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Implementation of Project Based Learning Integrated TPACK in Improve Creative Thinking Skills Through Lesson Study

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Abstract *: Facing 21st century learning, lecturers need to carry out student-centered learning that is able to improve creative thinking skills. This research aims to improve students' creative thinking skills by applying Project Based learning integrated TPAC through lesson study. This study used classroom action research through study lessons with three open classes with subjects totaling 32 students of the Hamzanwadi University, mathematics education study program. The data were analyzed using descriptive statistics. Student activity scores during the learning process from the first, second and third open classes were 73.34%, 77% and 87% there was an increase in average activity of 6.83%. Data on the percentage of students who scored the ability to think above 75 in the first open class was 78.13%, the second open class was 81.25% and the third open class was 93.75%, there was an average increase of 7.81%. The conclusion of this study is that the application of Project Based learning integrated TPACK through lesson study can improve students' creative thinking skill. Researchers hope that lecturers can apply TPACK integrated project-based learning to the courses taught.*
Keyword: Creative Thinking, Project Based Learning, TPACK

INTRODUCTION

In most students, mathematics is a lesson that leaves an unpleasant experience in learning that will affect students' attitudes and learning outcomes. The results of observations on integral courses in students of the Mathematics Education study program at Hamzanwadi University show that lecturers have not been optimal in implementing innovative student-centered learning. Lecturers have also not been able to facilitate students in learning who are able to develop creative thinking skills. Students also have difficulty in solving questions related to daily life. Facing 21st century learning is characterized by the presence of technology, which affects the management of learning and student characteristics which is a challenge for teachers. This challenge can be overcome by developing creative thinking skills(Ulger, 2018, p. 7). A person's creative thinking ability in learning will determine their learning outcomes (Yanti, 2019, p. 72). Meanwhile, the results of a PISA study in 2015 stated that the creative thinking ability possessed by students in Indonesia is still relatively low (OECD, 2016, p. 8). The ability to think creatively is one of the important competencies needed in the 21st century . In addition, the learning carried out by the teacher will affect the learning atmosphere carried out (Kilinc, 2018, p. 224). Teachers need to design and manage learning by actively engaging students in learning that encourages students to learn (Mbhiza, 2021, p. 281; Akturk, 2019, p. 286; Tsakeni, 2021, p. 133). Creative thinking is indispensable for a person when they enter the world of work. The ability to think creatively is the ability to create something new (Sulistiyono, 2017, p. 1228). Meanwhile, Risnanosanti (2020, p. 171) states that creative thinking skills can be trained according to the learning material. Teachers must be able to use innovative or varied learning models that are adapted to the learning material to be learned by students, so that students will not feel bored in following the lesson and motivated to learn well and be

enthusiastic during learning (Furmanti, 2019, p. 3). Therefore, in mathematics learning, a teacher is required to carry out learning that not only memorizes facts but is also required to train and develop the creative thinking skills of learners that will be needed to face and solve problems in his life. In creative thinking, students are required to explore new ideas, insights, and ideas to solve the problems faced, so that in the learning process in the classroom they are required to be able to design learning that is able to train and develop creative thinking skills.

