

The Effect of a Blended Learning Project Based Learning Model on Scientific Attitudes and Science Learning Outcomes

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ABSTRAK

Pandemi covid-19 menuntut pembelajaran menggunakan sistem daring. Namun masih banyak guru yang kesulitan merancang pembelajaran yang sesuai untuk siswa. Penelitian ini bertujuan menganalisis model pembelajaran berbasis project berbantuan blended learning terhadap Sikap ilmiah dan Hasil Belajar IPA. Populasi penelitian dengan jumlah siswa sebanyak 184 siswa. Sampel penelitian berjumlah 61 siswa. Pengambilan sampel menggunakan teknik random sampling. Rancangan menggunakan Post test Only Control Group Design. Data Sikap Ilmiah dikumpulkan menggunakan kuesioner dan hasil belajar IPA di kumpulkan melalui test objektif. Data dianalisis melalui statistik deskriptif dan uji Manova SPSS-17. Hasil penelitian menunjukkan bahwa terdapat perbedaan yang signifikan sikap ilmiah antara siswa yang mengikuti model pembelajaran berbasis project berbantuan blended learning dengan siswa yang mengikuti model pembelajaran konvensional, dengan nilai F sebesar 471,8. Terdapat perbedaan yang signifikan hasil belajar IPA antara siswa yang mengikuti model pembelajaran berbasis project berbantuan blended learning dengan siswa yang mengikuti pembelajaran konvensional dibuktikan hasil belajar IPA memiliki nilai F sebesar 3,69. Terdapat perbedaan sikap ilmiah dan hasil belajar IPA secara simultan antara siswa yang mengikuti model pembelajaran berbasis project berbantuan blended learning dengan siswa yang mengikuti model pembelajaran konvensional. taraf signifikansi 0,05 menghasilkan harga $p < 0,05$. Dapat disimpulkan bahwa model pembelajaran Blended Learning berbasis Project dapat meningkatkan sikap ilmiah dan hasil belajar siswa.

ABSTRACT

The COVID-19 pandemic requires learning to use an online system. However, there are still many teachers who have difficulty designing appropriate learning for students. This study analyses the project-based learning model assisted by blended learning on scientific attitudes and science learning outcomes—the research population with as many as 184 students. The research sample amounted to 61 students—sampling using the random sampling technique. The design uses Post-test Only Control Group Design. Scientific Attitude data was collected using a questionnaire, and science learning outcomes were collected through an objective test. Data were analyzed through descriptive statistics and the SPSS-17 Manova test. The results showed a significant difference in scientific attitudes between students who followed the project-based learning model assisted by blended learning and students who followed the conventional learning model, with an F value of 471.8. There is a significant difference in science learning outcomes between students who follow the project-based learning model assisted by blended learning and students who take conventional learning, as evidenced by the science learning outcomes with an F value of 3.69. There are differences in scientific attitudes and science learning outcomes simultaneously between students who follow the project-based learning model assisted by blended learning and students who follow the conventional learning model. a significance level of 0.05 resulted in a $p < 0.05$. It can be concluded that the Project-based Blended Learning learning model can improve scientific attitudes and student learning outcomes.

1. INTRODUCTION

Scientific attitude is the tendency of people to act in solving a problem systematically through scientific steps (Maison et al., 2020; Rubini et al., 2018). Scientific attitude is also an indicator of the progress

of a nation. Developed countries are determined by the mindset of their citizens, who are dominant in thinking rationally and using logic, and far from being subjective (Pennings et al., 2018; Shohel & Kirkwood, 2012). These phenomena happen based on the dominance of social influence that consists of several factors. The factors will shape human attitudes, namely personal experience, culture, other people who are considered essential, mass media, religious, educational institutions or institutions, and emotional factors in individuals (Chien, 2017; Jubaedah, 2017). Some Indonesians still use non-scientific methods to determine decision-making, such as being easily manipulated by hoax news that often gives birth to anarchic acts and more to shamans in solving health problems and other life problems (Suharyanto, 2019). It becomes the challenge of education's world to cultivate a scientific attitude from an early age (Khan & Masood, 2015; Ridlo, 2020). Therefore, the education sector needs to be addressed by the state to improve scientific attitudes. A scientific mindset is a prerequisite and a necessary behavior to be practiced by every citizen. This attitude is built by tendencies, adaptability, appreciation, and expected values, as exemplified by the work of scientists (Kim et al., 2019; Evi Suryawati & Osman, 2018). The formation of scientific attitudes from an early age is essential because scientific attitudes can shape the human personality, especially students in making rational considerations when making a decision (Atmojo et al., 2020; Learning, 2018). Scientific attitudes in children have been widely cultivated, namely, to be honest, objective, open, tenacious, critical, and cooperate with others. The earlier the scientific attitude, the easier it is to form in children.

