



INTEGRATING COLLABORATIVE MOBILE LEARNING INTO THE MATHEMATICS CLASSROOM: AN EXPLORATION OF STUDENT' MEANINGFUL LEARNING ACTIVITIES USING TECHNOLOGY

Hera Deswita^{1*}, Muhammad Japar², Etin Solihatin³

¹⁻³Universitas Negeri Jakarta, Indonesia

*heradeswita_9902921023@mhs.unj.ac.id

ABSTRACT

Research on the utilization of mobile technology in schools is increasingly widespread. However, studies on implementing meaningful learning using mobile technology still need to be completed. Meaningful learning activities must still be the primary goal in mathematics, even with technology. Technology-integrated collaborative learning is an appropriate alternative to build students' knowledge of what to know, their attitude of wanting to do something, and their skills in how to do something. This research focuses on how high school students learn mathematics meaningfully by utilizing mobile technology collaboratively. The purpose of this study is to provide an empirical analysis of meaningful learning activities carried out by students through mobile technology in learning mathematics in face-to-face social communication. This study used a qualitative approach to data collection. Data were collected from 42 students and one teacher through observation and interview. This study found five meaningful activities conducted by students with collaborative mathematics learning integrated with mobile technology. The key finding that stands out is that the cooperative environment with group work causes students to learn more during group work, but they enjoy working with their friends to solve math problems.

Keywords: Mobile Learning, Collaborative, Mathematics, Meaningful Learning

1. INTRODUCTION

In recent years, the integration of mobile technologies in education has gained significant attention (Criollo-C et al., 2021; Bano et al., 2018). Mobile learning, also known as m-Learning, has emerged as a powerful tool in promoting meaningful and engaging learning experiences in mathematics classrooms. By leveraging the capabilities of mobile devices, students have the opportunity to engage in collaborative activities that promote critical thinking, problem-solving, and deeper understanding of mathematical concepts (Surez et al., 2018). The integration of mobile devices and collaboration in mathematics classrooms can create a dynamic and interactive learning environment that supports the construction of knowledge through social interaction (Yosiana et al., 2021; Larkin & Calder, 2015). This approach not only enhances students' understanding of mathematical concepts but also fosters important skills such as communication, teamwork, and creativity (Costa et al., 2020; Fu & Hwang, 2018). Furthermore, the use of mobile devices has been shown to increase student achievement, productivity, engagement, and motivation (Atan & Shahbodin, 2018).

Collaboration through mobile learning can be an effective strategy for promoting meaningful learning in mathematics classrooms. By allowing students to work together and share ideas using mobile devices, they can engage in deeper discussions, problem-solving, and critical thinking (Fu & Hwang, 2018; Criollo-C et al., 2018; Bano et al., 2018). This collaborative approach not only enhances students' understanding of mathematical concepts, but also fosters important skills such as communication, teamwork, and creativity (Lee et al., 2019; Drigas & Pappas, 2015; Larkin & Calder, 2015; Sung et al., 2017). Furthermore, the use of mobile devices in mathematics classrooms can provide students with access to a wide range of resources and tools that can support their learning (Larkin & Calder, 2015; Sung et al., 2017). Some sources suggest that the use of mobile devices as cognitive tools can promote higher-order thinking skills in mathematics (Crompton & Burke, 2014; Bano et al., 2018; Fu & Hwang, 2018). Overall, the integration of collaboration through mobile learning in mathematics



classrooms has the potential to create a rich learning environment that encourages active engagement, critical thinking, and meaningful learning experiences for students (Costa et al., 2020; Statti & Villegas, 2020)

Collaboration through mobile learning in mathematics classrooms has the potential to promote active engagement, critical thinking, and meaningful learning experiences for students. (Rifai & Sugiman, 2018; Costa et al., 2020) By leveraging the capabilities of mobile devices in a rich learning environment, students can engage in collaborative activities that not only enhance their understanding of mathematical concepts but also foster important skills such as communication, teamwork, and creativity (Supandi et al., 2018). The use of mobile devices in mathematics classrooms has been shown to increase student achievement, productivity, engagement, and motivation (Fu & Hwang, 2018). Furthermore, mobile devices can serve as scaffolded problem-solving tools and provide access to additional internet resources, expanding students' learning opportunities beyond the traditional classroom setting. Furthermore, by aggregating and synthesizing the findings of small-scale studies, the research community can provide evidence for the effectiveness of m-Learning pedagogies in mathematics education, which can then inform educational policies and practices (Fabian et al., 2018; Rifai & Sugiman, 2018). By integrating mobile devices and collaboration into mathematics classrooms, students have the opportunity to engage in collaborative activities that promote critical thinking, problem-solving, and deeper understanding of mathematical concepts.