One of the learning models that can be applied and adopted to place students as learning centers is the application of the project-based Learning model (PjBL). PjBL is effective learning to develop students' creative thinking skills. PjBL to provide opportunities for teachers to manage classroom learning by involving project work (Wena, 2014, 72). PjBL is student-centered and gives students the opportunity to conduct in-depth investigations on important topics (Grant, 2003, p. 77). PjBL is an activity where students can explore knowledge and teachers facilitate students in exploring knowledge. PjBL is carried out based on students' external motivations to foster independence in carrying out and completing tasks in learning(Ramesh, 2020, p. 566; Timberlake, 2020, p. 4). PjBL also encourages students to define and select key principles on the subjects students are studying (Guo, 2020, p. 4). PjBL requires students to design and develop systems that can be used to conduct real-world investigations and solve problems (Sababha, 2016, p. 2577). PjBL is a method by which students engage in intellectually challenging tasks to acquire knowledge and abilities used in solving problems (Movahedzadeh, 2012, p. 3). PjBL is a complex activity based on challenging problems that involve students in project design as well as providing opportunities for students to work independently (Fitriyani, 2018, p. 246). PjBL is an effective learning to develop students' creative thinking skills (Tasiwan, 2015, p. 765). The use of PjBL must also be in accordance with the material to be delivered in order to encourage students to carry out projects (Farihatun, 2019, p. 637). PjBL provides an opportunity for teachers to motivate students to design the right strategies, design projects and conduct research in solving real problems at hand. PjBL emphasizes the interrelationships between concepts and everyday experiences so that students can relate concepts they already have with new knowledge they have gained. The application of PjBL can improve learning outcomes, motivation and encourage students to creatively and independently produce products, provide a student experience to build their own knowledge and improve the ability of students to communicate products(Adinugraha, 2018, p. 2). Through project-based learning students can gain more active knowledge, and students are more responsible in the learning process.

Facing the development of technology in today's 21st century learning, teachers are required to have Technological, Pedagogical, Content Knowledge (TPACK) knowledge that is able to integrate technology in learning, let alone learning. TPACK is a type of knowledge that must be acquired by teachers to be able to integrate technology well in learning(Mishra, 2006, p. 142). TPACK is the transformation of knowledge, content and pedagogical knowledge into different types of knowledge used to develop and implement teaching strategies (Tuithof, 2021, p. 5). TPACK is the knowledge of how various technologies can be used in learning and the use of these technologies can change the way teachers teach (Farikah, 2020, p. 192). In learning, teachers must have the necessary competencies in integrating technology appropriately and effectively (Akturk, 2019, p. 288). TPACK is a container that is an integration of technology, pedagogy, and knowledge of material or content that influences each other in the learning process (Rahmadi, 2020, p. 115). The integration of technology in the implementation of learning carried out by teachers is a major factor in using the TPACK approach (Malik, 2019, p. 390). Koehler (2013, p. 16) states that TPACK is a framework used to analyze the integration of technology in learning carried out by teachers.

Lesson study is a learning improvement process that applies professional development practices. In PjBL students work in groups, the teacher discusses learning objectives, plans learning, observes how students convey their idea ideas during learning (Takahashi, 2016, p. 515). Lesson study is learning that is carried out in a cyclical manner where teachers collaboratively plan learning, implement learning, observe and revise learning (Hurd, 2005, p. 389). Lesson study is one of the models that aims to improve teacher competence in developing their teaching ability (Seleznyov, 2020, p. 182). In the lesson study, various learning methods or strategies can be selected and applied according to the situation, condition, or learning problem faced by lecturers and students.

Referring to the above presentation, researchers are interested in applying TPACK integrated PjBL to integral calculus courses to improve students' creative thinking ability through lesson study.

METHOD

The sampling technique used in this study was cluster random sampling. The sample in this study was 3rd semester students of the Hamzanwadi University mathematics education study program, totaling 32 people consisting of 25 women and 7 men. The type of research used in this study is classroom action research with a lesson study approach for 3 cycles with stages of activity including (1) plan, (2) do and (3) see. At the planstage , lecturers prepare supporting tools that will be used in lesson studies including: 1) Learning implementation plans, 2) Student activity sheets, 3) Cameras to document and record the implementation of learning. At the do stage , there are two main activities carried out, namely: 1) model lecturers carry out learning designs that have been developed together, 2) observation activities by 3 lecturers about the implementation of learning carried out by model lecturers. At this stage, the supporting documents used include: 1) observation sheets for the implementation of learning, 2) observation sheets for student activities during learning, and 3) instruments for students' creative thinking ability. At the see stage, the observer delivers a response based on his observational data, regarding student activities during learning and observation of the implementation of learning designs carried out by model lecturers.