Lack of interaction, resulting in a scientific attitude that also declines (Bal-Taştan et al., 2018; Faisal & Martin, 2019). Therefore, a method is needed to trigger the rise of scientific attitudes among students. Therefore, a scientific attitude must be carried out from an early age (Aini et al., 2019; Dewi et al., 2018). Elementary school children are at an age that needs to strengthen scientific attitudes, so initiation is needed. The characteristics of elementary school children are generally aged between 7-12 years, namely starting to have a high curiosity by investigating, trying, and experimenting about something considered interesting for them (Nurlaily et al., 2019; Yupita, 2013). In this condition, scientific attitude becomes very important to be formed through science learning. In learning science in elementary schools, teachers are required to apply science to produce products that can be justified. The scientific attitude of Indonesian students has not been maximized. It is because still constrained by the learning process that prioritizes lectures and learning that involves practicum requires more time and laboratory infrastructure. So those teachers are fixated on completing the learning materials as quickly as possible (Hamzah & Mentari, 2017; Setiyani et al., 2020). This condition certainly does not give birth to the ability of scientific attitudes, and students are a priori, and less use their reason. This condition is supported by the results of interviews and observations reinforced by the results of document recording conducted on October 25-31, 2019, to find out the results of learning science in fifth-grade elementary school students in Cluster I, Buleleng District. The number of students is 184, with a KKM of 68-70. From the KKM, 75 students completed and 105 students did not complete with an average score of 64-66. It can be explained that the value of learning outcomes has not been completed. The problem of low learning outcomes for theme five about the ecosystem needs to find a solution so that the learning carried out can provide optimal results and improve students' scientific attitudes and student learning outcomes.

This condition is supported by the organism stimulus theory (SOR), namely behavior change is a person's response or reaction to a stimulus (stimulus from outside) (Bervell et al., 2020; Setiawati et al., 2013). This theory is based on the assumption that the cause of behavior change depends on the quality of the stimulus (stimulus) that communicates with the organism. Stimulation should be given at an early age, so adaptation to changes in behavior and attitudes is more easily formed. Therefore, it is interesting to study scientific perspectives at the elementary school level. Various efforts have been made to form and build scientific attitudes in elementary school students, have been carried out using learning models. Those models are by using a guided inquiry learning model that result is improving scientific attitudes, Think learning method of Talk Write (TTW), guided inquiry model, project-based learning with a scientific attitude, a model project by knowing the scientific attitude (Alawiyah & Sopandi, 2016; Ayu Apriliyani et al., 2018; Santiasih et al., 2013; Utomo et al., 2020; Widani et al., 2019). From those descriptions, it can be seen that there has not been much in using the project model by combining blended learning in elementary school science learning (Widani et al., 2019).

Blended learning and scientific attitudes are fundamental to do (Kurniawati et al., 2019; Taruh et al., 2019). It is important because the project learning model of the Project-Based Learning (PjBL) model is a learning model that develops conceptual understanding through meaningful problem investigations and can produce an authentic product (Izati et al., 2018b; Sart, 2014; Wu & Wu, 2020). However, when the COVID-19 pandemic hit the world, the learning process underwent a radical change, usually face-to-face and then used online (in a network). Therefore, a new approach is needed as this study implements blended learning (Fitriyana et al., 2020; Simatupang et al., 2020; Yustina et al., 2020). Online learning has several

weaknesses; it requires a reasonably fast and stable internet connection, namely (1) requires an intelligent device such as an android or a good laptop. (2) For some students, online learning is challenging and difficult to understand. (3) Can be misused for identity fraud. (4) There is no direct interaction that can hinder the learning process. The poor internet connections, students do not understand the material, students feel tired, students cannot discuss with friends are the online learning' weakness (Bervell & Arkorful, 2020; Mulyanto et al., 2020). At the same time, the advantages of this learning are that students are more effective in learning, not tired, fun, new experiences (Berga et al., 2021; Bervell et al., 2020).

Several models have been applied, such as the project-based learning model assisted by blended learning. The results can make the learning atmosphere in the classroom fun and meaningful because it involves students actively and creatively in finding problems and how to solve them so that students are successful in learning. The blog-assisted blended learning method can also improve student learning outcomes (Lestari, 2020; Wulandari et al., 2020). In addition, Blended learning is for the independence of elementary school students (Effendi & Hendriyani, 2020; Sufia & Lestari, 2020). The unanswered problem in the classroom condition during the pandemic is challenging to do entirely to build a scientific attitude. This study proposes that the penetration that is served is to apply the project learning model. Project-Based Learning (PBP) is a learning method that uses problems as the first step in collecting and integrating new knowledge based on their experience in actual activities. Students are involved in solving assigned problems to allow students to build and organize their learning actively. It helps students to be more realistic (Agustiana et al., 2018; Izati et al., 2018a). Due to the pandemic situation, all learning activities must follow health procedures, namely maintaining distance, washing hands, and wearing masks. Concerning maintaining a distance, the project learning model must be modified by integrating it with blended learning, and this integration is interesting to study further (Boyd, 2019; Suryandari et al., 2018). Blended learning combines e-learning or online-based learning with classroom/face-to-face learning (Hrastinski, 2019; Sefriani et al., 2021). The primary purpose of blended learning is to provide opportunities for learners to make independent, sustainable, and lifelong learning occur so that that maximum learning can be achieved (Berga et al., 2021; Haka et al., 2020). The advantages of blended learning, one of which is not only learning in one direction in a row, but students have the opportunity to learn the desired material and set a flexible schedule and time for a subject (Alfi et al., 2016). The purpose of this study is analyzing the blended learning-assisted project learning model on scientific attitudes and science learning achievement.