Collaboration through mobile learning in mathematics classrooms not only enhances students' understanding of mathematical concepts, but also fosters important skills such as communication, teamwork, and creativity (Drigas & Pappas, 2015; Heflin et al., 2017). By utilizing mobile devices in a collaborative learning environment, students can actively engage with the material, work together to solve problems, and share their ideas and perspectives with their peers (Lai et al., 2013; Nam & Jang, 2013). This collaborative learning approach allows for a deeper level of understanding as students construct knowledge together and develop their critical thinking skills. Additionally, mobile learning devices have the capability to capture and document students' learning experiences, allowing for personalized feedback and assessment (Costa et al., 2020). By leveraging the capabilities of mobile devices in a collaborative learning environment, students can engage in interactive and meaningful learning experiences that go beyond rote memorization and repetitive drill (Lai et al., 2013).

In this context, it is crucial to explore the potential of collaboration through mobile learning to promote active engagement and meaningful learning experiences for students in mathematics education. This exploration will contribute to the ongoing discourse on the effectiveness of m-Learning pedagogies and their impact on educational policies and practices. By integrating mobile learning into mathematics classrooms, both students and instructors can benefit from enhanced engagement, participation, and interaction, ultimately transforming traditional learning environments into dynamic and engaging spaces for meaningful learning experiences.

It is important to realize that the effectiveness of mobile learning in mathematics education must be supported by rigorous research. This research investigates the impact of collaboration through mobile learning on students' learning activities and engagement. By conducting well-designed and high-quality research, the educational community can gather valuable evidence on the effectiveness of mobile learning pedagogies in mathematics education. This evidence can then guide educational policies and practices, ensuring that the integration of mobile technologies in mathematics classrooms is based on solid research and best practices. Thus, the aim of this research is to explore student learning activities and provide empirical analysis of meaningful learning activities carried out by students through mobile technology in mathematics learning in face-to-face social communication. It is hoped that the research findings can provide teachers with implications and guidelines to successfully integrate mobile technologies to enhance learning in mathematics classrooms.

2. METHODS

This study uses a qualitative method. Qualitative research methods are a set of approaches and techniques used to gather rich, in-depth data and insights about individuals, groups, or phenomena (Grossoehme, 2014). These methods focus on understanding the meanings, experiences, and perspectives of the participants in their natural context. Data collection was done by observation and interview. Data was collected from 42 students and one teacher. The observation process was carried out for 6 meetings held over 6 weeks. Documentation in the form of videos was conducted to examine and identify learning activities during learning. Interviews were conducted with



students. The data analysis techniques used were data reduction, data display and conclusion drawing. Data reduction is the selection and simplification of data. This activity is carried out to avoid accumulation of data or the same information. The data reduction process includes editing, summarizing, and tidying up the data. Furthermore, data display. Presentation of written data is carried out in the form of textual representations in the form of brief descriptions and tables, while documentation data is in the form of images and videos relevant to the research results. Finally, conclusion drawing is making meaningful statements that describe the interpretation of the data that has been presented. The topic chosen for this research is special trigonometry in right triangles. This research was conducted in grade 10.

3. RESULTS & DISCUSSION

The learning implementation used collaborative learning integrated with mobile learning. Students are divided into 11 heterogeneous groups, each with four people with high, medium, and low abilities. The learning process uses an Android-based application that can be installed and accessed on mobile devices. The mobile application is called Ajarin Mobile.

Ajarin Mobile application provides features including student identity, material, learning media, class discussion, and score list. The material feature describes learning material where students learn with the syntax of harmonization, exploration, reflection, and assessment. In harmonization activities, students are given short videos that can motivate them to learn. In the exploration activity, students are presented with material descriptions equipped with relevant videos and student worksheets. The provision of learning videos aims to allow students to repeat the explanation of the material if they have yet to understand it. This section also provides video tutorials on using learning media such as Geogebra. Exploration activities also involve solving contextual math problems so that they better understand the learning material. In reflection activities, students can convey what they have gained during the learning process through Ajarin Mobile. All students have the same opportunity to convey their responses through the application. The teacher can take further action based on the results of the reflection. The last is Assessment, where students are given several objective and essay questions individually to see each student's understanding of the mathematical concepts learned.