The data collection instrument used in this study was in the form of an observation sheet for student activities and a test of students' creative thinking ability. Student activity observation sheet indicators include: 1) topic determination, 2) project design making, 3) project schedule making. While the creative thinking ability test is in the form of an essay test with indicators: 1) fluency 2). flexible, 3) original, and 4) elaboration. The data collected in the form of data from observations of student activities during learning and data on students' creative thinking ability were analyzed using descriptive statistics. Indicators of success in this study are 1) the percentage of student activities in participating in project-based learning is at least 80%, 2) classically there are 85% of students who obtain a score of creative thinking ability of at least 75.

RESULT AND DISCUSSION

Plan Stage

Researchers compile instruments including planning the implementation of learning using project-based learning, compiling observation sheets on student activities in project-based learning and test instruments to measure students' creative thinking ability. Before the instrument is used, FGD is carried out with 4 lecturers to get input and revise the instrument to be used in learning.

Do Stage

Researchers as model lecturers carry out learning based on learning designs that have been prepared by involving 3 lecturers of the mathematics education study program as observers. The implementation of learning is carried out for 3 open class.

First Open Class

The first open clas was held on November 18, 2022 for 2 x 50 minutes. In this activity, model lecturers apply project-based learning to the material of indeterminate integral application by involving 3 partner lecturers as observers. Azima (2020) in her research, partner lecturers as observers who have been selected to observe model lecturers in the implementation of learning. The first open class activity is shown as shown in Figure 1

Figure 1. Implementation of the First Open Class

The results of observations related to student activities in participating in learning are presented as shown in Figure 2.

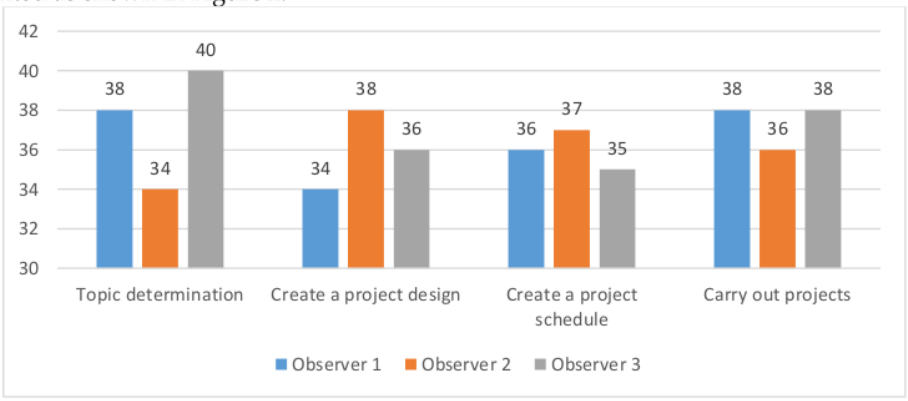

Figure 2. Average student activity score in the first open class

Based on Figure 2, the average student activity during the learning process is 73.34% still below 80%. Meanwhile, based on the results of the students' creative thinking ability test after taking the first open class shown like figure 3.

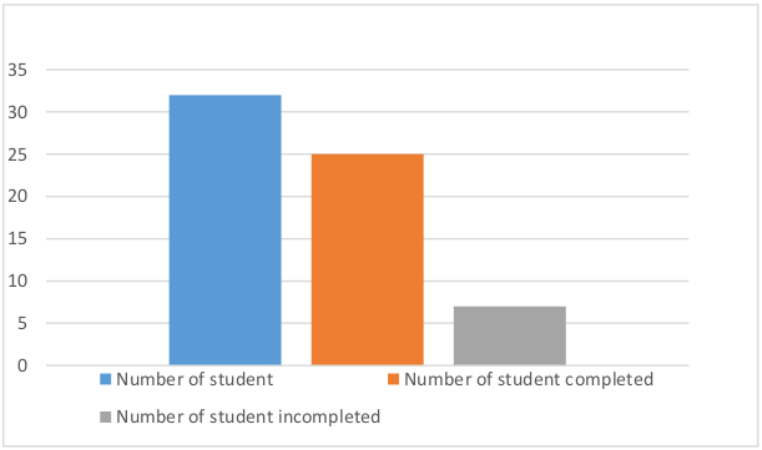

Figure 3. Data on students' creative thinking ability on first open class

Based on figure 3, that out of 32 students, there are 25 or 78.13% of students who get a creative thinking ability score above 75, still below 85% Based on the indicators set, the implementation of the first open class has not met the achievement indicators set so it is necessary to do the second open class.

