The Effectiveness of Blended Learning Model on Mathematical Communication Ability of Vocational Education Students During the Covid 19 Pandemic

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Abstract: The purpose of this study was to determine the effectiveness of the blended learning model for improving the mathematical communication skills of vocational education students during the COVID-19 pandemic. The research was conducted at the Bali State Polytechnic (BSP), using a quasi-experimental approach, with a pre-test post-test nonequivalent control group design. The subjects are students in the engineering field of BSP in 2020/2021. Samples were taken purposively about10 classes and divided into experimental and control groups. Data were analyzed using a t-test and paired t-test. The analysis results showed a significant difference between the average mathematical communication skills of students taught using the blended learning model and those being taught using the full e-learning model. The correlation between abilities before and after the learning process in students taught using the blended learning model was stronger and more significant than full e-learning. The blended learning model was effective in improving mathematical communication skills in vocational education during the pandemic 19.

Keywords: Blended learning, Mathematical Communication, Vocational, COVID-19,

1 Introduction

The 21st-century is an era of very rapid development of computer and internet technology, marked by the use of information and communication technology in all aspects of life. Its development demands quality human resources. Education has an important role in creating quality human resources. The impact of the development of the 21st-century on education in Indonesia has become very large, especially in vocational education.

Vocational education prepares students to work using a competency-based approach [1]. Vocational education prepares students to become professionals with high work skills. The aim is to prepare and produce skilled graduates to enter the world of work or to continue to higher education levels. It is prioritizing the readiness of the students to work, equipped with various knowledge and skills. The learning pattern is 30% theory and 70% practice. Its role is strategic and is at the forefront of handling the age of the workforce and educating them to become

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skilled, professional, and highly competitive workers who will increase the nation's competitiveness. Vocational education must prepare and implement learning with the formation of 4C skills, namely: critical thinking, communication, collaboration, and creativity. Vocational education must be able to prepare and implement 21st-century learning.

21st-century learning is characterized by learning skills and literacy skills. In learning skills, learning process development is needed to adapt and develop in modern society. The learning activities use technology-based learning media, emphasizing the formation of collaboration, communication, and critical and creative thinking skills [2]. While in literacy skills, learning focuses on how students can distinguish facts, data, and supporting technology to determine reliable sources, ultimately being able to distinguish factual information from misinformation in cyberspace [3]. 21st-century learning leads to the honing of media literacy, technological literacy, and information literacy. The implementation of learning activities integrates ICT as a means of support.

At the beginning of 2020, the Covid-19 pandemic suddenly appeared and affected various aspects of life, including vocational education [4] [5]. As its spread increases every day, the government is closing all schools until the Covid-19 outbreak is declared gone [6]. Learning activities must be carried out online through e-learning. This condition requires all education components to innovate in the learning process, changing face-to-face learning patterns into e-learning patterns.

E-learning is an educational system that utilizes information technology in the teaching and learning process. Through e-learning, learning can be more flexible regarding the time, place, and speed of the process so that students control their learning. Flexibility is the keyword for e-learning systems. Students become very flexible in choosing a time and place to study. They do not have to come to one place at a certain time at the same time. E-learning has a minimum level of effectiveness equivalent to face-to-face learning [7]. However, e-learning is less able to accommodate all learning needs [8], such as the differences in the characteristics of each student. Besides that, there are limited interactions between lecturers and students and even between students [9]. This lack of interaction can slow down the formation of values in the learning and teaching process. The communication process between lecturers and students occurs in one direction. Learning requires a two-way communication process or feedback between the two parties. Joyce stated that e-learning is just to improve insight and knowledge alone. Real-face activities are necessary to gain and increase skills and attitudes [10]. Bates and Sangra emphasized that the e-learning model requires face-to-face learning to provide feedback from students to instructors/lecturers and vice versa [11]. The combination between e-learning and face-to-face learning can produce effective and efficient learning. Hameed, Badii, & Cullen stated that the e-learning model would be more efficient when mixed with face-to-face learning [12]. Blended learning can complement each other between e-learning and face-to-face learning.