In implementing learning using the technology-integrated collaborative learning model, it is necessary to see how it is implemented meaningfully for students. Meaningful learning is relevant to students' lives and aims to achieve deep understanding through active and constructivist learning. In the learning that has been done, there are five meaningful activities carried out by students with collaborative mathematics learning integrated with mobile technology.

First, students can learn at their own pace through collaborative learning integrated with mobile learning. In learning, each student has a different speed in understanding concepts. High and medium-ability students quickly understand the material, but low-ability students need more time. Based on observations made during the learning process, in the same group, low-ability students repeatedly read the description of the material and played the learning video more than once. Figure 1 below is one example of how students learn at different speeds.

Figure 1 provides evidence that there are advantages to learning through mobile technology. Low-ability students can listen to the videos available in the application anytime and anywhere. Based on interviews, students stated that the Ajarin Mobile application can help them repeat material without carrying textbooks that are large in size and weight. In today's digital era, technology has revolutionized the way students learn. With the help of technology, especially through video, students have the flexibility to learn at their own pace (Castillo et al., 2021) and provides a personalized learning experience that encourages engagement and deep understanding (Lee et al., 2018). They can pause, rewind, and rewatch the video as many times as necessary to fully understand the content. This allows for a personalized learning experience, meeting individual needs and preferences. The use of



technology, especially video, in education has revolutionized the student learning experience. Additionally, integrating technology and videos into education has also proven to be an effective method for bridging learning gaps among students (Brame, 2016).



Figure 1. Students learn at different paces.

Additionally, the use of technology in education has expanded learning opportunities beyond the traditional classroom (Poquet et al., 2018). Students are no longer limited to learning within the confines of a physical classroom, as they can access educational videos and resources from anywhere with an internet connection.

Second, there is social interaction between students to help each other in the learning process, both in understanding the material and using learning media. Based on observations, students are enthusiastic about using Geogebra. In Geogebra activities, students are asked to follow the instructions in the video tutorials. However, some still need help with using Geogebra. In addition to the teacher, students who already understand and simulate Geogebra also help friends in their groups, as seen in Figure 2.



Figure 2. Students help each other in learning.

Based on Figure 2, there is social interaction in the classroom. Based on interviews, most students prefer group learning rather than individual learning. In group learning, there will be social interactions that help them learn. In the context of learning, social interaction plays a crucial role in enhancing the overall educational experience for students. It allows students to engage in active discussions and collaborative learning activities, which can deepen their understanding of the subject matter (Panoy et al., 2022). Additionally, social interaction promotes critical thinking skills by encouraging students to question and evaluate different perspectives (Mr, 2021). Moreover, social interaction fosters the development of communication and interpersonal skills, as



students learn to express their thoughts and listen to others' viewpoints. Furthermore, social interaction in learning creates a supportive and inclusive learning environment, where students feel valued and connected to their peers (Apriliyanto et al., 2018). This ultimately leads to higher levels of engagement, motivation, and academic achievement. Furthermore, social interaction in learning facilitates the exchange of ideas and knowledge among students, enabling them to learn from each other's experiences and perspectives (Li et al., 2020). In summary, social interaction in learning is essential as it enhances understanding, critical thinking, communication skills, engagement, and knowledge sharing among students. Incorporating social networking platforms and technologies in educational settings can provide students with opportunities for collaborative learning and authentic communication. By promoting social interaction in learning, students are able to engage with their peers and develop important skills such as communication, critical thinking, and collaboration.

Third, students can reflect on their understanding of the subject matter directly. Reflection is one of the most essential parts of a learning process. Through reflection activities, students can confirm their learning achievements about what they have not and have not understood. Teachers can find out how much students have learned. The results of reflection can be used as teacher evaluation material to improve the learning process that is not appropriate. The teacher can review and take further action based on the reflection results stated by the students. In traditional classes, only some students get the opportunity to express their responses to the learning that has been carried out. However, using the Ajarin Mobile application, all students have the same opportunity. Figure 3 below is an example of the reflection results submitted by students through the Ajarin Mobile application.