Second Open Class

The second open class will be held on November 25, 2022 for 2 x 50 minutes. In this activity, model lecturers carry out revised project-based learning. To measure the implementation of learning, this activity involves 3 partner lecturers as observers. The learning activities in the second open class are shown as shown in Figure 4.

Figure 4. Activities in the Second Open Class

The results of observations of student activities during the second open class learning are presented as shown in Figure 5.

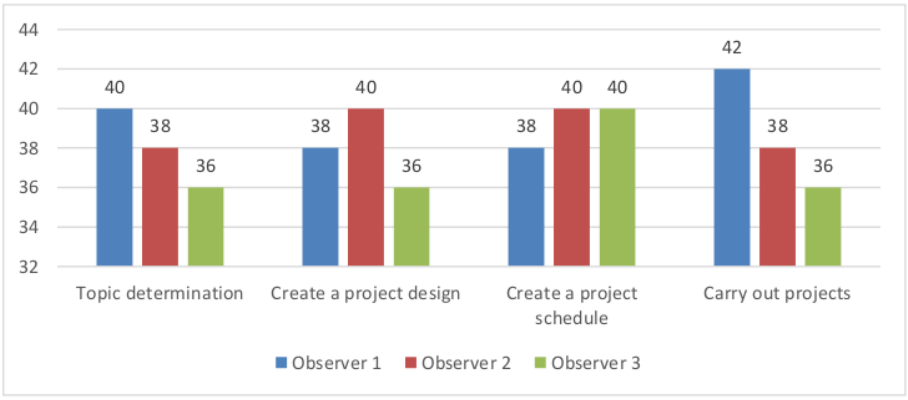

Figure 5. Average student activity score in the second open class

Based on data from Figure 5, the average student activity during the learning process is 77% below the set indicator of 80%. Meanwhile, the score of students' creative thinking ability after participating in learning showed figure 6.

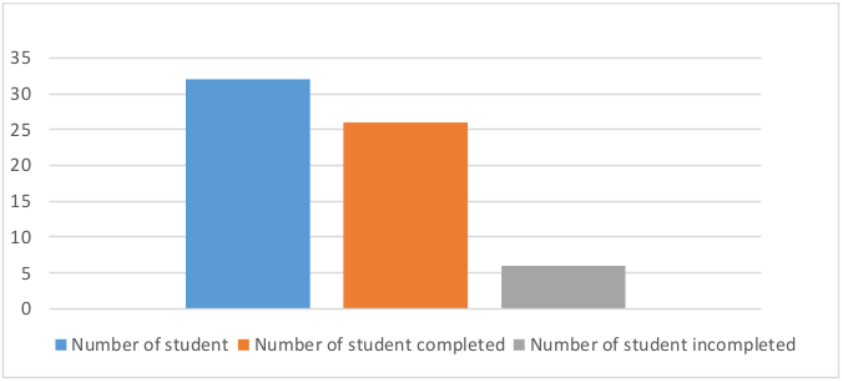

Figure 6. Data on students' creative thinking ability on second open class

Based on data from Figure 6 that of the 32 students who took part in the learning, there were 26 students or 81.25% who got a score above 75. Based on the achievement indicators set, it is necessary to do a third open class.

Third Open Class

The third open class will be held on December 5, 2022 for 2 x 50 minutes. In the third open class, the model lecturers carry out learning using a revised learning design based on observer input in the second open class. This activity involved 3 partner lecturers as observers. Learning activities in the third open class by model lecturers are shown as shown in Figure 7.

Figure 7. Implementation of the third open class

The results of observations of student activities in the third open class are presented as shown in Figure 8.

