



## The Evaluation of Mathematical Communication Skills with Moodle-assisted CTL Learning Model in Middle School

Ricky Yusuf Susanto<sup>1✉</sup>, Rochmad Rochmad<sup>2</sup>, Wardono Wardono<sup>3</sup>

<sup>1,2,3</sup>Universitas Negeri Semarang, Indonesia

### Article Info

History Articles  
Received:  
20 December 2021  
Accepted:  
15 January 2022  
Published:  
30 March 2022

Keywords:  
Mathematical  
communication, CTL,  
moodle

### Abstract

Mathematical communication skills are the ability to identify and write everyday problems into mathematical language. One way to improve mathematical communication skills is to apply Moodle-assisted CTL learning. This study is written to analyze and evaluate mathematical communication skills improvement of the students taught by moodle-assisted CTL learning model. The research design used is experimental research with Pre-Experimental Design. The samples of this research are students of class VIII A at SMP Negeri 22 Semarang. The research data is obtained using a mathematical communication ability test. The data analysis in this study are; (1) Right Side Proportion Test; (2) Average difference Test; (3) N-Gain Test. The results of data analysis in this study are interpreted as follows: (1) students' mathematical communication skills in Moodle-assisted CTL learning are classically complete ( $Z_{count} > Z_{table}$ ;  $1.66 > 1.64$ ); (2) mathematical communication skills in CTL learning assisted by Moodle have completed the minimum completeness criteria ( $t_{count} > t_{table}$ ;  $5.55 > 1.72$ ); (3) there is an average increase in students' mathematical communication skills between before being given Moodle-assisted CTL learning and after Moodle-assisted CTL learning with N-Gain of 0.57. So we can conclude that students' mathematical communication skills have improved during the application of the moodle-assisted model, and we can suggest that the moodle-assisted CTL learning model can be used to improve mathematical communication skills.

✉Correspondence Address :

Postgraduate, Universitas Negeri Semarang  
Jalan Kelud Utara III, Kel. Petompon Kec. Gajah Mungkur  
Kota Semarang 50237  
E-mail : rickyusufs@gmail.com

**p-ISSN 2252-6420**  
**e-ISSN 2503-1732**

## INTRODUCTION

Humans were created as social beings, and therefore, as humans, everyone needs other people to live side by side (Sulistiawati, Amalia, & Rahma, 2021). Human dependence on each other makes humans need communication to exchange information and express desires. In learning activities, communication is used to exchange messages and information related to the material being studied verbally and non-verbally (Iskandar, 2019). Verbal and non-verbal communication can be understood if a common language is used.

According to Baroody (in Tanjung 2019), mathematics has its own language used to communicate someone's mathematical ideas to others. The importance of communication in mathematics is supported by Permendikbud Number 21 of 2016 (in Rahmalia, Hajidin, & Ansari, 2020), which states that one of the goals of learning mathematics is to communicate. The ability to communicate in mathematics is usually associated with conveying mathematical ideas orally or in writing to show the level of understanding of the concept being studied (Ahdhianto & Santi, 2020; Ernawati et al., 2021; Putri & Rochmad, 2021). The ability to communicate ideas in learning mathematics is known as mathematical communication skills.

Mathematical communication skills need to be possessed by students (Riyati & Suparman, 2019; Sudia & Muhammad, 2018) because everyday problems involving communication can often be solved with mathematics. Therefore, to develop students' mathematical communication skills, Contextual Teaching and Learning (CTL) learning is used.

CTL is a learning concept that helps teachers connect subject matter with everyday life to help students connect their knowledge and its application in everyday life (Lotulung et al., 2018; Surya & Purba, 2020). This statement aligns with the opinion of Suryawati & Osman (2017), which states that by applying

the CTL model, it is expected that students can apply the knowledge gained in everyday life.

