e-ISSN: 062-7109
Proceeding International Conference on Learning Community (ICLC)
Volume 1 No 1, 2024
https://jurnal.untirta.ac.id/index.php/iclc/index

Implementation of Learning Communities to Improve Critical Thinking Skills in Mathematics Lesson: A Systematic Literature Review

Winda Khadijah Ashareni Tanjung[1], Entit Puspita[2]

[1]Department of Mathematics Education, Faculty of Mathematics and Natural Sciences Education, Bandung-Indonesia
[2]Department of Mathematics Education, Faculty of Mathematics and Natural Sciences Education, Bandung-Indonesia

email correspondence: windakhadijah3@upi.edu

ABSTRAK

Learning communities are a form of sustainable collaboration and knowledge-sharing between individuals to achieve certain goals. Learning communities are a way for groups of people to solve problems, especially in education. In mathematics lessons, it is important to have high-level thinking skills, one of which is critical thinking. This research aims to analyze the design and practice of learning communities in schools to improve students' mathematical critical thinking skills. The method used is the SLR (Systematic Literature Review) method. Collecting journals is done by identifying journals that meet the specified inclusion and exclusion criteria. The research results show that several learning community designs that can be practiced in schools, include Math-Talk Learning Community, Lesson Study for Learning Community, professional learning community, and interactive groups. Apart from that, learning community practices show that there are positive implications in improving students' mathematical critical thinking skills with the existence of learning practices in schools.

Keywords: Learning communities; Critical Thinking Skills; Mathematics Lesson.

INTRODUCTION

Education is a process of helping individuals discover their potential and develop individual abilities in a better direction. This process will form, train, and improve individuals or group abilities through the teaching and learning process (Hamdiyanti, 2019). In the 21st era of education, learning outcomes not only refer to understanding learning materials but also emphasize the development of student's cognitive and social abilities. These abilities will direct students to face the challenges of changing times. Students need to be encouraged to develop their knowledge so that they can resolve and solve the problems they face (Haryanti, 2017).

One of the important thinking skills that students must have is critical thinking skills, especially in mathematics. Facione (2015) stated that critical thinking is one of the thinking skills that proves, interprets, synthesizes, and evaluates information to obtain the truth. Critical thinking in mathematics is the ability to process previous knowledge, and mathematical reasoning and prove or evaluate mathematical situations with cognitive strategies in a reflective way (Abdullah, 2013). Students who think critically can provide inferences from the information obtained can use the information to solve a problem and can find appropriate information to support solving the problems faced (Ida et al., 2021).

However, in reality, education in Indonesia is still low and many students cannot think critically. Several factors that influence this are learning which is still centered in one direction, which is monotonous and still relies on the lecturing method. The lecture method is very good to use in learning, but this makes students feel bored in the learning process (Mardliyah et al., 2023). There needs to be a slight change that involves students in the thinking process so that interaction can be two-way like a learning community.

A learning community is an activity of sharing knowledge and collaborating between individuals which is carried out in a sustainable and planned manner, discussing and reflecting to

improve quality by the goals to be achieved (Rini, 2021). Through learning community, a school learning community will be formed, where there is a process of cooperation in learning and teaching between teachers, students, or teacher and students, even more broadly between the school community and outside the school (Jaya, 2020). In this case, learning communities are considered a form of collaboration and discussion between individuals to achieve common goals.

In this research, learning community practice plays an important role in improving students' cognitive abilities. In this case, the LC focuses more on critical-thinking skills so that LC becomes accessible for students to reflect on their learning and become critical thinkers in developing their understanding. This provides an illustration that when an LC is implemented, critical thinking skills will emerge with the existence of various learning sources and knowledge between individuals (Sukarjita, 2020) Research on the effect of LC in improving critical thinking skills was conducted by Indrawati et al (2019) on triangular problem-solving material for class VII junior high school students. The results of the research show that LC has a significant influence on critical thinking abilities.

The development of students' critical thinking abilities will support their abilities in mathematics lessons. In this case, the application of learning communities becomes one of the accesses in the process of supporting critical-thinking students in learning mathematics. Collaboration that is formed in the classroom or at school provides a different learning experience in the learning process. Therefore, the existence of several learning community designs used has an impact and influence in improving students' critical thinking abilities.