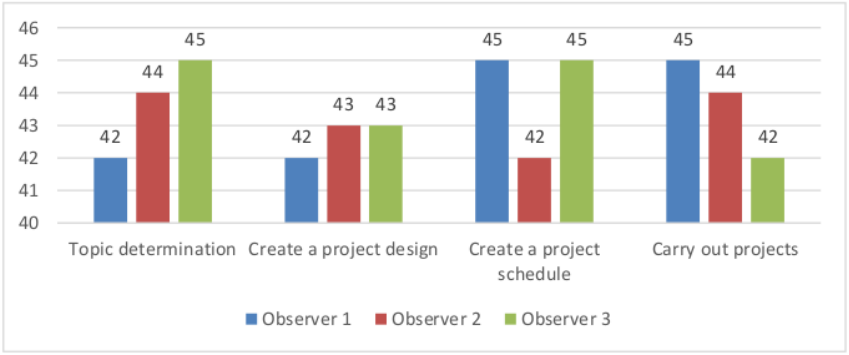

Figure 8. Average student activity score in the third open class

Based on data from Figure 8, the average student activity during the third open class is 87% above the set indicator of 80%. Meanwhile, the score of students' creative thinking ability after participating in learning showed figure 9.

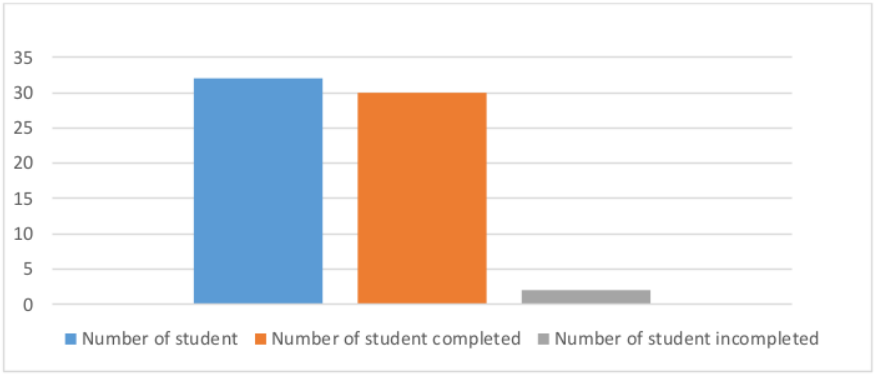

Figure 9. Data on students' creative thinking ability on third open class

Based on data from Figure 9 that out of 32 students who take part in learning, there are 30 students or 93.75% who get a creative thinking ability score above 75. In the third open class, the achievement indicator set has been achieved so that there is no need to open the next class.

See Stage

At this stage, a discussion was held between model lecturers and observers regarding the implementation of learning during open classes. Based on the results of observations about the implementation of learning in open classes, revisions were made to the lesson learn that will be used in the next open class implementation. The achievement of the indicators set during the student's learning is greatly influenced by how the model lecturer is able to apply the learning prepared with the observer at the planning stage. In the implementation of the first open class, some of the findings obtained include: 1) model lecturers have not followed the learning steps based on sequential learning design, 2). model lecturers are still dominant in learning so that learning is not student-centered, 3) task sharing and jumping task activities have not been seen, 4) students need to be guided in making project designs and project schedules, 5) Student cooperation in making projects is still low. Some of the findings in the first open class are what cause student activity while participating in learning is still low. Meanwhile, (Alghayth , 2020.p. 425) In his research, he mentioned that in the learning process must be student-centered. In the learning process, lecturers need to create a learning environment that makes students a learning center (Ancar, 2007, p. 76). Low student activity during learning and students' creative thinking ability is caused by learning by model lecturers who are not optimal. This is in accordance with the research conducted by (Kizkapan , 2017, p. 39) which states that the application of learning strategies carried out by teachers affects the learning outcomes obtained by students. Hsieh (2013, p. 21) states that students' creative thinking ability is shown by the achievement of each of the creative thinking indicators that are set.