2. METHOD

This research is a type of quasi-experimental research. The design of this research is a Non-Equivalent Post-test Only Control Group Design. This research was conducted on fifth-grade students of SD Negeri 1 Banyuning and fifth-grade SD Negeri 8 Banyuning. Buleleng Regency for the 2020/2021 academic year consists of 8 elementary schools with a total of 184 students. The research population must be in an equal state. Therefore it is necessary to carry out an equivalence test using one-way analysis of variance (Anava A) with the help of SPSS 17.0 for windows. Based on the equivalence test that has been carried out, it is known that the significance value of the science learning outcomes theme five on ecosystems (with sub-themes: Ecosystem Components; Relationships Between Living Things in Ecosystems; Ecosystem Balance) is 0.490. sig value. 0. It means that each member of the population, namely all fifth-grade elementary school students in Cluster I, Buleleng District, Buleleng Regency, is equal or homogeneous. Based on the equivalence test results, it can be seen that all elementary schools in Cluster I, Buleleng District, Buleleng Regency can be used as research samples. Before determining the sample, the population is put into classes as an entire group. The next step is to determine the research sample using a random sampling technique: taking classes at random without being picky. The research sample was determined by drawing lots. The sample used in this study was the fifth-grade students of SD N 1 Banyuning, totaling 31 students as the experimental class, and the fifth-grade students of SD N 8 Banyuning, totaling 30 students as the control class.

The data collected in this study are scientific attitude data and science learning outcomes data. The scientific attitude consists of 30 statement items, which include: curiosity (curiosity), inventiveness (discovery attitude), critical thinking (critical thinking attitude), and persistence (steadfast attitude). Science learning outcomes data were collected using multiple-choice objective test methods with four choices. The number of questions was 30 questions. The instrument used is under the grid that has been designed and guided by the 2013 curriculum. Before the instrument is used, an expert test is carried out by two experts and tested in the field to get a good quality test. The research data were analyzed in stages, namely by descriptive statistical analysis and inferential statistics. Descriptive statistics are used to describe the spread of data by finding the mean and standard deviation. Before testing the hypothesis, a prerequisite test is first carried out by normality test, homogeneity test of variance, and correlation test between

dependent variables. Inferential statistics are used to test research hypotheses through the MANOVA test with the help of SPSS-17 for windows. The follow-up to the MANOVA test was a significant test of the average value between groups using the Least Significant Difference (LSD). Furthermore, there are differences in the blended learning-assisted project learning model on scientific attitudes and science learning outcomes for elementary school students to test this hypothesis. The Pillae Trace, Wilk's Lambda, Hotelling's Trace statistic, and Roy's Largest Root were carried out. Firstly, the Pillae trace is the most suitable test if; 1. the assumption of homogeneity of the variance-covariance matrix is not met. 2. The sample sizes are small. 3. the results of the tests contradict each other. For example, if some vector means differ while others do not. Secondly is Wilk's Lambda. This test statistic is used if there are more than two groups of independent variables and the homogeneity of the variance-covariance matrix is fulfilled. Thirdly is Hotelling's Trace. This test statistic is suitable to be used if there are only two groups of independent variables. The higher the Hotelling's Trace statistic, the greater the influence on the model. The last one is Roy's Largest Root. This test statistic is only used if the assumption of homogeneity of variance-co-variance is met. The higher the statistical value, Roy's Largest Root, the greater the effect on the model.

3. RESULT AND DISCUSSION

Result

The data on science learning outcomes for fifth-grade elementary school students were obtained from the post-test scores. The description of the research results of student learning outcomes data describes the number of students, maximum score, minimum score, mean, and standard deviation. The experimental group's science learning outcomes (post-test) were mean = 82.0 and standard deviation = 6.97; while in the control group, the mean = 69.8 and standard deviation = 9.53. The value of student learning outcomes after being taught using a project-based learning model assisted by blended learning is in the "high" category, which is in the range of 85-100. Meanwhile, for the control group using those who were taught without a project-based learning model assisted by blended learning, the average value of 69.8 was in the "enough" category, namely in the range of 65-75. It can be concluded that the average post-test science learning outcomes of the experimental group are higher than the average score of the control group students' results. Data on scientific attitudes of fifth-grade elementary school students were obtained from the post-test scores. The results of scientific attitude data research describe the number of students, maximum score, minimum score, mean, and standard deviation. The scientific attitude of the experimental group is mean = 131.58 and standard deviation = 8.130; while in the control group, the mean = 87.30 and standard deviation = 7.809. It can be concluded that the average scientific attitude of the experimental group is higher than the average value of the scientific attitude of the control group students. The level of the post-test variable of students' scientific attitudes can be known through the average score of students' learning motivation which is converted using the ideal average criteria (M_i) and S_{di} . The average student in the experimental group was 131.58. The value of students' scientific attitudes after being taught using a project-based learning model assisted by blended learning is in the "very good" category, in the range of 120-150. Meanwhile, for the control group using those who were taught without a project-based learning model assisted by blended learning, the average value of 87.30 was in the "enough" category, which was in the range of 80-100.

In the Kolmogorov-Smirnov test, the significance value of the scientific attitude of fifth-grade elementary school students in the experimental class was $0.200 > 0.05$, while the control class was $0.200 > 0.05$. It means that the scientific attitude data of fifth-grade elementary school students tested using the Kolmogorov-Smirnov test is usually distributed. Shapiro Wilk test the significance value of scientific attitude in the experimental class is $0.142 > 0.05$; while the control class is $0.307 > 0.05$; which means that the scientific attitude of the fifth-grade elementary school students who were tested using the Shapiro Wilk test was normally distributed. So, it can be concluded that the scientific attitude data of fifth-grade elementary school students in the experimental class and control class are normally distributed. Based on the normality test's result in Table 5, the science learning outcomes in the experimental class were $0.126 > 0.05$, while the control class was $0.067 > 0.05$. It means that the learning outcomes of fourth-grade elementary school students tested using the Kolmogorov-Smirnov test were normally distributed. Shapiro Wilk test the significance value of learning outcomes in the experimental class $0.53 > 0.05$; while the control class was $0.51 > 0.05$; which means that the learning outcomes of fifth-grade elementary school students tested using the Shapiro Wilk test were normally distributed. So, it can be concluded that the learning outcomes of fifth-grade elementary school students in the control class and the experimental class are normally distributed.