RESEARCH METHODS

The research method used is the System Literature Review (SLR) method.SLR is the process of collecting, identifying, and analyzing a particular topic that is relevant to a predetermined topic to obtain answers to the questions being researched (Mengist et al., 2019). In this research, researchers will review several journals related to learning community design and practices on students' mathematical critical thinking abilities. The stages carried out in this research include:

The first stage is a Research Question (RQ) which is adapted to the research topic. In this case, the researcher asked three questions, including (RQ1) What are the learning community designs applied in the school environment and which LC designs are most widely applied to mathematics lessons?; (RQ2) How the LC design is implemented in the school environment; (RQ3) How are students' critical thinking abilities after implementing LC at school?

The second stage is the search process, which is looking for journal references that match the research topic. References that have been registered on Google Scholar, Semantic Scholar Research Gate, and Taylor and Francis which were published from 2015-2024. The journals that have been collected to the keywords used, namely related to the application of LC in the school environment and students' critical thinking abilities will be included in the analysis stage.

The third stage is inclusion and exclusion criteria which are used to determine articles that are appropriate to the research topic. Inclusion and exclusion criteria can be seen in Table 1 below.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
National and international journals relevant to the research topic	National or international journals that are not relevant to the research topic
Journals obtained via Google Scholar, Semantic Scholar, Research Gate, and Taylor and Francis	The Journals were not obtained through Google Scholar, Semantic Scholar, Research Ggate, and Taylor and Francis
Subject used in research on mathematics subjects	Subjects used in research are not mathematics subjects
The publication time range for the journals used is 2015-2024	The published time range for journals used it before 2015
The language used is Indonesian or English	The language used is other than Indonesia or English

The fourth stage is Quality assessment (QA) which evaluates journal quality based on assessment criteria. Some questions used to evaluate the journals include: (QA1) Does the collected journal include information on how the learning community is implemented in school? (QA2) Was the journal published between 2015-2024? (QA3) Does the journal discuss students' critical thinking skills? Based on these QA questions, the answer for each journal will be either yes or no.

The fifth stage is the collection and analysis of data. After the journals were collected, the researchers found 25 journals related to learning communities in schools, then selected 12 journals appropriate to the research topic and inclusion criteria that would be reviewed. Based on the evaluation results of several criteria above, the researcher includes 12 journals that are relevant to the topic to be reviewed.

RESULTS AND DISCUSSION

Result

Based on the results of journal searches via Google Scholar, Semantic Scholar, Research Gate, Taylor and Francis, 12 journals were obtained that were relevant to keywords relating to the application of learning communities in mathematics learning, and their relationship to critical thinking skills, then the journals that had been collected would be reviewed accordingly with the topic to be reviewed The following are the results of research on learning community design and practice on students' critical thinking abilities.

Table 2 Research results on learning community practices in schools to improve student's critical thinking skills

Researchers and research Years	Journal	Research Result
Million Chauraya & Patrick Barmby (2022)	Indonesian Journal of Educational Research and Review	In developing the practical community used a professional learning community that is a collaboration between teacher and facilitators, teacher and students, and between students in improving the quality of continuous mathematics learning. The research showed that teachers changed from passive to active learning and created collaboration in sharing ideas
Dawn M. Woods (2022)	Journal of Mathematical Behavior	This research focuses on learning communities among students, namely using the math-talk learning community method. The research results show that math-talk supports students in building and understanding their mathematical thinking. Teachers provide space for students to guide so that students can provide that will develop their thinking process.
Ari Saputra & Riris Sugianto (2023)	Journal of Education and Counseling	The research results show that the application of Lesson Study for Learning Community provides innovative students with critical thinking skills. In their activities, teachers and lecturers carry out learning reconstruction by applying LSLC and designing contextual learning methods with P3K, namely studying, presenting, strengthening, and working on questions. After the implementation