The development of students' mathematical communication skills through CTL learning needs to be done because, according to Zulfah & Rianti (2018) in their research, which tested students in Bangkinang using 2015 PISA mathematical communication test questions, it is known that students' abilities in making mathematical models are still weak. The students' weak ability in making mathematical models can be caused by them not being accustomed to solving contextual problems that represent everyday life problems. According to Sriwahyuni et al. (2019), to solve contextual problems, good mathematical communication skills are needed so that students can translate contextual problems into mathematical language. Familiarizing students with contextual problems is necessary to improve mathematical communication skills (Sumandi, Sholihah, & Musannadah, 2019); therefore, CTL learning is needed to develop mathematical communication skills (Efriani & Asmar, 2020).

CTL model needs to be applied because of the lack of students' ability to make mathematical models and the world's condition being hit by the Covid-19 outbreak that has reduced students' communication activity with others. Therefore, with the application of CTL learning, students will still be able to connect their knowledge with normal life. Furthermore, CTL learning needs to be assisted with online learning media, namely Moodle, to optimize today's CTL learning.

Moodle is an application used for online learning by presenting learning media in web form (Simanullang & Rajagukguk, 2020). According to Styawati et al., 2020 & Rachmadtullah et al., 2020, Moodle is a technology that can be a solution during a pandemic to carry out learning activities without eliminating communication activities between teachers and students or students with

students. This is because Moodle provides online chat features, online forums that secure communication during learning activities, and online evaluation features to measure students' abilities after participating in learning activities (Aidah, 2019).

Moodle-assisted CTL learning can improve mathematical communication skills because one of the indicators assessed to measure mathematical communication skills is interpreting mathematical ideas (Rohid & Rusmawati, 2019). Meanwhile, learning with the CTL method trains students to interpret the learned material independently (Afni, 2020). Looking at the similarities in interpreting the studied material, applying Moodle-assisted CTL learning is expected to improve students' mathematical communication skills. Based on the above problems, the authors are interested in examining the effectiveness of Moodle-assisted CTL learning on mathematical communication skills. Therefore, this article aims to analyze and evaluate mathematical communication skills improvement of the students taught by the moodle-assisted CTL learning model.

## METHODS

Quantitative data analysis techniques consist of prerequisite test analysis and final data test analysis. The prerequisite test in the study used the normality test to find out that the data from the final communication ability test results were normally distributed. In this study, the normality test was calculated using SPSS 26 software using the Shapiro Wilk method.

After the normality test had been carried out, the final data test analysis was conducted. The final data test analysis consists of; (1) the classical completeness test, (2) the average difference test of mathematical communication skills, and (3) the improvement test. The classical mastery improvement test was conducted to determine whether the mathematical communication

skills of class VIII SMP Negeri 22 Semarang students who received Moodle-assisted CTL learning achieved mastery of more than or equal to 75%. The right-side proportion test was carried out to test the hypothesis regarding the classical completeness. The hypotheses used in this study are as follows.

$H_0$  : the proportion of class students who received Moodle-assisted CTL learning who had achieved completeness with less than or equal to 75%.

$H_1$  : the proportion of class students who received Moodle-assisted CTL learning who has achieved more than 75% completeness.

The average test was used to determine whether the average mathematical communication ability of students who received Moodle-assisted CTL learning reached the minimum completeness criteria. Meanwhile, the improvement test was conducted to determine whether there was a difference in students' mathematical communication skills before receiving Moodle-assisted CTL learning (pre-test) and after receiving Moodle-assisted CTL learning (post-test).

## RESULTS AND DISCUSSION

### Results

#### Normality test

The results of the mathematical communication ability test in normality test used SPSS 25 software. The hypothesis for the normality test of mathematical communication ability test results data is as follows.

$H_0$  : The data from the final mathematical communication ability test results are normally distributed.

$H_1$  : The data from the final mathematical communication ability test results are not normally distributed.

The normality test used SPSS with the Shapiro Wilk method. The criteria for this test used a significance level with the amount of 5% (0.05). If the significance value in the

normality test is more than 0.05, then  $H_0$  is rejected.