Blended learning is a learning model that combines harmoniously, structured, and systematically the advantages of face-to-face and online learning. This learning combines the advantages of face-to-face learning models in classroom learning and online learning that can be done anywhere and at any time. In direct face-to-face learning between lecturers and students, it was common learning in our education before the COVID-19 pandemic. Students can discuss, exchange opinions or ideas about certain materials, but time constraints result in the face-to-face learning process being not optimal. Through e-learning, it can be done anywhere and at any

time, and continue the previous face-to-face learning through online learning. Then, the learning process can be more optimal.

Blended learning is very in line with the learning style of the millennial generation and provides opportunities for students to use ICT to search for information based on big data [13]. The application of blended learning for students will increase digital literacy and technological literacy as it demands 21st-century skills. Blended learning is very relevant to 21st-century learning [14]. Previous researchers have conducted many studies related to the effectiveness of Blended Learning in Education. As Atmacasoy & Aksu conducted a literature review, they concluded that Blended Learning develops positive attitudes and face-to-face learning activities [15]. Bernard conducted a meta-analysis of Blended Learning and the use of technology in universities and found that technology-assisted Blended Learning can improve learning outcomes and the quality of the learning process [16]. Boelens conducted a literature review of four important concepts in Blended Learning, showing that social interaction occurs in face-to-face learning, while personalization and monitoring of learning progress occur during online activities [17]. Baragash & Al-Samarraie found that Blended Learning improves the quality of the learning process and improves critical thinking skills [18].

Blended learning orientation is active learning to increase student interaction with other students and lecturers [19]. One form of student interaction is when students with lecturers or students with students can communicate their ideas and problems both during face-to-face learning and online. In the face-to-face, blended learning classroom environment, students have the opportunity to communicate with open dialogue and critical debate through group discussions so that they can expand their learning experience [20]. This situation requires the ability to communicate all ideas and concepts that are owned effectively. Communication skills need to be developed in learning mathematics. Communication plays an important part in mathematics learning. Through the communication process, students can exchange ideas and clarify their understanding and knowledge in learning[21].

The National Council of Mathematics Teachers explained that one of the basic skills students must have in learning mathematics is communication [21]. Communication skills in mathematics are called mathematical communication, the ability to convey mathematical ideas both orally and in writing. In line with Yeager, mathematical communication is the ability to communicate mathematics both orally, visually, in writing, with precise and correct mathematical symbols, and pay attention to mathematical rules [22]. Mathematical abilities in students can be in the form of abilities: 1) connecting actual objects, pictures, and diagrams into mathematical ideas; 2) explaining ideas, situations, and mathematical relations orally or in writing with actual objects, pictures, graphs, and algebra; 3) expressing daily events in mathematical language or symbols; 4) listening, discussing, and writing about mathematics; 4) reading with understanding a written mathematical presentation, making conjectures, constructing arguments, formulating definitions and generalizations; and 5) explaining and make questions about the mathematics that has been learned [23]. Mathematical communication is an attempt to convey and reflect on mathematical ideas they have, discuss ideas by exchanging ideas related to mathematics both orally and in writing [21], [24].

Mathematical communication is one of the important competencies that must be developed on every mathematical topic because it is a fundamental tool in transmitting and building mathematical knowledge [25]. Mathematical ability is essential in learning mathematics

because it can help students: explore mathematical ideas, see various relationships of mathematical material, help organize and consolidate their mathematical thinking, construct mathematical knowledge, develop mathematical problem-solving skills, and foster self-confidence. Mathematical abilities provide enormous opportunities for students to conduct discussions, reflection, and improvement of conceptual understanding. With good communication skills, students can exchange their ideas with others, the lecturers, and the environment.

Blended learning can be applied in the learning process using online learning resources without leaving the learning activities in the classroom. Online-based technology supports learning with digital technology. This digital technology assistance will make learning more effective. Through blended learning, students can be trained to master technology, use technology wisely, and improve their mathematical communication skills. This study aims to determine the difference between students' mathematical communication skills taught using the blended learning model and students taught using full e-learning.

2 Research methods

This is quantitative research aimed at determining the effect of the blended learning model on mathematical communication skills. The study used a quasi-experimental approach with a pre-test–post-test nonequivalent control group design [26]. The design is shown in Table 1.

Table 1 Pre-test–post-test nonequivalent control group design.