1	Al Fakhri Al Hafid Dhafa Ramadhan	Klinometer berfungsi untuk mengukur besar sudut.	
2	ATTAUFA SALSABILA EFFENDI	Saya jadi mengetahui cara penggunaan klinometer	
3	Aulia Hamina Nighaban	Kenal, menggunakan klinometer dan mendapat sudut elevasi minimum kita dapat menghitung tinggi suatu objek	
4	BIRWAN WILUJAH PUTRAWANING	Pada pembelajaran kali ini, saya menjadi tahu bahwa klinometer dapat membantu kita untuk mengukur sudut sudut pengamatan dari objek. Hal ini dapat kita manfaatkan untuk mencari tinggi dari objek tersebut, tanpa harus susah susah mengukur tinggi objek secara langsung.	
5	Eya Hayati El Samaranghita	untuk mengetahui objek yang tinggi atau sudut dikur kita bisa menggunakan klinometer	

Figure 3. Example of Student Reflection via Ajarin Mobile

Figure 3 shows that students convey what they have gained during the learning process. The concept of reflection plays a crucial role in the learning process. It allows individuals to evaluate their past experiences, gain insights, and make informed decisions for future actions (Smetanina et al., 2020). Reflection helps individuals think deeply and analyze their beliefs, knowledge, and experiences. It promotes personal growth and development by increasing understanding and enhancing professional practices. Reflection in the learning process helps individuals gain a deeper understanding of the material being learned and how it applies to real-world situations. By reflecting, learners can critically analyze their performance and identify areas for improvement (Gupta, 2019). By reflecting on their learning journey, individuals can also identify patterns and make connections between different concepts or experiences, leading to a more holistic understanding of the subject matter (Tsingos et al.,



2014). Overall, reflection is a valuable tool for promoting self-awareness, self-improvement, and professional development in the learning process. The concept of reflection is widely recognized and studied in various fields and subfields of psychology. It is considered an inherent human ability for self-analysis and interpretation of social relations. Reflection is particularly important for teachers' professional development (Tsingos et al., 2014). Reflection allows teachers to analyze their teaching practices, identify areas of strength and areas for improvement, and make informed decisions about instructional strategies. By engaging in reflective practices, teachers can enhance their skills, knowledge, and effectiveness in the classroom (Weng & Shen, 2022). Additionally, research has shown that reflection helps teachers recognize their biases and reconsider their assessment practices (Weng & Shen, 2022). This leads to a more inclusive and effective learning environment for all students. Teachers' reflection is key to their professional development and growth (Smetanina et al., 2020). It helps them to continuously improve their teaching strategies, understand the needs of their students better, and adapt their approach to meet those needs. It also allows teachers to build confidence and gain the ability to handle assessment dilemmas by seeking opinions and reflecting on experiences from different contexts.

Fourth, students do the assessment well after the learning process. Assessment is one of the most essential parts of the learning process. Assessment can be used as an indicator of the achievement of learning objectives. Routine assessments at every meeting are essential in confirming students' understanding of the subject matter. The assessments given are based on the concepts learned and contextualized. The data obtained from the assessment process shows that most students can answer the questions given correctly. Based on the assessments that have been carried out, students obtain encouraging results even though some still need to be corrected in using concepts. Assessment through the Ajarin Mobile application allows students to get the results automatically.

Assessment plays a crucial role in learning by providing valuable insights into students' knowledge and understanding. It helps educators gauge the effectiveness of their teaching methods and identify areas where students may need additional support or instruction (Osman et al., 2012). This information allows educators to make informed decisions about instructional strategies and materials and adapt their teaching to meet the diverse needs of their students. Furthermore, assessment data can track students' progress over time and assess the effectiveness of educational programs or interventions (Yus et al., 2021). Educators can ensure they accurately capture students' abilities and growth by employing valid and reliable assessment measures. Additionally, assessment helps create a sense of accountability and responsibility for students, as it provides feedback on their learning progress and areas for improvement. Moreover, assessment can also be a motivational tool for students (Lora et al., 2020). When students receive feedback on their performance, they better understand their strengths and weaknesses, which can drive them to work harder and strive for improvement (Xu & Brown, 2016). Overall, assessment in the learning process empowers educators to make informed decisions, allows for personalized and targeted instruction, tracks progress and growth, promotes accountability and responsibility, and motivates students to strive for improvement.