**Table 1.** Normality Test of Mathematical Communication Ability

Statistic	Df	Sig	Criteria	Conclusion
0.929	20	0.147	sig. > $\alpha$	H0 accepted

Based on Table 1. The normality test's of mathematical communication results showed that the sig value is 0.147. It means that sig value is greater than 0.05. It can be concluded that the data is normally distributed.

### Proportion test

The proportion test was conducted to find out whether the class using the Moodle-assisted CTL model had achieved classical completeness of more than or equal to 75%. That means the percentage of the number of students in one class who achieved a score of more than or equal to 75 was at least 75%. The right side proportion test was used with the following hypothesis to analyze the completeness test.

$H_0 : \pi \leq 75\%$  (The proportion of students' completeness in the Moodle-assisted CTL learning model with less than or equal to 75%)

$H_1 : \pi > 75\%$  (The proportion of students' completeness in the Moodle-assisted CTL learning model that reached more than 75%)

The analysis used for the proportion test in this study used Z table with the following formula.

$$Z = \frac{\frac{x}{n} - \pi_0}{\sqrt{\frac{\pi_0(1-\pi_0)}{n}}}$$

The applicable test criterion is that  $H_0$  is rejected if  $Z_{score} \geq Z_{(0.5-\alpha)}$  which  $Z_{(0.5-\alpha)}$  obtained from the standard normal distribution table with a 5% significant level and a probability  $(0.5 - \alpha)$ .

$Z_{score}$  value = 1.66 which is then compared with the value of the Z table, with

the amount 1.64. If the value of  $Z_{count} > Z_{table}$ , then according to the test criteria,  $H_1$  is accepted, so it can be concluded that the students' mastery of the Moodle-assisted CTL learning model was more than 75%.

### Average difference test

This test was conducted to determine whether the average mathematical communication ability of experimental class students who received learning using the Moodle-assisted CTL model was more than the minimum completeness criteria. The hypothesis used in the average difference test was as follows.

$H_0: \mu \leq 75$  (The average mathematical communication ability of students who received learning using the Moodle-assisted CTL model with less than or equal to 75).

$H_1: \mu > 75$  (The average mathematical communication ability of students who received learning using the Moodle-assisted CTL model with more than 75).

The analysis used for the average difference test was using t table with the following formula.

$$t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$

The test criteria is that  $H_0$  is rejected if  $t_{count} \geq t_{(1-\alpha),dk}$  which  $t_{(1-\alpha),dk}$  is obtained from the t distribution table with a significant level of 5% and  $dk = n - 1$ . Otherwise,  $H_0$  is accepted.

$t_{score}$  value = 5.55 compared to the t table value with degrees of freedom =  $n - 1$  or  $20 - 1 = 19$ , with a significant level of 5% is 1.72. Because  $t_{score} > t_{table}$  it means  $H_0$  is rejected and  $H_1$  is accepted. Thus, it can be concluded that the average mathematical communication ability of students who received Moodle-assisted CTL learning model was more than the minimum completeness criteria.

### N-Gain

The gain test is used to see whether there is an improvement in students'

mathematical communication skills before receiving Moodle-assisted CTL learning (pre-test) and after receiving Moodle-assisted CTL learning (post-test). The calculation on the improvement test used the gain value. The average of students' initial mathematical communication skills was 70.45. After being treated with Moodle-assisted CTL learning, the average mathematical communication ability of students became 86.6, so the N-Gain obtained became 0.57. It can be concluded that Moodle-assisted CTL learning can improve mathematical communication skills with a moderate improvement category.

### Discussion

This study tries to explain and prove the effectiveness of the Moodle-assisted CTL learning model in improving students' mathematical communication skills by looking at students' evaluation test scores. What distinguishes this research from previous research is the combination of the CTL model with Moodle media. By applying the CTL model combined with Moodle, it is hoped that students' mathematical communication skills can improve, and learning using the Moodle-assisted CTL model can be said to be effective. The selection of the CTL model in this study was based on the success of previous studies in using the CTL model, such as research conducted by Yuwandra & Arnawa (2020), Priyadi (2021), Syamsuddin & Istiyono (2018), Syaifuddin & Nurlaela (2021), and Khaldun (2020). The selection of Moodle media is based on the success of previous studies, such as research conducted by Umek et al. (2015), Braga, Rodrigues, & Bolzan (2015), and Tiantong & Teemuangsai (2013).