Class	Pre-test	Treatment	Postest
Experiment	O_1	A_1	O_2
Control	O_1	A_2	O_2

Explanation:
O_1 = Pre-test for experimental and control groups
O_2 = Posttest for the experimental and control groups
A_1 = Learning treatment with a blended learning model
A_2 = Learning treatment with a full e-learning model

This research was conducted in Engineering Bali State Polytechnic. The population was students who received applied mathematics courses in 2020/2021. It was about 18 classes spread over six majors and 15 study programs. Samples were taken purposively about ten classes and divided into experimental and control groups. Each group has 130 people. The experimental group was taught to use the Flipped Classroom version of the blended learning model with the LMS Schoology application, while the control group was taught to use the full e-learning model with the LMS Schoology application.

The data were collected using a mathematical ability test developed by the researcher himself and has been tested. The level of instrument validity ranges between 0.31 and 0.89, and the reliability is 0.97, the average difficulty level was 0.41 with a discriminating power index ranging from 0.25 to 0.75. The data were analyzed by t-test and related t-test. Previously, the analysis requirements were tested, namely normality and homogeneity tests. All data have been proven to meet the analysis requirements.

3 Results and discussion

Descriptive analysis showed that the average of students' initial mathematical communication skills in both groups was 57.9 and 56.6. Both were categorized as moderate. Both groups had the same initial ability. The average score of mathematical communication skills in the group taught using the blended learning model was 79.0, while in the group taught using the e-learning model, 73.6, both were categorized as high. The average student achievement in the blended learning group was higher than in the full e-learning group.

Paired t-test results showed that the correlation between initial ability (before) and final ability (after) the learning process in the blended learning group was 0.642, categorized as positive, very strong, and significant. The correlation between abilities before and after the learning process was positive and very strong and was actually related significantly (significantly). Meanwhile, in the group taught using full e-learning, the correlation between initial and final abilities was 0.311, categorized as positive, strong, and significant.

The results of the average difference test through the t-test show the value of t = 25.26 with probability (sig.2-talled) = 0.000, meaning t was significant. There was a significant difference between the mathematical communication skills of students taught using the blended learning model and students taught using the full e-learning model. The results of the t-test in the experimental group found that the value of t = -28.028 with a probability of (two-sided sig.) 0.00 was less than 0.05, (mean difference 21.04). The ability was significantly different before and after the learning process (mean difference 21.04). The test results for the control value were t = -16.34 with a probability (two-sided sig) of 0.00 was less than 0.05. The ability was significantly different before and after the learning process, with a mean difference of 16.94. The learning process using the full e-learning model could significantly improve learning achievement, but the correlation was weak and significant. The average proportion of test scores before and after learning in the experimental group was 0.58 and 0.79 or an increase of 0.21, while in the control group, it was 0.57 and 0.74 or an increase of 0.16. The difference between the initial test scores and the final test scores for the experimental class was slightly higher than the control class. This indicates that the blended learning model was more effective in improving mathematical communication skills than the full e-learning model.

The findings above are evidence that the blended learning model is more effective in improving mathematical communication skills than the full e-learning model. These findings support the research results: 1) Ya-Wen Lin, who stated that blended learning had a positive effect not only on learning outcomes but also attitudes towards learning mathematics [27]; 2) Setiyani, who stated that students' mathematical communication skills were learned to use Schoology better than without using Schoology [28]; 3) Obiedat, who found that blended learning had a positive impact on increasing student academic achievement [29]; 4) Almasaeid, who stated that blended learning had a positive effect on learning outcomes in the form of skills and attitudes [30]; 5) Bibi & Jati, who proved that blended learning could improve students' understanding of concepts [31].

There was a significant difference in communication skills between students who were taught using the blended learning model and the full e-learning model. This difference was caused by the effectiveness of each model's process. Both models were increasingly popular among teachers and students in Indonesia. Both have in common, namely using computers and the

internet as intermediaries. However, conceptually blended learning and e-learning have fundamental differences.

E-learning is structured using an electronic or computer system to support the learning process [32]. E-learning is an education system that utilizes information technology in the teaching and learning process. E-Learning is a learning technique in a network (online) that uses the internet to connect with each other. However, the interaction between teachers and students is limited in exchanging data and information. The material is packaged in digital format. Students can only follow the material through text, audio, and video online. There is no interaction between the teacher and the students. Students can take lessons anywhere and can choose the time they like.

