UIN Sunan Kali Jaga.

Suwastini. (2012). *Pengaruh Kepuasan Kerja, Motivasi kerja, Gaya Kepemimpinan dan Budaya Kerja terhadap Kinerja Karyawan Rumah Sakit Royal Progres Jakarta*. Universitas Terbuka.

Thornhill-Miller, B., Camarda, A., Mercier, M., Burkhardt, J. M., Morisseau, T., Bourgeois-Bougrine, S., Vinchon, F., El Hayek, S., Augereau-Landais, M., Mourey, F., Feybesse, C.,

Sundquist, D., & Lubart, T. (2023). Creativity, Critical Thinking, Communication, and Collaboration: Assessment, Certification, and Promotion of 21st Century Skills for the Future of Work and Education. *Journal of Intelligence*, *11*(3), 54–60.

Tomlinson, C. A., & Moon, T. R. (2013). Assessment and Student Success in A Differentiated Classroom. In *Association for Supervision and Curriculum Development*.

Tuti, K. N., & Mawardi. (2019). Peningkatan Keterampilan Kolaborasi dan Hasil Belajar Siswa Melalui Penerapan Model Teams Games Tournament Pada Siswa Kelas 4 SD Negeri 05 Angan Tembawang. *Jurnal Basicedu*, *3*(2), 320–325.

Ulhusna, M., Putri, S. D., & Zakirman, Z. (2020). Permainan Ludo untuk Meningkatkan Keterampilan Kolaborasi Siswa dalam Pembelajaran Matematika. *International Journal of Elementary Education*, *4*(2), 130–137.