Learning will be effective if student learning outcomes exceed the predetermined criteria. The effective criteria determined in this study are; (1) at least 75% of students in the class achieve classical completeness; (2) every individual achieves the minimum completeness criteria; and (3) there's an improvement in mathematical communication skills. The achievement of classical mastery is

shown from the results of the students' mathematical communication ability test, which showed that 18 out of 20 students of class VIII A had achieved the minimum mastery criteria. After going through the calculations using the proportion test, it was found that the mathematical communication skills in Moodle-assisted CTL learning were classically complete. In addition to being classically complete, learning outcomes must also show individual mastery. In this study, individual mastery was calculated using the right-hand average test, so it was known that the average mathematical communication ability of students in Moodle-assisted CTL learning was complete. After classical completeness and average or individual completeness were known, the N-Gain test was carried out to see the increase's magnitude. In this study, the average student's initial communication ability was 70.45. After the Moodle-assisted CTL learning was carried out, the average student's final communication ability was 86.6. It shows an increase in students' communication skills after Moodle-assisted CTL learning was carried out. After calculating to find the N-Gain, the results of the N-Gain in this study were 0.57. This is in line with the research of Dewi & Afriansyah (2018), which states that CTL learning can improve mathematical communication skills.

Based on the explanation above, it can be concluded that Moodle-assisted CTL learning is effective. Moodle-assisted CTL learning is effective because it meets 3 criteria, namely; (1) at least 75% classical completeness; (2) the individual achieves the minimum completeness criteria; (3) there's an improvement of mathematical communication skills. So it can be said that Moodle-assisted CTL learning is effective and can be used to improve students' mathematical communication skills.

### CONCLUSION

Based on the results of the research and discussion above, it can be concluded that

Moodle-assisted CTL learning is effective in improving mathematical communication skills. This conclusion is indicated by students' mathematical communication skills tests in Moodle-assisted CTL learning, which was completed classically. Mathematical communication skills in Moodle-assisted CTL learning have met the minimum completeness criteria. In addition, there was an average improvement in students' mathematical communication skills between before being given Moodle-assisted CTL learning and after being given Moodle-assisted CTL learning with N-Gain of 0.57 with a moderate improvement category; this is in line with the research of Utami, Sulhadi, & Sugianto (2018), which states that CTL can improve students' cognitive learning outcomes.

Moodle-assisted CTL learning is not perfect; there were several obstacles, including limited infrastructure such as a stable internet network, in its implementation. Often, there were network coverage differences between one room and another, causing Moodle-assisted learning to take a longer time. In addition, it was difficult to identify students who opened their mobile phones to access Moodle or played on their mobile phones. Therefore, continuous supervision was required to ensure students use their mobile phones to access Moodle. By looking at the obstacles in implementing Moodle-assisted CTL learning, it is hoped that further research will explore the CTL model and the various features that Moodle has provided to facilitate learning activities more deeply.