In learning with PjBL, model lecturers need to provide guidance to each group in solving problems so that each group member actively participates both in making project designs and making project schedules. Research conducted by(Wolthuis, 2020, p. 138) states that in learning the teacher must be able to coordinate the atmosphere and class time, as well as re-conclude the material taught. (Celik & Guzel, 2020, p. 4) In his research, he stated that teachers need to support students to find and discuss various solutions by giving enough time. Meanwhile, Kula Ünver (2016, p. 334) states that broadening students' thinking is important in developing students' ideas.

In this study, the problem of applying certain integrals as the main problem that must be solved by students. Projects designed by students are solutions to the problems faced, namely the problem of using integrals. Students are divided into six groups with each group given the opportunity to determine the right method for solving integral problems. Next they explain and test the projects they have compiled. Based on the implementation of 3 open classes, it shows that the application of PjBL through lesson studies can improve students' creative thinking ability in certain integral application materials. In the project design stage, students actively discuss in conducting experiments and presenting projects produced Learning with PjBL is believed to be able to create student curiosity and improve students' creative thinking skills (Nuraini, 2021, 106). The results of this study are in line with the research conducted by (Nita, 2021, p. 235) which states that the application of PjBL through lesson study can improve students' creative thinking ability with a score of 95 and an average of 79.19%. Through PjBL, students not only identify problems and find solutions to the problems they face, but students can also use their various knowledge and creative thinking abilities to solve problems.(Yamin, 2020, p. 228). PjBL has also facilitated students to develop themselves both academically and practically to find solutions in everyday life (Husamah, 2015, p. 113). Meanwhile, Sasson (2018, p. 205) in his research stated that PjBL is included in innovative learning that can develop students' creative thinking skills. By applying PjBL in learning, students will be facilitated in developing their creative thinking skills in facing contextual problems(Chen, 2019, p. 75). By implementing PjBL, students are given the freedom to be more active and express their ideas through the projects they create

(Ririn, 2021, p. 12). By applying this PjBL, learning is not only delivered theoretically but also through direct practice in making works. Therefore, it can stimulate students to think creatively and work together in completing the compiled project

CONCLUSION

The results of this study concluded that the implementation of PJBL through lesson studies can help students develop creative thinking skills. In PjBL, improving students' creative thinking skills is carried out through project planning activities as their efforts to solve the problems they face. The increase in students' creative thinking ability is shown by the high percentage of student activities during the implementation of learning and the percentage of achievement of students' creative thinking ability.

The implications of implementing project-based learning through lesson study are believed to be able to improve teacher professionalism and teach the importance of how to work together with fellow lecturers to achieve certain learning goals, improve the ability of a lecturer to carry out his duties in order to achieve learning objectives. In addition, by carrying out project-based learning through lesson studies, it is hoped that students' abilities can be improved in every course taught by lecturers. However, the limitation in implementing this learning is that it takes a long time both when designing the design and implementation of lessons in the classroom. Learning is carried out up to 3 cycles also takes a long time. It is also difficult to determine the time agreement between the model lecturer and the observer in discussing the learning of lessons and reflection activities . In addition, various media are also needed that are used in developing projects carried out by students

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REFERENCES

Abu-Alghayth, K., Jones, P., Pace-Phillips, D., & Meyers, R. (2020). Through the Looking Glass: Lesson Study in a Center School. *International Journal of Educational Methodology*, *6*(2), 423–433.

Adinugraha, F. (2018). Model pembelajaran berbasis proyek pada mata kuliah media pembelajaran. *Jurnal SAP*, *3*(1), 1–9.

Akturk, A., & Ozturk, H. (2019). Teachers TPACK levels and students self-efficacy as predictors of students academic achievement. *International Journal of Research in Education and Science*, *5*(1), 283–294.

Ancar, L. N., Freeman, S. A., & Field, D. W. (2007). Professional Connections through the Technology Learning Community. *The Journal of Technology Studies*, *33*(2), 73–78.

Celik, A. O., & Guzel, E. B. (2020). How to Improve A Mathematics Teacher ' s Ways of Triggering and Considering Divergent Thoughts through Lesson Study. *International Electronic Journal of Mathematics Education,* 15(3), 1-14

Chen, C. H., & Yang, Y. . (2019). Revisiting the effects of project based learning on students' academicachievement: A meta-analysis investigating moderators. *Educational Research Review*, *26*(1), 71–81.