The main finding that stood out was that the cooperative environment with group work caused students to learn more during group work, yet they enjoyed working with their peers to solve math problems in both in-class and out-of-class activities.

Figure 4 shows that students are actively discussing in their groups. Students solve contextual problems that are close to their daily lives. Instruction through student worksheets can be necessary so students can learn well and enjoy every learning activity. Providing worksheets to groups can train students to be responsible for solving them. In collaborative learning, worksheets play an important role in facilitating students' active involvement in the mathematics learning process. Worksheets provide a structured framework for students to



explore math concepts, solve problems, and engage in meaningful discussions with their peers (Sartika et al., 2020). By working on worksheets together, students can collaborate, share different approaches and strategies, and learn from each other's perspectives.



Figure 4. Learning activities inside and outside the classroom.

This collaborative approach helps students build a deeper understanding of mathematical concepts and develop critical thinking and problem-solving skills. Additionally, worksheets can be used to assess students' understanding and track their progress in mastering math concepts (Nurhayati et al., 2019). Overall, worksheets in collaborative learning provide a structured and interactive platform for students to actively engage in mathematics learning, collaborate with their peers, deepen their understanding of mathematical concepts, and develop important skills for problem solving and critical thinking. In the context of collaborative mathematics learning, worksheets serve as a valuable tool for facilitating active student engagement, encouraging critical thinking and problem-solving skills, encouraging collaboration and peer learning, assessing student understanding and progress, and encouraging independent learning. Furthermore, collaborative learning in mathematics can also foster a supportive and inclusive classroom environment, where students feel comfortable sharing their thoughts and learning from one another (Harper & Crespo, 2020). This can ultimately lead to increased confidence in their own mathematical abilities and a more positive attitude towards the subject. Incorporating collaborative learning activities such as group problem-solving, peer teaching, and collaborative projects can greatly enhance the overall mathematics learning experience for students (Harper & Crespo, 2020). By actively engaging with their peers, students can develop not only their mathematical skills, but also important life skills such as communication, teamwork, and respect for diverse perspectives.

4. CONCLUSION

Collaborative learning integrated with mobile learning can create meaningful learning in mathematics classrooms. Students can learn at their own pace, there is good social interaction, each student can reflect on the learning process, students can conduct regular assessments for evaluation, and most importantly, students enjoy working with their peers to solve mathematics problems in and out of class activities. Integrating mobile devices and collaboration in mathematics classrooms can create a dynamic and interactive learning environment that supports knowledge construction through social interaction. Thus, collaboration through mobile learning has the potential to transform traditional mathematics classrooms into dynamic and engaging environments where students actively participate in meaningful learning experiences. In summary, collaboration through mobile learning can improve mathematics education by encouraging active engagement and meaningful learning experiences.



5. ACKNOWLEDGMENTS

This research was sponsored and funded by the Pusat Layanan Pendidikan (Puslapdik) and Lembaga Pengelola Dana Pendidikan (LPDP), Ministry of Education, Research and Technology (Kemendikbudristek) of Indonesia.