## REFERENCES

- Afni, N. (2020). Contextual teaching and learning (CTL) as a strategy to improve students mathematical literacy. In *Journal of Physics: Conference Series* (Vol. 1581, No. 1, p. 012043). IOP Publishing.
- Afriani, E., & Asmar, A. (2020, May). The development of device learning based on contextual teaching and learning improve mathematical communication skills class VII. In *Journal of Physics: Conference Series* (Vol. 1554, No. 1, p. 012041). IOP Publishing.
- Ahdhianto, E., & Santi, N. N. (2020). The Effect of Metacognitive-Based Contextual Learning Model on Fifth-Grade Students' Problem-Solving and Mathematical Communication Skills. *European Journal of Educational Research*, 9(2), 753-764.
- Aidah, S. (2019). Pemanfaatan e-learning sebagai media pembelajaran di STIA Al Gazali Barru. *Meraja journal*, 2(1), 1-12.
- Braga, F. L., Rodrigues, R., & Bolzan, M. S. (2015). Moodle and Physics learning: A Good Experience With High School Students. *Latin-American Journal of Physics Education*, 9(3), 6.
- Dewi, P. Y., & Primayana, K. H. (2019). Effect of learning module with setting contextual teaching and learning to increase the understanding of concepts. *International Journal of Education and Learning*, 1(1), 19-26.
- Ernawati, N., Kurniasih, N., & Purwaningsih, W. I. (2021). Analisis Kemampuan Komunikasi Matematis dalam Pemecahan Masalah Matematika ditinjau dari Metakognisi Siswa. *Prosiding Sendika*, 7(2).
- Hendriana, B. (2018). Identifikasi Kemampuan Komunikasi Matematis dan Gaya Belajar Siswa. *Prosiding SENAMKU*, 1, 477-484.
- Iskandar, W. (2019). Kemampuan Guru Dalam Berkomunikasi Terhadap Peningkatkan Minat Belajar Siswa di SDIT Ummi Darussalam Bandar Setia. *AR-RIAYAH: Jurnal Pendidikan Dasar*, 3(2), 135.
- Khaldun, I. (2020, February). Influence of the contextual teaching and learning model against student learning outcome. In *Journal of Physics: Conference Series* (Vol. 1460, No. 1, p. 012128). IOP Publishing.
- Priyadi, H. G. (2021). The Effect of Contextual Teaching and Learning (CTL) Model With Outdoor Approach Towards the Students' Ability of Mathematical Representation. *Education Quarterly Reviews*, 4(3).
- Purba, G. I. D., & Surya, E. (2020, February). The improving of mathematical understanding ability and positive attitudes of unimed fmipa students by using the contextual teaching learning (CTL) approach. In *Journal of Physics: Conference Series* (Vol. 1462, No. 1, p. 012019). IOP Publishing.