Blended learning is a learning model that combines harmoniously, structured, and systematically the advantages of face-to-face and online learning [33]. Blended learning is a hybrid learning method that can make student interactions while participating in lessons varied and more enjoyable. In the activity, there is a direct two-way interaction in the form of direct discussion. The learning process takes place in the classroom and utilizes the virtual world in a virtual classroom. Class schedules are flexible so that students can balance academic and non-academic activities. There is a formula for learning combination method patterns, for example, 65/20/15. The portion of 65% of learning is done interactively with a group of students based on the tasks that must be done, 20% is time to learn online, and 15% is time to learn formally face to face. The pattern of different methods by carrying out a longer interaction, students will get different experiences not only limited to theory but have a tendency to practice the implementation of the theories obtained. In a blended learning environment, learning can be done anywhere and anytime using the internet. Students can access the material freely and are required to learn independently. Between lecturers and students can provide feedback in the form of questions and suggestions in real-time. The discussion between lecturers and students occurs not only during class hours but also outside class hours. Lecturers can also control student learning.

The blended learning process is student-centered learning (SCL). Groups of students taught using blended learning are likely to be actively involved in learning. Students get a learning experience when accompanied by lecturers in class and outside the classroom and independently get a wider learning experience. When studying in class, they get learning materials and experiences in the form of orientation, exercises and feedback, examples, and direct motivation from the lecturer. When studying online, they can control their own learning time so that they can study anywhere, anytime, and are not depending on the lecturer. They can also study independently or interact easily with lecturers and fellow students and access various online learning resources that can be obtained using their gadgets and applications. The variety of learning objects is richer, be in the form of electronic books or electronic articles, simulations, animations, augmented reality, virtual reality, learning videos, or other multimedia that can be accessed online [13]. Students become increasingly motivated to learn and seek information from various online and printed sources. The increased motivation impacts the learning outcome as the students actively look for supporting materials from various sources.

The learning process is the interaction of students with lecturers and learning resources. The process is limited to providing information from lecturers to students and through reciprocal communication between the two parties. In the process of reciprocal communication, students have the opportunity to be actively involved in learning both mentally, intellectually,

emotionally, and physically to seek and find knowledge, attitudes, and skills. There are limited interactions between lecturers and students in groups of students taught using the full e-learning model, even between students [9]. This lack of interaction can slow down the formation of values in the learning process. The communication process between lecturers and students occurs in one direction. Learning requires a two-way communication process, or there is feedback between the two parties. The learning process tends towards training rather than education. Students who do not have high learning motivation and willingness to learn independently tend to fail. The success of e-learning highly depends on students' willingness to learn independently [34]. The further impact on those who are taught full e-learning is an "impression of loneliness" that encourages boredom and laziness in the learning process. Learning motivation tends to decrease. In the end, it affects the achievement of learning outcomes. Those who are taught using full e-learning get lower learning outcomes compared to those who are taught using blended learning.

Based on the results of the findings, the implementation of blended learning was effective in improving mathematical communication skills. This finding was supported by the theory expressed by: 1) Stein and Graham, who stated that blended learning as a solution to solve the learning gap was currently more focused on face-to-face learning or only online learning [35]. Ronsen and Stewart stated that blended learning could improve learning outcomes and was more effective than only face-to-face learning or only online learning [36]. Handoko and Waskito explained that implementing the blended learning model increased the effectiveness of the learning process [37]. Blended learning could stimulate skills and give a creative attitude to carry out learning activities independently. The activities did not depend on the instructor or lecturer. Blended learning provided convenience and built independent attitudes for students to be creative and innovative in carrying out learning activities. Thus, blended learning is very appropriate to be applied in the conditions of the COVID-19 pandemic, especially in vocational education.

Vocational education is generally aimed at preparing and producing graduates who have various knowledge and skills. In addition to continuing to higher education levels, it is preferable to be ready and able to work in the industrial world. Therefore, learning in vocational education must prepare and implement learning with the formation of 21st-century skills, namely critical thinking, communication, collaboration, and creativity. Vocational education graduates must have higher-order thinking skills because they need for work skills in the 21st century is quite complex and tends to lead to the use of higher-order thinking skills [38].