Farihatun, S. M., & Rusdarti, R. (2019). Keefektifan pembelajaran project based learning (PjBL) terhadap peningkatan kreativitas dan hasil belajar. *Economic Education Analysis Journa*, *8*(2), 2019, 635-651

Farikah, & F. (2020). Technological Pedagogical and Content Knowledge (TPACK): The Students' Perspective on Writing Class. *Jurnal Studi Guru Dan Pembelajaran*, *3*(2), 190–197.

Fitriyani, L.O., Koderi, & Anggraini, W. (2018). Project based learning : Pengaruhnya terhadap kemampuan proses sains peserta didik di tanggamus. *Indonesian Journal of Science And Mathematics Education*, *1*(3), 243–253.

Furmanti, T., & Hasan, R. (2019). Pengaruh model pembelajaran inkuiri terbimbing terhadap kemampuan berpikir kritis, motivasi dan keaktifan siswa di smpn 5. *Prosiding Semnas Sain & Enterpeneurship VI*, *1*(1), 1–9.

Grant, & Michael, M. (2003). Getting a Grip on Project-Based Learning: Theory, Cases and Recommendations. *Meridian : A Middle School Computer Technologies Journal*, *5*(1), 78–85.

Guo, P., Nadira, S., Lysanne, S. P., & Wilfrid, A. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, *102*(101586), 1–13.

Hsieh, H., Lou, S., Shih, R., & Economics, H. (2013). *Applying Blended Learning with Creative Project-Based Learning : A Case Study of Wrapping Design Course for Vocational High School Students*. *3*(2), 18–27.

Hurd, J., & Licciardo-musso, L. (2005). Lesson Study : Teacher-Led Professional Development. *Language Arts*, *82*(5), 388–395.

Husamah, H. (2015). Thinking skills for environmental sustainability perspective of new students of biology education department through blended project based learning model. *Jurnal Pendidikan IPA Indonesia*, *4*(2), 110–119.

Kilinc, E., Tarman, B. & Aydin, H. (2018). Examining turkish social studies teachers' beliefs about barriers to technology integration. *TechTrends: Linking Research and Practice to Improve Learning*, *6*(2), 221–233.

Kizkapan, O., & Bektas, O. (2017). The effect of project based learning on seventh grade students' academic achievement. *International Journal of Instruction*, *10*(1), 37–54.

Koehler, M., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge. *Journal of Education*, *193*(3), 13–19.

Kula Ünver, S., & Bukova Güzel, E. (2016). Conceptualizing Pre-Service Mathematics Teachers' Responding to Students' Ideas While Teaching Limit Concept. *European Journal of Education Studies*, *2*(12), 33–57.

Malik, S., Rohendi, D., & Widiaty, I. (2019). Technological Pedagogical Content Knowledge (TPACK) With Information And Communication Technology (ICT) Integration : A Literature Review. *Advances in Social Science, Education and Humanities Research*, *299*(5), 489–503.

Mbhiza, H. (2021). Shifting paradigms: rethinking education during and post-covid-19 pandemic. Research in Social Sciences and Technology. *Research in Social Sciences and Technology*, *6*(2), 279-289.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017–1054.

Movahedzadeh F., Patwell, R., Rieker, J.E., & Gonzalez, T. (2012). Project based learning to promote effective learning in biotechnology courses. *Education Research International :*, *5*(2), 1–8.

Nita, R., & Irwandi, I. (2021). . Peningkatan kemampuan berpikir kreatif siswa melalui model project based learning (PjBL). *Bioedusains: Jurnal Pendidikan Biologi Dan Sains*, *4*(2), 231–238.

Nuraini, Waluyo, E. (2021). Development Of Instructional Design Project-Based Learning Model Integrated Science Process Skills To Improve Science Literacy. *Jurnal Pendidikan Sains*, *9*(1), 104–112.