The homogeneity test of variance used is Levene's Test of Equality of Error Variance. The significance value of the fifth-grade elementary school students' learning outcomes is $0.135 > 0.05$. It means

the data on science learning outcomes for fifth-grade elementary school students has a homogeneous variance. The significance value of the scientific attitude of fifth-grade elementary school students is $0.820 > 0.05$. It identifies the scientific attitude data of fifth-grade elementary school students in the experimental and control class have a homogeneous variance. The analysis results show that the F value for Pillai Trace, Wilk' Lambda, Hotelling Trace, Roy's Largest Root has significantly less than 0.05. It means that the F prices for Pillai Trace, Wilk' Lambda, Hotelling Trace, Roy's Largest Root are all significant. So H_0 is rejected. This result means significant differences in science learning outcomes and scientific attitudes between students who follow the project-based learning model assisted by blended learning and students who follow the conventional learning model. Research Hypothesis Test Based on the results of prerequisite tests (normality test, homogeneity test of variance, and correlation test between dependent variables). The data used in this study can inevitably be continued to be used in hypothesis testing. There are three hypotheses tested by MANOVA analysis followed by the Least Significant Different (LSD) test to analyze the significance of differences in learning outcomes and scientific attitudes of experimental and control class students. The first hypothesis is that the value of class significance on learning outcomes is $0.00 < 0.05$, which means H_0 is rejected and H_1 is accepted.

Based on the Least Significant Different (LSD) test, the value $\Delta\mu > \text{LSD}$ is obtained. So it can be concluded that there is a significant effect of the project-based learning model assisted by blended learning on the learning outcomes of fourth-grade students in science subjects at SD Gugus I, Buleleng District, 2019/2020 Academic Year. Second Hypothesis, the value of class significance on scientific attitudes is $0,00 < 0.05$; which means H_0 is rejected and H_1 is accepted. Based on the Least Significant Different (LSD) test, the value $\Delta\mu > \text{LSD}$ is obtained. So it can be concluded that there is a significant effect of the project-based learning model assisted by blended learning on the scientific attitude of grade IV students in science subjects at SD Gugus I, Buleleng District, for the 2019/2020 academic year. The third Hypothesis, the significance value in the analysis of Pillai Trace, Wilk Lambda, Hotelling's Trace, Roy's Largest Root is $0.000 < 0.05$, which means H_0 is rejected, and H_1 is accepted. Based on these calculations, the results show that there is a significant effect of the project-based learning model assisted by blended learning on the learning outcomes and scientific attitudes of fourth-grade students in science subjects at SD Cluster I Buleleng District, 2019/2020 academic year. Thus, the three hypotheses in this study were declared accepted.

Discussion

First, the project-based learning model assisted by blended learning makes the learning atmosphere in the classroom fun. Students are given the freedom to express opinions, ask questions, make conclusions and answers without feeling ashamed and afraid during the learning process. Blended learning requires serious preparation to run well (Akyol & Garrison, 2011; Utami, 2017). Teachers must find fun ways to learn during this corona pandemic by providing interesting teaching materials so that students do not feel bored and saturated, in this case, in the form of videos and learning resources with exciting pictures (Dziuban et al., 2018; Wulandari et al., 2020). This condition can be implemented by blending through the provision of interesting teaching materials. Attitudes towards science have been highly influential in students' engagement with science and future career choices. Science is also essential in our daily lives, in a society that demands more scientific vocations and higher levels of scientific literacy (Rubini et al., 2018; Zulfiani et al., 2020). It is parallel to one of the fundamental goals of science learning, which is to make students have scientific curiosity, improve their scientific attitudes and skills, and turn them into scientific behavior (Bal-Taştan et al., 2018; Irwansyah et al., 2017). However, it still has not resulted in changes. It can be seen from the data in the field that the scientific attitude of students in the science learning process so far is still lacking. This lack of scientific attitude is caused by the teacher never inviting students to carry out scientific activities in the learning process.

Second, this learning model makes learning meaningful (Yustina et al., 2020; Zeptyani & Wiarta, 2020). It is because, during the learning process, students are actively involved in solving problems, and learning is also associated with real situations (Suryandari et al., 2018; Susilawati et al., 2017). So, students' knowledge can be applied in their respective lives. Third, students can exchange ideas with their friends and express their ideas during the learning process. Students exchange ideas with their friends and seek more in-depth information to support the opinions they convey so that their opinions can be recognized as valid (Mutakinati et al., 2018; Pan et al., 2021). Fourth, it can increase students' curiosity, in the orientation phase the teacher provides authentic problems so that students' interest rises. Fifth, Indents study in groups; in the stage of exploring creative ideas, students are divided into several groups to share their problems with their group members and solve problems faster. Sixth, learning is student-centered, so during the learning process, students are active in finding issues and solve these problems through investigations and experiments carried out by students during the learning process (Mutakinati et al., 2018; Potvin et al., 2021).