Blended learning combines the best aspects of face-to-face learning with the advantages of online learning. The learning process integrates ICT, combining various delivery methods, teaching models, learning styles, and various variations of technology-based media. The implementation begins with a learning orientation to prepare face-to-face and online scheduling through clear instructions such as learning materials and assignments that must be done every week. It is also equipped with online and face-to-face learning directions. The task content in learning includes making a structured and systematic project. It is the order of the topics hierarchically related to the topic of the previous project. There is an increase in the scope of material that students must understand to encourage them to think at a higher level. There are an enrichment in each project task that combines online and face-to-face learning, online and face-to-face group discussions with critical thinking elements, such as making assumptions and drawing conclusions. Discussions can be held virtually via video conference or discussion

forums. Group discussion activities can encourage increased ability to collaborate, work in teams, communicate in the classroom and outside the classroom. Students can innovate and be creative in doing project assignments and use technology to produce a quality product. Learning resources or teaching materials are accessed online through learning links, such as YouTube and other sites. While working on project assignments, students are encouraged to build higher-order thinking skills, collaborate, innovate and be creative, and improve communication skills, technology literacy, and data literacy. Sahim stated that the blended learning model could improve the performance of vocational education students and produce more effective learning [39].

The application of blended learning makes it possible for learning interactions to occur anywhere and anytime (time and place flexibility). Learning resources have been packaged electronically and are available to be accessed by students via the internet to interact with these learning resources anytime and from anywhere. The tasks of learning activities that have been completed can be submitted to the instructor/lecturer, not strictly tied to the time and place of learning activities, as is the case with face-to-face learning. The implementation of blended learning can provide security and comfort for students and lecturers in carrying out learning activities during the COVID-19 pandemic. Blended learning can reduce mass gathering activities as one of the health protocols to avoid contracting COVID-19. However, blended learning remains oriented towards achieving learning outcomes, namely increasing knowledge, skills, and attitudes. Online learning can increase insight and knowledge, and face-to-face learning can improve skills, especially in materials that are not automatically obtained from increased knowledge. The implication is that the proper and correct application of the blended learning model in vocational education during the COVID-19 pandemic effectively improves students' mathematical communication skills.

4 Conclusion

There was a significant difference between the average mathematical communication skills of students taught using the blended learning model and those taught using the full e-learning model. The correlation between abilities before and after the learning process in students taught using the blended learning model was stronger and significant than being taught using full e-learning. The difference in the proportion of pre-test and post-test scores for the group taught using the blended learning model was higher than those taught using the full e-learning model. The blended learning model effectively improved mathematical communication skills in vocational education during the Covid-19 pandemic. The implication is that the proper and correct application of the blended learning model in vocational education during the COVID-19 pandemic effectively improves students' mathematical communication skills.

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References

[1] M. Pavlova, “Technology and Vocational Education UNESCO-UNEVOC Book Series Technical and Vocational Education and Training : Issues , Concerns and Prospects,” pp. 1–208, 2009.

[2] T. Mailani, Zulfarina, and W. Syafii, “Development of the PDEODE-WEB Model in Blended Learning to Improve the Students Critical Thinking Skills,” *J. Phys. Conf. Ser.*, vol. 1655, no. 1, pp. 1–6, 2020, doi: 10.1088/1742-6596/1655/1/012054.

[3] J. Voogt and N. R. Pareja, “21st Century Skills. Discussienota. Zoetermeer,” *The Netherlands: Kennisnet*, 2010. http://www.billielee.co.nz/wp-content/uploads/2015/04/White-Paper-21st-CS-Reading-week-2.pdf (accessed Jun. 19, 2021).

[4] J. Ambarita, H. Helwaun, and L. Van Houten, “Workshop Pembuatan E-book Sebagai Bahan Ajar Elektronik Interaktif Untuk Guru Indonesia Secara Online di Tengah Covid 19.,” *Community Engagem. Emerg. J.*, vol. 2, no. 1, pp. 44–57, 2021.