OECD. (2016). PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematics and Financial Literacy. In *OECD Publishing*. http://dx.doi.org/10.1787/97892642

Rahmadi, I.F., Hayati, E., & Nursyifa, A. (2020). Comparing Pre-Service Civic Education Teachers' TPACK Confidence Across Course Modes: Insights For Future Teacher Education Programs. *Research in Social Sciences and Technology*, *5*(2), 113–133.

Ramesh, K., & Duncan, M. (2020). Project based learning in an engineering design course developing mechanical engineering graduates for the world of work. *Procedia CIRP*, *9*(1), 565–570.

Ririn, P., Wiyanarti, E., Kurniawati, Y. (2021). The Analysis of Students' Creative Thinking Skills through the Implementation of the Project Based Learning Model in Social Studies Learning. *International Journal Pedagogy Of Social Studie*, *6*(2), 9–18.

Risnanosanti, R., Syofiana, M., & Hasdelyati, H. (2020). Kemampuan berpikir kreatif matematis siswa dan model pembelajaran problem solving berbasis lesson study. *INDIKTIKA*, *2*(2), 168–178.

Sababha, B., Alqudah, Y., Albasal, A., & Qaralleh, A. (2016). Project based learning to enhance teaching embedded systems. *Eurasia Journal of Mathematics, Science & Technology Education*, *12*(9), 2575–2585.

Sasson, I., & Malkinson, N. (2018). Fostering the skills of critical thinking and question-posing in a project-based learning environment. *Thinking Skills and Creativity*, *29*(1), 203–212.

Seleznyov, S. (2020). Lesson study: exploring implementation challenges in England. *International Journal for Lesson and Learning Studies*, *9*(2), 179–192.

Sulistiyono, E., Mahanal, S., & Saptasari, M. (2017). Pembelajaran biologi berbasis speed reading-mind mapping. *Jurnal Pendidikan: Teori, Penelitian, & Pengembangan*, *2*(9), 1226–1230.

Takahashi, A., & McDougal, T. (2016). Collaborative lesson research: maximizing the impact of lesson study. *Mathematics Education*, *48*(4), 513–526.

Tasiwan. (2015). Efek pembelajaran berbasis proyek terbimbing terhadap perkembangan keterampilan proses dan sikap sains siswa. *Berkala Fisika Indonesia*, *7*(2), 753–769.

Timberlake, M. (2020). Recognizing ableism in educational initiatives: Reading between the lines. *Research in Educational Policy and Management*, *2*(1), 1-12.

Tsakeni, M. (2021). Transition to online learning by a teacher education program with limited 4IR affordances. *Research in Social Sciences and Technology*, *6*(2), 129–147.

Tuithof, H, Van Drie, J, Bronkhorst, L, Dorsman, L, & Van Tartwijk, J. (2021). Teachers' pedagogical content knowledge of two specific historical contexts captured and compared. *Educational Studies*, *47*(2), 1–26.

Ulger, K. (2018). The effect of problem-based learning on the creative thinking and critical thinking disposition of students in visual arts education. *Interdisciplinary Journal of Problem-Based Learning*, *12*(1), 1–21.

Wena, M. (2014). *Strategi Pembelajaran Inovatif Kontemporer*. Jakarta : PT Bumi Aksara.

Wolthuis, F., Veen, K. Van, Vries, S. De, & Hubers, M. D. (2020). Between lethal and local adaptation : Lesson study as an organizational routine. *International Journal of Educational Research*, *100*(, 101534), 135-144

Yamin, Y., Permanasari, A., Redjeki, S., & Sopandi, W. (2020). Implementing project-based learning to enhance creative thinking skills on water pollution topic. *JPBI (Jurnal Pendidikan Biologi Indonesia), 6*(2), 225–232.

Yanti, M. N., Sudia, M., Arapu, L. (2019). Pengaruh model pembelajaran mind mapping terhadap kemampuan berpikir kreatif matematis peserta didik kelas VIII SMP Negeri 8 Konawe Selatan. *Jurnal Penelitian Pendidikan Matematika*, *7*(3), 71–84.

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