These findings are also supported by the research results of Suci Utami and colleagues. The results revealed significant differences in science learning outcomes between students who study using the project-based learning model with blended learning and groups of students who learn using conventional learning models in science learning. It happens because students can have better critical thinking (Pérez-Escolar et al., 2021; Putri & Hendawati, 2018). Learning with project-based learning models assisted by blended learning on scientific attitudes is caused by several things. First, the inquiry phase can train students to collect relevant facts, classify, determine tools and materials, determine activity steps and interpret (Anjelina & Mawardi, 2021; Learning, 2018). Second, the elaboration phase can prepare students to organize, communicate, analyze, and make experimental reports. Students make experimental investigation reports in this phase by building cooperative values, practicing communication skills, expressing opinions, defending opinions, and gathering information through discussion. Third, the phase of presenting the work can train students' communication skills through presentations. In this phase, students present their work in an open discussion. Problem-based learning makes students can find solutions to these problems through a scientific attitude (Kristinawati et al., 2018; E. Suryawati et al., 2020). Based on the research that has been done and strengthened by some of the opinions above, it can be concluded that the project-based learning model assisted by blended learning affects scientific attitudes. Based on this, student learning outcomes and scientific attitudes greatly improved. Based on the explanation above, it can be concluded that there is a significant simultaneous effect of the project-based learning model assisted by blended learning on the learning outcomes and scientific attitudes of fourth-grade students in science subjects at SD Cluster I Buleleng District, 2019/2020 academic year.

4. CONCLUSION

First, there is a significant difference in scientific attitudes between students who follow the project-based learning model assisted by blended learning and students who follow the conventional learning model. Second, here is a significant difference in science learning outcomes between students who follow the project-based learning model assisted by blended learning and students who take conventional learning as evidenced by the science learning outcomes. Third, there are differences in scientific attitudes and science learning outcomes simultaneously between students who follow the project-based learning model assisted by blended learning and students who follow the conventional learning model. It can be concluded that the Blended Learning Project-based learning model can improve scientific attitudes and student learning outcomes.

5. REFERENCES

- Agustiana, I. G. A. T., Agustini, R., & Ibrahim, M. (2018). The Prototype Development of Creative Thinking Skills Model's Book. *SHS Web of Conferences*. <https://doi.org/10.1051/shsconf/20184200116>.
- Aini, R. Q., Rachmatullah, A., & Ha, M. (2019). Indonesian primary school and middle school students' attitudes toward science: Focus on gender and academic level. *Journal of Baltic Science Education*, 18(5), 654–667. <https://doi.org/10.33225/jbse/19.18.654>.
- Akyol, Z., & Garrison, D. R. (2011). Understanding cognitive presence in an online and blended community of inquiry: Assessing outcomes and processes for deep approaches to learning. *British Journal of Educational Technology*, 42(2), 233–250. <https://doi.org/10.1111/j.1467-8535.2009.01029.x>.
- Alawiyah, I., & Sopandi, W. (2016). Pembelajaran Berbasis Proyek Untuk Meningkatkan Sikap Ilmiah Siswa Sekolah Dasar Pada Materi Peristiwa Alam. *Jurnal Penelitian Pendidikan*. <https://doi.org/10.17509/jpp.v16i2.4241>.
- Alfi, C., Sumarmi, S., & Amirudin, A. (2016). Pengaruh Pembelajaran Geografi Berbasis Masalah Dengan Blended Learning Terhadap Kemampuan Berpikir Kritis Siswa SMA. *Jurnal Pendidikan - Teori, Penelitian, Dan Pengembangan*, 4(1). <https://doi.org/10.17977/jp.v1i4.6203>.
- Anjelina, Y., & Mawardi, M. (2021). Validity of Flipped Classroom Based on Guided Inquiry in Chemical Bonding Materials Using Edmodo. *International Journal of Progressive Sciences and Technologies*, 27(1), 29–34. <https://doi.org/10.52155/ijpsat.v27.1.3023>.
- Atmojo, S. E., Muhtarom, T., & Lukitoaji, B. D. (2020). The level of self-regulated learning and self-awareness in science learning in the covid-19 pandemic era. *Jurnal Pendidikan IPA Indonesia*, 9(4), 512–520. <https://doi.org/10.15294/jpii.v9i4.25544>.
- Ayu Apriliyani, N. K., Dantes, N., & Pudjawan, K. (2018). Pengaruh Model Pembelajaran Think Talk Write (TTW) Terhadap Sikap Ilmiah Dan Hasil Belajar IPA. *International Journal of Elementary Education*. <https://doi.org/10.23887/ijee.v2i3.15967>.
- Bal-Taştan, S., Davoudi, S. M. M., Masalimova, A. R., Bersanov, A. S., Kurbanov, R. A., Boiarchuk, A. V., &