[5] A. Sadikin and A. Hamidah, “Pembelajaran Daring di Tengah Wabah Covid-19,” *Biodik*, vol. 6, no. 2, pp. 109–119, 2020, doi: 10.22437/bio.v6i2.9759.

[6] S. A. K. Shdaifat, N. A. K. Shdaifat, and L. A. Khateeb, “The Reality of Using E-Learning Applications in Vocational Education Courses During COVID 19 Crisis from the Vocational Education Teachers’ Perceptive in Jordan,” *Int. Educ. Stud.*, vol. 13, no. 10, p. 105, 2020, doi: 10.5539/ies.v13n10p105.

[7] T. Nguyen, “The Effectiveness of Online Learning: Beyond No Significant Difference and Future Horizons,” *MERLOT J. Online Learn. Teach.*, vol. 11, no. 2, pp. 309–319, 2015.

[8] N. Tuncay, H. Uzunboylu, and N. Teker, “Students evaluation of EDU 2.0: A case study,” *Procedia - Soc. Behav. Sci.*, vol. 28, pp. 948–956, 2011, doi: 10.1016/j.sbspro.2011.11.175.

[9] Nursalam and F. Efendi, *Pendidikan Dalam Keperawatan Nursalam Ferry Efendi*, no. March 2014. 2008.

[10] B. Joyce, M. Weil, and E. Calhoun, *Models of Teaching (Model-Model Pengajaran)*, Ed. Ke-8,. Yogyakarta: Pustaka Pelajar, 2011.

[11] A. W. Bates(Tony) and A. Sangra, *Managing Technology in Higher Education: Strategies for Transforming Teaching and Learning*. San Francisco: ossey-Bass, 2011.

[12] S. Hameed, A. Badii, and A. J. Cullen, “Effective e-learning integration with traditional learning in a blended learning environment,” *Proc. Eur. Mediterr. Conf. Inf. Syst. EMCIS 2008*, vol. 2008, pp. 1–16, 2008.

[13] A. Junaidi, D. Wulandari, H. Soetanto, and S. S. Kusumawardani, *Panduan Penyusunan Kurikulum Pendidikan Profesi*, IV. Jakarta: Direktorat Jenderal Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan, 2020.

[14] I. K. Darma, I. G. M. Karma, and I. M. A. Santiana, “Blended Learning, Inovasi Strategi Pembelajaran Matematika di Era Revolusi Industri 4.0 Bagi Pendidikan Tinggi,” *Pros. Semin. Nas. Pendidik. Mat.*, vol. 3, pp. 527–539, 2020.

[15] A. Atmacasoy and M. Aksu, “Blended learning at pre-service teacher education in Turkey: A systematic review,” *Educ. Inf. Technol.*, vol. 23, no. 6, pp. 2399–2422, 2018, doi: 10.1007/s10639-018-9723-5.

[16] R. M. Bernard, E. Borokhovski, R. F. Schmid, R. M. Tamim, and P. C. Abrami, “A meta-analysis of blended learning and technology use in higher education: From the general to the applied,” *J. Comput. High. Educ.*, vol. 26, no. 1, pp. 87–122, 2014, doi: 10.1007/s12528-013-9077-3.

[17] R. Boelens, B. De Wever, and M. Voet, “Four key challenges to the design of blended learning: A systematic literature review,” *Educ. Res. Rev.*, 2017, doi: 10.1016/j.edurev.2017.06.001.