- Putri, D. K., & Rochmad, R. (2021). Mathematical communication ability of 7th grade Junior High School students by using Knisley's model assisted by textbook supplements. *Unnes Journal of Mathematics Education*, 10(2).
- Rachmadtullah, R., Marianus Subandowo, R., Humaira, M. A., Aliyyah, R. R., Samsudin, A., & Nurtanto, M. (2020). Use of blended learning with moodle: Study effectiveness in elementary school teacher education students during the COVID-19 pandemic. *International journal of advanced science and technology*, 29(7), 3272-3277.
- Rahmalia, R., Hajidin, H., & Ansari, B. I. (2020). Peningkatan Kemampuan Komunikasi Matematis dan Disposisi Matematis Siswa SMP Melalui Model Problem Based Learning. *Numeracy*, 7(1), 137-149.
- Riyati, I., & Suparman, S. (2019). Design student worksheets based on problem-learning to enhance mathematical communication. *Asian Journal of Assessment in Teaching and Learning*, 9(2), 9-17.
- Rohid, N., & Rusmawati, R. D. (2019). Students' Mathematical Communication Skills (MCS) in Solving Mathematics Problems: A Case in Indonesian Context. *Anatolian Journal of Education*, 4(2), 19-30.
- Simanullang, N. H. S., & Rajagukguk, J. (2020). Learning Management System (LMS) based on moodle to improve students learning activity. In *Journal of Physics: Conference Series* (Vol. 1462, No. 1, p. 012067). IOP Publishing.
- Styawati, S., Ariany, F., Alita, D., & Susanto, E. R. (2020). Pembelajaran Tradisional Menuju Milenial: Pengembangan Aplikasi Berbasis Web Sebagai Penunjang Pembelajaran E-Learning Pada Man 1 Pesawaran. *Journal of Social Sciences and Technology for Community Service (JSSTCS)*, 1(2).
- Sudia, M., & Muhammad, A. P. A. (2020). A PBL model to improve students' mathematical communication abilities: self-regulated learning. *Int. J. Innovat. Creativ. Change*, 12(7), 537-554.
- Sugiyono. (2015). *Metode Penelitian Kombinasi (Mixed Methods)*. Bandung: Alfabeta.
- Sulistiawati, Y., Amalia, R., & Rahma, R. A. (2021). Hubungan kebutuhan afeksi terhadap perilaku cyberbullying pada mahasiswa. In *Seminar Nasional Psikologi UM* (Vol. 1, No. 1, pp. 173-178).
- Sumadi, N. G., Sholihah, N., & Musannadah, R. (2019). Penerapan model think-talk-write (TTW) dalam pembelajaran matematika sebagai upaya meningkatkan kemampuan komunikasi matematis dan menurunkan mathematics anxiety siswa. In *Prosiding Seminar Pendidikan Matematika dan Matematika* (Vol. 1, pp. 105-111).
- Sumadi, N. G., Sholihah, N., & Musannadah, R. (2019). Penerapan model think-talk-write (TTW) dalam pembelajaran matematika sebagai upaya meningkatkan kemampuan komunikasi matematis dan menurunkan mathematics anxiety siswa. In *Prosiding Seminar Pendidikan Matematika dan Matematika* (Vol. 1, pp. 105-111).
- Suryawati, E., & Osman, K. (2017). Contextual learning: Innovative approach towards the development of students' scientific attitude and natural science performance. *Eurasia Journal of mathematics, science and technology education*, 14(1), 61-76.
- Syaifuddin, T., & Nurlaela, L. (2021). Contextual Teaching and Learning (CTL) Model to Students Improve Learning Outcome at Senior High School of Model Terpadu Bojonegoro. *IJORER: International Journal of Recent Educational Research*, 2(5), 528-535.
- Syamsuddin, S., & Istiyono, E. (2018, September). The effectiveness of mathematics learning through contextual teaching and learning approach in Junior High School. In *AIP Conference Proceedings* (Vol. 2014, No. 1, p. 020085). AIP Publishing LLC.
- Tanjung, H. S. (2019). Peningkatan Kemampuan Komunikasi dan Matematis Siswa SMA melalui Model pembelajaran Berbasis Masalah. *MAJU: Jurnal Ilmiah Pendidikan Matematika*, 4(2).
- Tiantong, M., & Teemuangsai, S. (2013). Student Team Achievement Divisions (STAD) Technique through the Moodle to Enhance Learning Achievement. *International Education Studies*, 6(4), 85-92.
- Umek, L., Keržič, D., Aristovnik, A., & Tomažević, N. (2015). Analysis of selected aspects of students' performance and satisfaction in a Moodle-based e-learning system environment. *Eurasia Journal of Mathematics, Science and Technology Education*, 11(6), 1495-1505.

- Utami, F. D., Sulhadi, S., & Sugianto, S. (2018). Pembelajaran Fisika Menggunakan Pendekatan CTL Berbantuan Media Video untuk Meningkatkan Hasil Belajar Siswa. *UPEJ Unnes Physics Education Journal*, 7(2), 94-103.
- Wahyuni, T. S., Amelia, R., & Maya, R. (2019). Analisis kemampuan komunikasi matematis siswa SMP pada materi segiempat dan segitiga. *Jurnal Kajian Pembelajaran Matematika*, 3(1), 18-23.
- Yuwandra, R., & Arnawa, I. M. (2020, May). Development of learning tools based on contextual teaching and learning in fifth grade of primary schools. In *Journal of Physics: Conference Series* (Vol. 1554, No. 1, p. 012077). IOP Publishing.
- Zulfah, Z., & Rianti, W. (2018). Kemampuan Komunikasi Matematis Peserta Didik Melalui Soal PISA 2015. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, 7(1), 49-56.