- Pavlushin, A. A. (2018). The Impacts of Teacher's Efficacy and Motivation on Student's Academic Achievement in Science Education among Secondary and High School Students. *EURASIA Journal of Mathematics, Science and Technology Education*, 14(6), 2353–2366. <https://doi.org/10.29333/ejmste/89579>.
- Berga, K. A., Vadnais, E., Nelson, J., Johnston, S., Buro, K., Hu, R., & Olaiya, B. (2021). Blended learning versus face-to-face learning in an undergraduate nursing health assessment course: A quasi-experimental study. *Nurse Education Today*, 96(October 2020), 104622. <https://doi.org/10.1016/j.nedt.2020.104622>.
- Bervell, B., & Arkorful, V. (2020). LMS-enabled blended learning utilization in distance tertiary education: establishing the relationships among facilitating conditions, voluntariness of use and use behaviour. *International Journal of Educational Technology in Higher Education*, 17(1), 6. <https://doi.org/10.1186/s41239-020-0183-9>.
- Bervell, B., Nyagorme, P., & Arkorful, V. (2020). LMS-Enabled Blended Learning Use Intentions among Distance Education Tutors: Examining the Mediation Role of Attitude Based on Technology-Related Stimulus-Response Theoretical Framework (TR-SR-TF). *Contemporary Educational Technology*, 12(2), ep273. <https://doi.org/10.30935/cedtech/8317>.
- Boyd, L. (2019). Using Technology-Enabled Learning Networks to Drive Module Improvements in the UK OpenUniversity. *Journal of Interactive Media in Education*, 2019(1), 1–7. <https://doi.org/10.5334/jime.529>.
- Chien, Y. H. (2017). Developing a pre-engineering curriculum for 3D printing skills for high school technology education. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(7), 2941–2958. <https://doi.org/10.12973/eurasia.2017.00729a>.
- Dewi, N. R., Kannapiran, S., & Wibowo, S. W. A. (2018). Development of digital storytelling-based science teaching materials to improve students' metacognitive ability. *Jurnal Pendidikan IPA Indonesia*, 7(1), 16–24. <https://doi.org/10.15294/jpii.v7i1.12718>.
- Dziuban, Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended Learning: The New Normal and Emerging Technologies. *International Journal of Educational Technology in Higher Education*, 15(3), 1–16. <https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-017-0087-5>.
- Effendi, H., & Hendriyani, Y. (2020). The Conceptual and Hypothetical Model of Interactive Blended Problem Based Learning. *JPI (Jurnal Pendidikan Indonesia)*, 8(2), 285. <https://doi.org/10.23887/jpi-undiksha.v8i2.24162>.
- Faisal, & Martin, S. N. (2019). Science education in Indonesia: past, present, and future. *Asia-Pacific Science Education*, 5(1). <https://doi.org/10.1186/s41029-019-0032-0>.
- Fitriyana, N., Wiyarsi, A., Ikhsan, J., & Sugiyarto, K. H. (2020). Android-Based-Game And Blended Learning In Chemistry: Effect On Students'self-Efficacy And Achievement. *Jurnal Cakrawala Pendidikan*, 39(3), 507–521. https://journal.uny.ac.id/index.php/cp/article/view/28335/pdf_1.
- Haka, N. B., Anggita, L., Anggoro, B. S., & Hamid, A. (2020). Pengaruh Blended Learning Berbantuan Google Classroom Terhadap Keterampilan Berpikir Kreatif Dan Kemandirian Belajar Peserta Didik. *Edu Sains Jurnal Pendidikan Sains & Matematika*. <https://doi.org/10.23971/eds.v8i1.1806>.
- Hamzah, I., & Mentari, S. (2017). Development of Accounting E-Module to Support the Scientific Approach of Students Grade X Vocational High School. *Journal of Accounting and Business Education*, 1(1), 78. <https://doi.org/10.26675/jabe.v1i1.9751>.
- Hrastinski, S. (2019). What Do We Mean by Blended Learning? *TechTrends*. <https://doi.org/10.1007/s11528-019-00375-5>.
- Irwansyah, F. S., Lubab, I., Farida, I., & Ramdhani, M. A. (2017). Designing Interactive Electronic Module in Chemistry Lessons. *Journal of Physics: Conference Series*, 895(1). <https://doi.org/10.1088/1742-6596/895/1/012009>.
- Izati, S. N., Wahyudi, & Sugiyarti, M. (2018a). Project Based Learning Berbasis Literasi untuk Meningkatkan Hasil Belajar Tematik. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, 3(9), 1122–1127. <https://doi.org/10.17977/jptpp.v3i9.11508>.
- Izati, Wahyudi, & Sugiyarti, M. (2018b). Project Based Learning Berbasis Literasi untuk Meningkatkan Hasil Belajar Tematik. *Jurnal Pendidikan*, 3(9), 1122–1127. <https://doi.org/10.17977/jptpp.v3i9.11508>.
- Jubaedah, J. (2017). Penerapan Model Cooperative Learning Tipe Student Teams Achievement Division (STAD) Untuk Meningkatkan Hasil Belajar Siswa Pada Mata Pelajaran IPA. *Jurnal Cakrawala Pendas*. <https://doi.org/10.31949/jcp.v3i2.591>.
- Khan, F. M. A., & Masood, M. (2015). The Effectiveness of an Interactive Multimedia Courseware with Cooperative Mastery Approach in Enhancing Higher Order Thinking Skills in Learning Cellular Respiration. *Procedia - Social and Behavioral Sciences*, 176, 977–984.