REFERENCES

- Apriliyanto, B., Saputro, D R S., & Riyadi, R. (2018, March 1). Student's social interaction in mathematics learning. *Journal of Physics: Conference Series*, 983, 012130-012130. <https://doi.org/10.1088/1742-6596/983/1/012130>.
- Atan, M., & Shahbodin, F. (2018, January 1). Significance of mobile learning in learning Mathematics. *MATEC web of conferences*, 150, 05049-05049. <https://doi.org/10.1051/mateconf/201815005049>.
- Bano, M., Zowghi, D., Kearney, M., Schuck, S., & Aubusson, P. (2018, June 1). Mobile learning for science and mathematics school education: A systematic review of empirical evidence. *Computers & Education*, 121, 30-58. <https://doi.org/10.1016/j.compedu.2018.02.006>
- Brame, C J. (2016, December 1). Effective Educational Videos: Principles and Guidelines for Maximizing Student Learning from Video Content. *CBE- Life Sciences Education*, 15(4), es6-es6. <https://doi.org/10.1187/cbe.16-03-0125>.
- Castillo, S., Calvitti, K., Shoup, J., Rice, M., Lubbock, H., & Oliver, K H. (2021, June 1). Production Processes for Creating Educational Videos. *CBE- Life Sciences Education*, 20(2), es7-es7. <https://doi.org/10.1187/cbe.20-06-0120>.
- Costa, R S., Medrano, M M., Ostáriz, P L., & Moreno-Guerrero, A. (2020, May 6). How to Teach Pre-Service Teachers to Make a Didactic Program? The Collaborative Learning Associated with Mobile Devices. *Sustainability*, 12(9), 3755-3755. <https://doi.org/10.3390/su12093755>.
- Criollo-C, S., Guerrero-Arias, A., Jaramillo-Alcázar, Á., & Luján-Mora, S. (2021, April 30). Mobile Learning Technologies for Education: Benefits and Pending Issues. <https://doi.org/10.3390/app11094111>.
- Crompton, H., & Burke, D. (2014, January 1). Review of Trends in Mobile Learning Studies in Mathematics: A Meta-Analysis. *Communications in computer and information science*, 304-314. https://doi.org/10.1007/978-3-319-13416-1_29
- Drigas, A., & Pappas, M A. (2015, July 31). A Review of Mobile Learning Applications for Mathematics. *International journal of interactive mobile technologies*, 9(3), 18-18. <https://doi.org/10.3991/ijim.v9i3.4420>.
- Fabian, K., Topping, K J., & Barron, I. (2018, February 23). Using mobile technologies for mathematics: effects on student attitudes and achievement. *Educational Technology Research and Development*, 66(5), 1119-1139. <https://doi.org/10.1007/s11423-018-9580-3>.
- Fu, Q., & Hwang, G. (2018, April 1). Trends in mobile technology-supported collaborative learning: A systematic review of journal publications from 2007 to 2016. *Computers & Education*, 119, 129-143. <https://doi.org/10.1016/j.compedu.2018.01.004>.
- Grossoehme, D H. (2014, June 13). Overview of Qualitative Research. <https://doi.org/10.1080/08854726.2014.925660>.
- Gupta, T. (2019, April 23). Reflective Teaching as a Strategy for Effective Instruction. *Educational Quest: An International Journal of Education and Applied Social Sciences*, 10(1). <https://doi.org/10.30954/2230-7311.1.2019.6>.



- Harper, F K., & Crespo, S. (2020, October 1). Learning to Collaborate While Learning Mathematics. *Mathematics Teacher: Learning and Teaching PK–12*, 113(10), 800-811. <https://doi.org/10.5951/mtlt.2019.0192>.
- Heflin, H., Shewmaker, J., & Nguyen, J. (2017, April 1). Impact of mobile technology on student attitudes, engagement, and learning. *Computers & Education*, 107, 91-99. <https://doi.org/10.1016/j.compedu.2017.01.006>.
- Lai, C., Chu, C., Luo, P., & Chen, W. (2013, January 1). Learners' acceptance of mobile technology supported collaborative learning. *International Journal of Mobile Learning and Organization*, 7(3/4), 277-277. <https://doi.org/10.1504/ijmlo.2013.057166>.
- Larkin, K., & Calder, N. (2015, December 23). Mathematics education and mobile technologies. *Mathematics Education Research Journal*, 28(1), 1-7. <https://doi.org/10.1007/s13394-015-0167-6>.
- Lee, C C., Hao, Y., Lee, K S., Sim, S C., & Huang, C C. (2019, June 1). Investigation of the effects of an online instant response system on students in a middle school of a rural area. *Computers in Human Behavior*, 95, 217-223. <https://doi.org/10.1016/j.chb.2018.11.034>.
- Lee, D., Huh, Y., Lin, C., & Reigeluth, C M. (2018, July 19). Technology functions for personalized learning in learner-centered schools. *Educational Technology Research and Development*, 66(5), 1269-1302. <https://doi.org/10.1007/s11423-018-9615-9>.
- Li, Y., Qiu, L., & Sun, B. (2020, September 3). School engagement as a mediator in students' social relationships and academic performance: a survey based on CiteSpace. *International journal of crowd science*, 5(1), 17-30. <https://doi.org/10.1108/ijcs-02-2020-0005>.
- Lora, H A., Rosidin, U., & Distrik, I W. (2020, January 1). The Analysis of Implementation of Assessment for Learning and Assessment. <https://doi.org/10.2991/assehr.k.200323.116>.
- Mr, N T H. (2021, February 28). The impact of ICTs on collaborative learning: A literature review. *Innovations in Information and Communication Technology Series*, 46-52. https://doi.org/10.46532/978-81-950008-7-6_004.
- Nam, C W., & Jang, S. (2013, August 1). The development of an ID model for collaborative learning in mobile learning environments. <https://doi.org/10.1109/tale.2013.6654430>.
- Nurhayati, N., HERNANI, & Sinaga, P. (2019, November 1). The effectiveness of using integrated science practice worksheet of integrated type to enhance environmental literacy. *Journal of Physics: Conference Series*, 1280(3), 032049-032049. <https://doi.org/10.1088/1742-6596/1280/3/032049>.
- Osman, K., Rahmat, R A A O., & Soh, T M T. (2012, October 1). Catalysing Scholarship of Assessment using Programme Assessment Plan. <https://doi.org/10.1016/j.sbspro.2012.09.267>.
- Panoy, J F D., Andrade, R R., Febrer, L B., & Ching, D A. (2022, January 1). Perceived Proficiency with Technology and Online Learning Expectations of Students in the Graduate Program of One State University in the Philippines. *International Journal of Information and Education Technology*, 12(7), 615-624. <https://doi.org/10.18178/ijiet.2022.12.7.1661>.
- Poquet, O., Lim, L., Mirriahi, N., & Dawson, S. (2018, March 7). Video and learning. <https://doi.org/10.1145/3170358.3170376>.
- Rifai, A., & Sugiman, S. (2018, September 1). Students' Perceptions of Mathematics Mobile Blended Learning Using Smartphone. *Journal of Physics: Conference Series*, 1097, 012153-012153. <https://doi.org/10.1088/1742-6596/1097/1/012153>