[18] R. S. Baragash and H. Al-Samarraie, “Blended learning: Investigating the influence of engagement in multiple learning delivery modes on students’ performance,” *Telemat. Informatics*, vol. 35, no. 7, pp. 2082–2098, 2018, doi: 10.1016/j.tele.2018.07.010.
[19] J. H. Westover and J. P. Westover, “Teaching Hybrid Courses across Disciplines: Effectively Combining Traditional Learning and e-Learning Pedagogies,” *Int. J. Inf. Educ. Technol.*, vol. 4, no. 1, pp. 93–96, 2014, doi: 10.7763/ijiet.2014.v4.376.
[20] Sukarno, “Blended Learning Sebuah Alternatif Model Pembelajaran Mahasiswa Program Sarjana (S-1) Kependidikan bagi Guru dalam Jabatan,” *J. Didakt. Dwija Indria*, vol. 1, no. 2, pp. 1–11, 2011, [Online]. Available: http://jurnal.fkip.uns.ac.id/index. php/pgsdsolo/article/viewFile/77/52.
[21] NCTM, *Principles and Standards for School Mathematics*. Reston: National Council of Teachers of Mathematics, 2000.
[22] A. Yeager and R. Yeager, “Teaching through the Mathematical Processes,” 2008. gains-camppp.wikispaces.com.
[23] A. Qohar and U. Sumarmo, “Improving mathematical communication ability and self regulation learning of yunior high students by using reciprocal teaching,” *J. Math. Educ.*, vol. 4, no. 1, pp. 59–74, 2013, doi: 10.22342/jme.4.1.562.59-74.
[24] S. C. K. Sokoine, “The Perceived Importance of Communication Skills Courses among University Students: The Case of Two Universities in Tanzania,” *Int. J. Educ. Res.*, vol. 3, no. 2, pp. 497–508, 2015, [Online]. Available: http://www.ijern.com/journal.
[25] A. Guerreiro and L. Serrazina, “Communication As Social Interaction Primary School Teacher Practices,” *Cerme 6 - Proc. 6Th Congr. Eur. Soc. Res. Math. Educ.*, pp. 1744–1750, 2010.
[26] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif dan R&D*, Cet.26. Bandung: Alfabeta, 2017.
[27] Y. W. Lin, C. L. Tseng, and P. J. Chiang, “The effect of blended learning in mathematics course,” *Eurasia J. Math. Sci. Technol. Educ.*, vol. 13, no. 3, pp. 741–770, 2017, doi: 10.12973/eurasia.2017.00641a.
[28] Setiyani, “Blended learning: keefektifan e-learning berbasis schoology terhadap kemampuan komunitas matematika,” *J. Pendidik.*, vol. 3, no. 2, pp. 143–155, 2019.
[29] R. Obiedat, L. Nasir Eddeen, O. Harfoushi, A. Koury, M. Al-Hamarsheh, and N. AlAssaf, “Effect of blended-learning on academic achievement of students in the university of Jordan,” *Int. J. Emerg. Technol. Learn.*, vol. 9, no. 2, pp. 37–44, 2014, doi: 10.3991/ijet.v9i2.3220.
[30] T. F. Almasaeid, “The effect of using blended learning strategy on achievement and 9th grade students,” *Eur. Sci. J.*, vol. 10, no. 31, pp. 133–145, 2014, [Online]. Available: http://eujournal.org/index.php/esj/article/viewFile/4573/4370.
[31] S. Bibi and H. Jati, “Efektivitas model blended learning terhadap motivasi dan tingkat pemahaman mahasiswa mata kuliah algoritma dan pemrograman,” *J. Pendidik. Vokasi*, vol. 5, no. 1, p. 74, 2015, doi: 10.21831/jpv.v5i1.6074.
[32] A. Michael, *Michael Allen’s Guide to E-Learning: Building Interactive, Fun, and Effective Learning Programs for Any Company*. New Jersey: Wiley, 2016.
[33] S. Semler, “Use Blended learning to Increase Learner Engagement and Reduce Training Cost,” 2005. http://www.learningsim.com/content/lsnews/ blended_learning1.html (accessed Mar. 26, 2020).
[34] Munir, *Pembelajaran Digital*. Bandung: Alfabeta, 2017.
[35] J. Stein and C. R. Graham, *Essentials for Blended Learning A Standards-Based Guide*, 1st Editio. New York: Routledge, 2013.
[36] C. Stewart and D. J. Rosen, “Blended learning for the adult education classroom,” *Essential Education*, 2013. http://app.essentialed.com/resources/blended-learning-teachers-guide-web.pdf (accessed Jun. 25, 2020).

[37] Handoko and Waskito, *Blended Learning: Teori dan Penerapannya*. Padang: LPTIK Universitas Andalas, 2018.
[38] P. Sudira, *Metodologi Pembelajaran Vocational: Inovasi, Teori dan Praksis*. 2018.
[39] M. Sahin, "Blended learning in vocational education: An experimental study," *Int. J. Vocat. Tech. Educ.*, vol. 2, no. October, pp. 95–101, 2010.