- <https://doi.org/10.1016/j.sbspro.2015.01.567>.
- Kim, Y. J., Radloff, J. C., Stokes, C. K., & Lysaght, C. R. (2019). Interprofessional education for health science students' attitudes and readiness to work interprofessionally: a prospective cohort study. *Brazilian Journal of Physical Therapy*, 23(4), 337–345. <https://doi.org/10.1016/j.bjpt.2018.09.003>.
- Kristinawati, E., Susilo, H., & Gofur, A. (2018). ICT Based-Problem Based Learning on Students' Cognitive Learning Outcomes. *Jurnal Pendidikan Sains*, 6(2), 38–42. <https://doi.org/10.17977/jps.v6i2.11683>.
- Kurniawati, M., Santanapurba, H., & Kusumawati, E. (2019). Penerapan Blended Learning Menggunakan Model Flipped Classroom Berbantuan Google Classroom Dalam Pembelajaran Matematika Smp. *EDU-MAT: Jurnal Pendidikan Matematika*, 7(1), 8–19. <https://doi.org/10.20527/edumat.v7i1.6827>.
- Learning, P. (2018). The Effectiveness of Guided Inquiry-based Learning Material on Students' Science Literacy Skills. *Journal of Physics: Conference Series*, 947, 1–7. <https://doi.org/10.1088/1742-6596/1088/1/012106>.
- Lestari, H. (2020). Literasi Sains Siswa Melalui Penerapan Model Pembelajaran Blended Learning Dengan Blog. *Naturalistic: Jurnal Kajian Penelitian Pendidikan Dan Pembelajaran*. <https://doi.org/10.35568/naturalistic.v4i2b.769>.
- Maison, M., Haryanto, H., Ernawati, M. D. W., Ningsih, Y., Jannah, N., Puspitasari, T. O., & Putra, D. S. (2020). Comparison of student attitudes towards natural sciences. *International Journal of Evaluation and Research in Education*, 9(1), 54–61. <https://doi.org/10.11591/ijere.v9i1.20394>.
- Mulyanto, B. S., Sadono, T., Koeswanti, H. D., Dasar, S., Wonodoyo, N., Tengah, J., Kristen, U., Wacana, S., & Tengah, J. (2020). Evaluation of Critical Thinking Ability with Discovery Learning Using Blended Learning Approach in Primary School. *Journal of Educational Research and Evaluation*, 9(2), 78–84. <https://doi.org/10.15294/jere.v9i2.46135>.
- Mutakinati, L., Anwari, I., & Yoshisuke, K. (2018). Analysis of students' critical thinking skill of middle school through stem education project-based learning. *Jurnal Pendidikan IPA Indonesia*, 7(1), 54–65. <https://doi.org/10.15294/jpii.v7i1.10495>.
- Nurlaily, V. A., Soegiyanto, H., & Usodo, B. (2019). Elementary school teacher's obstacles in the implementation of problem-based learning model in mathematics learning. *Journal on Mathematics Education*, 10(2), 229–238. <https://doi.org/10.22342/jme.10.2.5386.229-238>.
- Pan, G., Shankaraman, V., Koh, K., & Gan, S. (2021). Students' evaluation of teaching in the project-based learning programme: An instrument and a development process. *The International Journal of Management Education*, 19(2). <https://doi.org/10.1016/j.ijme.2021.100501>.
- Pennings, H. J. M., Brekelmans, M., Sadler, P., Claessens, L. C. A., van der Want, A. C., & van Tartwijk, J. (2018). Interpersonal adaptation in teacher-student interaction. *Learning and Instruction*, 55, 41–57. <https://doi.org/10.1016/j.learninstruc.2017.09.005>.
- Pérez-Escolar, M., Ordóñez-Olmedo, E., & Alcaide-Pulido, P. (2021). Fact-Checking Skills And Project-Based Learning About Infodemic And Disinformation. *Thinking Skills and Creativity*, 41. <https://doi.org/10.1016/j.tsc.2021.100887>.
- Potvin, A. S., Boardman, A. G., & Stamatis, K. (2021). Consequential change: Teachers scale project-based learning in English language arts. *Teaching and Teacher Education*, 107. <https://doi.org/10.1016/j.tate.2021.103469>.
- Putri, S. U., & Hendawati, Y. (2018). Blended Project Based Learning : Strategy for Improving Critical Thinking of Pre-Service Teachers in Science Education. *Proceeding of the 1st UR International Conference on Educational Sciences*. <https://ices.prosiding.unri.ac.id/index.php/ICES/article/view/4745>.
- Ridlo, S. (2020). Critical Thinking Skills Reviewed from Communication Skills of the Primary School Students in STEM-Based Project-Based Learning Model. *Journal of Primary Education*, 9(3), 311–320. <https://doi.org/10.15294/jpe.v9i3.27573>.
- Rubini, B., Permanasari, A., & Yuningsih, W. (2018). Learning Multimedia Based on Science Literacy on the Lightning Theme. *Jurnal Penelitian Dan Pembelajaran IPA*, 4(2), 89–104. <https://doi.org/10.30870/jppi.v4i2.3926>.
- Santiasih, N. I., Marhaeni, A. A. I. N., & Tika, I. N. (2013). Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Sikap Ilmiah dan Hasil Belajar IPA Siswa Kelas V SD No. 1 Kerobokan Kecamatan Kuta Utara Kabupaten Badung Tahun Pelajaran 2013/2014. *Jurnal Pendidikan Dasar Ganesha*, 3(1). <https://doi.org/10.23887/jet.v3i1.17959> Article Metrics.
- Sart, G. (2014). The Effects of the Development of Metacognition on Project-based Learning. *Procedia - Social and Behavioral Sciences*, 152, 131–136. <https://doi.org/10.1016/j.sbspro.2014.09.169>.
- Sefriani, R., Sepriana, R., Wijaya, I., & Radyuli, P. (2021). Blended Learning with Edmodo: The Effectiveness