		of P3K, reflection was carried out to see the observer's notes regarding improvements in classroom learning from each cycle which had positive implications for future learning.
Laura Bofferfing & Melissa Kemmerle (2015)	Journal Teacher Educators	The research results concluded that the number string supports teachers in facilitating mathematical conversations. Number string is a discussion process between students where the teacher asks questions in a horizontal or vertical pattern which facilitates discussion and students' thinking process so that an active learning community is formed.
Rani Laksmita (2019)	Journal of Education Action Research	Applying the learning community model to students provides positive implications and improves students' learning outcomes and critical thinking abilities. In its implementation, students are divided into several groups and every student has a role and opportunity to share discussion results with other groups using a pair discussion system.
Dian Atika Sofie, Didik Sugeng Pambudi, Mohamat Fatekuhorman Nucholif Diah Seri Lestari & Dian Kurniati (2023)	Journal of the Mathematics Education Study Program	Based on the research results, it was found that the critical thinking abilities of students in the experimental class increased by implementing the LSLC-based Realistic Mathematics Education (RME) approach compared to the control class. In implementing LC, teachers take an RME approach where students rediscover mathematical concepts that are appropriate to the reality of the students' environment in solving mathematical problems.
Vara Ninan Yulian, Wahyudin & Darhim (2023)	Al-Jabar: Journal of Mathematics Education	The result obtained by having effective questions from the teacher builds mathematical discussions in the math-talk community encourages deeper student thinking and develops students' critical thinking and mathematical communication skills as well as enhancing students' learning experiences.
Teoh Sian Hoon, Muhammad Mubarrak bin Mohd Yusof, Nor Syazwani Mohd Rasid, Siti Rosiah binti Mohammed & Ainun Hafizah binti Mohd (2021)	Asian Journal of University Education (AJUE)	Based on the results of the study, it was found that the practice of mathematics learning communities in schools involves all parties, namely teachers, parents, and students in developing mathematics education with teachers playing a key role in building relationships within the learning community. The teacher conducts learning with question-and-answer discussions to develop student's

		metaphysical abilities. Increasing student interest will trigger students to be involved in learning mathematics and develop critical thinking skills.
Anita Zunarni, Behid Shalikatus, Sakina, Shirly Rizky Kusumaningrum & Raden Sukma Indra Dewi (2020)	Scientific Journal of Mandala Education (JIME)	Based on the research results, it can be concluded that classes that implement learning communities have a positive influence and improve students' problem-solving abilities. This also shows that students can put forward critical ideas in solving the problems given. In its application, students are divided into several groups and students hold discussions and exchange ideas related to the mathematical problems given
Asri Ode Samura, Darhim, Dadang Juandi, Arwan M. Said, Muhlis Malaka (2021)	International Journal of Interactive Mobile Technologies	The results of the analysis show that the application of the learning community assisted by Geogebra provides space for students to build their abilities and improve their critical and creative thinking abilities.
Hobri, Ice Stiawati, Antonius Cahya Prihandoko (2018)	International Journal of Engineering & Technology	The research results show that the application of LSLC-based CTL has a significant effect on students' higher-order thinking abilities. The implementation is by dividing students into small groups. The process consists of five stages, namely construction, finding, evaluating, presenting, and reflecting
Rocio Garcia, Carrion & Javier (2015)	European Educational Research Journal (EERJ)	In implementing learning communities, teachers form interactive groups coordinated by adults such as teachers, family members, or volunteers. This interactive group will provide space for students to engage in dialogue critically with each other's ideas.

Discussion

Based on research question 1, namely what learning community designs are applied in the school environment, and which LC designs are most widely applied in mathematics lessons? Based on the results of journals that have been collected in the period 2015-2024, 12 journals were obtained. The design used can be seen in Figure 1.

e-ISSN: 062-7109
Proceeding International Conference on Learning Community (ICLC)
Volume 1 No 1, 2024
https://jurnal.untirta.ac.id/index.php/iclc/index