- Sartika, E., Nizkon, N., & Nawawi, S. (2020, July 28). Developing Student Worksheets (LKPD) based on Problem Based Instruction on Environmental Pollution Material. *IJIS Edu*, 2(2), 131-131. <https://doi.org/10.29300/ijisedu.v2i>.
- Smetanina, M., Bobrovskaya, N., Abubakarova, E., Zherdeva, O., & Kozina, O. (2020, January 1). Development of Reflexive Thinking as Important Motivational Potential for Teaching Activity. <https://doi.org/10.2991/assehr.k.200723.071>.
- Statti, A., & Villegas, S. (2020, March 14). The Use of Mobile Learning in Grades K–12: A Literature Review of Current Trends and Practices. *Peabody Journal of Education*, 95(2), 139-147. <https://doi.org/10.1080/0161956x.2020.1745613>
- Sung, Y., Yang, J., & Lee, H. (2017, April 27). The Effects of Mobile-Computer-Supported Collaborative Learning. <https://journals.sagepub.com/doi/10.3102/0034654317704307>.
- Supandi, S., Ariyanto, L., Kusumaningsih, W., & Aini, A N. (2018, March 1). Mobile phone application for mathematics learning. *Journal of Physics: Conference Series*, 983, 012106-012106. <https://doi.org/10.1088/1742-6596/983/1/012106>.
- Surez, N., Specht, M., Prinsen, F., Kalz, M., & Ternier, S. (2018, March 1). A review of the types of mobile activities in mobile inquiry-based learning. *Computers & Education*, 118, 38-55. <https://doi.org/10.1016/j.compedu.2017.11.004>
- Tsingos, C., Bosnic-Anticevich, S., & Smith, L. (2014, February 1). Reflective Practice and Its Implications for Pharmacy Education. <https://doi.org/10.5688/ajpe78118>.
- Weng, F., & Shen, B. (2022, May 5). Language Assessment Literacy of Teachers. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.864582>.
- Xu, Y., & Brown, G. (2016, August 1). Teacher assessment literacy in practice: A reconceptualization. *Teaching and Teacher Education*, 58, 149-162. <https://doi.org/10.1016/j.tate.2016.05.010>.
- Yosiana, Y., Djuandi, D., & Hasanah, A. (2021, March 1). Mobile learning and its effectiveness in mathematics. *Journal of Physics: Conference Series*, 1806(1), 012081-012081. <https://doi.org/10.1088/1742-6596/1806/1/012081>
- Yus, A., Wulan, D S A., Sari, W W., & Salim, S. (2021, June 18). Exploring the Ability of Early Childhood Teachers to Carry Out Assessment. *Budapest International Research and Critics in Linguistics and Education Journal*, 4(1), 689-698. <https://doi.org/10.33258/birle.v4i1.2043>