- of Statistical Learning during the COVID-19 Pandemic. *International Journal of Evaluation and Research in Education*, 10(1), 293–299. <https://doi.org/10.11591/ijere.v10i1.20826>.
- Setiawati, F. A., Mardapi, D., & Azwar, S. (2013). Penskalaan Teori Klasik Instrumen Multiple Intelligences Tipe Thurstone Dan Likert. *Jurnal Penelitian Dan Evaluasi Pendidikan*, 17(2), 259–274. <https://doi.org/10.21831/pep.v17i2.1699>.
- Setiyani, Putri, D. P., Ferdianto, F., & Fauji, S. H. (2020). Designing a Digital Teaching Module Based on Mathematical Communication in Relation and Function. *Journal on Mathematics Education*, 11(2), 223–236. <https://doi.org/10.22342/jme.11.2.7320.223-236>.
- Shohel, M. M. C., & Kirkwood, A. (2012). Using technology for enhancing teaching and learning in Bangladesh: Challenges and consequences. *Learning, Media and Technology*, 37(4), 414–428. <https://doi.org/10.1080/17439884.2012.671177>.
- Simatupang, H., Purnama, D., & Simatupang, Z. (2020). The Development of Best Practice Handbook Learning Strategy Based on Flip Book to Support Blended Learning Processes. *Journal of Physics: Conference Series*, 1462(1). <https://doi.org/10.1088/1742-6596/1462/1/012014>.
- Sufia, R., & Lestari, U. N. (2020). Implementasi Blended Learning Selama Masa Pandemi Covid-19 Untuk Menumbuhkan Kemandirin Siswa Pada Mata Pelajaran Matematika di SD YP Nasional *JIEES: Journal of Islamic Education at ...*
- Suharyanto, C. E. (2019). Analisis Berita Hoaks Di Era Post-Truth: Sebuah Review. *Masyarakat Telematika Dan Informasi: Jurnal Penelitian Teknologi Informasi Dan Komunikasi*. <https://doi.org/10.17933/mti.v10i2.150>.
- Suryandari, Sajidan, Rahardjo, Prasetyo, & Fatimah. (2018). Project-Based Science Learning And Pre-Service Teachers' Science Literacy Skill And Creative Thinking. *Cakrawala Pendidikan*, 37(3). <https://doi.org/10.21831/cp.v38i3.17229>.
- Suryawati, E., Suzanti, F., Zulfarina, Putriana, A. R., & Febrianti, L. (2020). The implementation of local environmental problem-based learning student worksheets to strengthen environmental literacy. *Jurnal Pendidikan IPA Indonesia*, 9(2), 169–178. <https://doi.org/10.15294/jpii.v9i2.22892>.
- Suryawati, Evi, & Osman, K. (2018). Contextual learning: Innovative approach towards the development of students' scientific attitude and natural science performance. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(1), 61–76. <https://doi.org/10.12973/ejmste/79329>.
- Susilawati, A., Hernani, H., & Sinaga, P. (2017). The Application of Project-Based Learning Using Mind Maps To Improve Students' Environmental Attitudes Towards Waste Management in Junior High Schools. *International Journal of Education*, 9(2), 120–125. <https://doi.org/10.17509/ije.v9i2.5466>.
- Taruh, E., Abbas, N., & Umar, M. K. (2019). Studies The Influence Of Blended Learning-Based Guided Inquiry Learning Model And Self Efficacy On Students' Scientific Literacy. *European Journal Of Education*, 1, 137–150. <https://doi.org/10.5281/zenodo.3445474>.
- Utami, I. S. (2017). Pengujian Validitas Model Blended Learning di Sekolah Menengah Kejuruan. *Jurnal Ilmiah Pendidikan Teknik Elektro*, 2(1), 1–10. <https://doi.org/10.30870/volt.v2i1.963>.
- Utomo, A. C., Abidin, Z., & Rigiyanti, H. A. (2020). Keefektifan Pembelajaran Project Based Learning Terhadap Sikap Ilmiah Pada Mahasiswa PGSD. *Educational Journal of Bhayangkara*. <https://doi.org/10.31599/edukarya.v1i1.103>.
- Widani, N. K. T., Sudana, D. N., & Agustiana, I. G. A. T. (2019). Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Hasil Belajar IPA Dan Sikap Ilmiah Pada Siswa Kelas V SD Gugus I Kecamatan Nusa Penida. *Journal of Education Technology*, 3(1), 15–21. <https://doi.org/10.23887/jet.v3i1.17959>.
- Wu, T. T., & Wu, Y. T. (2020). Applying project-based learning and SCAMPER teaching strategies in engineering education to explore the influence of creativity on cognition, personal motivation, and personality traits. *Thinking Skills and Creativity*, 35(January), 100631. <https://doi.org/10.1016/j.tsc.2020.100631>.
- Wulandari, I. G. A. A. M., Sudatha, I. G. W., & Simamora, A. H. (2020). Pengembangan Pembelajaran Blended Pada Mata Kuliah Ahara Yoga Semester II di IHDN Denpasar. *Jurnal Edutech Undiksha*, 8(1), 1. <https://doi.org/10.23887/jeu.v8i1.26459>.
- Yupita, I. A. dan W. T. S. (2013). Penerapan Model Pembelajaran Discovery Untuk Meningkatkan Hasil Belajar Ips Di Sekolah Dasar. *Jurnal Penelitian Pendidikan Guru Sekolah Dasar*, 1(2). <https://jurnalmahasiswa.unesa.ac.id/index.php/jurnal-penelitian-pgsd/article/view/3017>.
- Yustina, Syafii, W., & Vebrianto, R. (2020). The effects of blended learning and project-based learning on pre-service biology teachers' creative thinking skills through online learning in the COVID-19 pandemic. *Jurnal Pendidikan IPA Indonesia*, 9(3), 408–420. <https://doi.org/10.15294/jpii.v9i3.24706>.

- Zeptyani, & Wiarta. (2020). Pengaruh Project-Based Outdoor Learning Activity Menggunakan Media Audio Visual Terhadap Perilaku Belajar Anak Usia Dini. *Jurnal Pendidikan Anak Usia Dini Undiksha*, 8(2), 69–79. <https://doi.org/10.23887/paud.v8i2.24740>.
- Zulfiani, Suwarna, I. P., & Sumantri, M. F. (2020). Science adaptive assessment tool: Kolb's learning style profile and student's higher order thinking skill level. *Jurnal Pendidikan IPA Indonesia*, 9(2), 194–207. <https://doi.org/10.15294/jpii.v9i2.23840>.