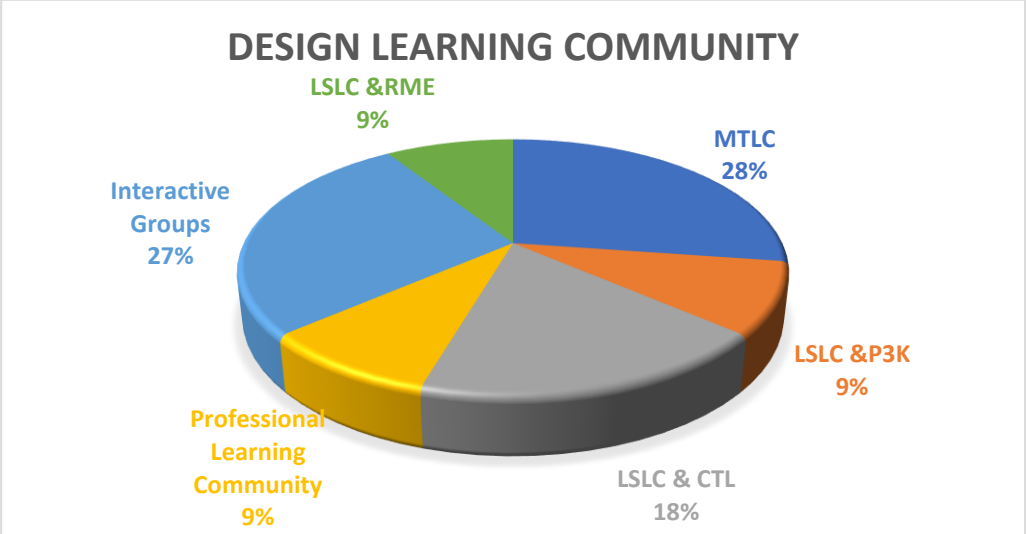

Figure 1. Designing Learning Communities in Schools in Mathematics Lessons

Based on the picture above, it can be seen that the learning designs used most often by implementing learning communities are Math-Talk Learning Community (MTLC) and interactive group learning at 27%. Apart from that, it can be seen that LC that is widely used is LSLC which is combined with several learning models such as RME, CTL, and P3K.

In research question 2, namely how the application of the LC design is implemented in the school environment based on the results of the review of the 12 journals above.

Based on the research above, there are several designs used in schools to improve student's critical thinking skills. First, the design of the MTLC in Wood's (2022) research, the practice of the MTLC process begins with collaboration between teachers and researchers in planning the learning process by implementing a weekly Number Talk Club (NTC) where teachers explore, prepare, implementing, and reflecting on the teaching methods that have been planner, apart from that in the research of Bofferding et al (2015) MTLC was combined with number strings and questions that build discussion. Learning begins with several constructive questions and the teacher provides problems to build students' thinking process. This was also carried out in research by Yulian et al (2023) where there were constructive questions that enabled students to play an active role and be able to explain the mathematical understanding they had obtained and write the answer on the blackboard. At the end of the lesson, the teacher summarizes the ideas obtained and provides conclusions in a group discussion. In the process there are five components including the role of the teacher in the community where the teacher facilitates students in reflecting on their understanding, explaining mathematical thinking between students, mathematical representation, and learning responsibility where students take an active role in learning.

Second, the learning design in schools that is often implemented is LSLC. LSLC is a collaborative process between teachers and observes and reconstructs learning to improve students' abilities. In practice, LSLC has three stages, including plan , do, and see. The plan is where the teacher prepares a learning plan, then the implementation of the learning plan, and after the lesson is finished reflection is carried out. Based on the journals above, LSLC is combined with P3K, CTL, and RME.

In practice, Saputra et al (2023) implemented LSLC combined with P3K applied with a process f studying, presenting, strengthening, and working on questions carried out in two cycles in the process of improving high school students critical thinking abilities. Apart from that, Laksmita (2019) implemented LSLC combined with CTL (Contextual Teaching and Learning). CTL is a

learning process where the teacher links the learning taught with students' lives so that students can see the relationship between the knowledge they have acquired and their daily lives. In practice, students are divided into several small groups where each student has their role, such as the leader, who takes notes, makes conclusions, and makes presentations so that there is interaction between each group. Meanwhile, Setiawati et al (2018) in practice apply several stages, namely the constructing and discovering stage where students are given practice questions, then the presentation and reflection stage, where students are focused on thinking individually or in groups, then the assessment stage where students are given practice questions, and then the presentation and reflection stage. The combined practice design in Sofie et al's (2023) research is LSLC combined with RME starting by dividing students into small groups and then providing worksheets. In solving these problems, students carry out RME steps where students solve real problems in everyday life.

Third, another design implemented is a professional learning community based on research by Chauraya et al (2022) where in practice teachers and facilitators work together continuously and reflectively to improve students' mathematical abilities. This is done by analyzing student errors and student understanding regarding mathematics story problems. Then discuss the teaching strategies that will be used to overcome previous student problems. The strategy used in this research is to mark keywords in each question. At the end of the meeting, everything that was obtained based on the implementation of the strategy was conveyed.

The fourth design is the formation of interactive groups at school. In the practical process, Hoon et al (2021) implemented LC by dividing students into several small groups of four or five students and then asking them high-level thinking questions to develop their thinking. Meanwhile, research by Samura et al (2021) implemented interactive groups with the help of the Geogebra application which helps students solve questions given by the teacher. Each group has a leader who animates the discussion then the results obtained will be presented followed by questions and answers by each group.

The third research question is how students' critical thinking abilities are after implementing at school. Based on the results of the review of the twelve journals, there are differences in indicators in determining student's increased critical thinking skills, including the following:

1. In the application of MTLC, critical thinking skills can be developed by implementing discussions and questions and answers that raise students' critical ideas during math talks. Apart from that, when the teacher asks constructive questions, it provides space for students to find answers to these problems which will encourage an increase in students' mathematical critical thinking abilities.
2. In implementing LSLC, with a plan from students to improve critical thinking skills, there are several strategies carried out by students that have positive implications for the development of student's critical thinking skills. In this case, several indicators observed by the teacher are clarity, precision, level of accuracy, relevance, logical thinking, breadth of viewpoint, depth of thinking, and student honesty. Apart from that, several studies use indicators of critical thinking skills such as interpretation, analysis, inference, and explanation. The results show that there is an increase in students; critical thinking abilities with the implementation of LSLC with a combination of approaches applied by the teacher.
3. In the implementation of professional learning communities, critical thinking skills can be improved by solving mathematics problems based on real problems which can build students' critical thinking skills.
4. In the application of interactive learning community groups, have a form that is almost the same as MTLC where it is focused on the active role of students and cooperative learning which encourages discussion and exchanging critical suggestions as well as group activities in solving text questions.

Thus the practice of learning communities in schools has positive implications, one of which is that it can improve students' mathematical critical thinking abilities. This can be influenced by discussions between students, questions and answers between teachers and students, or by mathematical problem-solving tests given which provide space for students to work together to improve their critical thinking skills.

CONCLUSIONS

Based on the results of the review and identification analysis from the twelve journals, it illustrates that the learning community design for mathematics lessons consists of a Math-Talk Learning Community (MTLC), Learning Study for Learning Community (LSLC) with several approaches such as contextual learning, RME, or P3K. Apart from that, the design used is a professional learning community and interactive group. This design is applied in schools to improve students' thinking abilities. One of them is the ability to think critically. The existence of a sustainable learning community supports students' thinking processes and provides challenges for teachers to continue to construct better learning in the future

REFERENCES

Abdullah, I. H. (2013). Berpikir Kritis Matematik. *Delta-Pi: Jurnal Matematika dan Pendidikan Matematika*. 2(1): 66-75

Bofferding, L., & Kemmerle, M. (2015). Elementary Teacher Candidates' Use of Number Strings: Creating a Math-Talk Learning Community. *Mathematics Teacher Educator*. 3(2):99-115. https://doi.org/10.5951/mathteaceduc.3.2.0099

Chauraya, M., Barmby, P. (2022) Features of a Developing Mathematics Professional Learning Community and Affordances for Teacher Learning Opportunities. *Indonesian Journal of Educational Research and Review*. 5(1):205-216. I: http://dx.doi.org/10.23887/ijerr.v5i1

Facione, P. A. (2015). *Critical Thinking: What it is and Why it counts*. Insight Assessment. https://doi.org/ISBN 13: 978-1-891557-07-1

Garcia, R.C., &Diez, J. Palomar., (2015). Learning Communities: Pathways for Educational Success and Social Transformation Through Interactive Groups in Mathematics. *European Educational Research Journal (EERJ*) 14(2): 151-166. DOI: 10.1177/1474904115571793

Hamdiyanti, M. (2019). Pengaruh Pembelajaran Kooperatif Tipe Talking Chips Melalui Pendekatan Learning Community Terhadap Hasil Belajar Matematika Siswa. *Pediamatika: Journal of Mathematical Science and Mathematics Education*.1(1):155-164

Haryanti, Y. D. (2017) Model Problem Based Learning Membangun Kemampuan Berpikir Kritis Siswa Sekolah Dasar. *Jurnal Cakrawala Pendas*. 3(2): 57-63. https://doi.org/10.31949/jcp.v3i2.596

Hobri, Septiawati, I., Prihandoko, A.C. (2018). High-Order Thinking Skill in Contextual Teaching and Learning of Mathematics Based on Lesson Study for Learning Community. *International Journal of Engineering & Technology*. 7(3):1576-1580

Hoon, T.S. Et al. (2021). Mathematics Learning Community: A Case Study. *Asian Journal of University Education (AJIUE).* 17(2): 253-261

Ida, Sunnah, Aziz, R., Irawan, W. H. (2021). Critical and Creative Thinking Skills for Math Story Problems Instruction at Elementary School. *Journal of Educational Thought and Research*. 19(2): 98- 113

Indrawati, D et al. (2019). Critical Thinking Ability in Solving Triangle Problems Based on Lesson Study for Learning Community (LSLC). *IOP Conf. Series: Earth Environ*. Sci.243 012146. doi:10.1088/1755-1315/243/1/012146

Jaya, P. E. J. (2020). Meningkatkan Hasil Belajar Siswa dengan Metode Learning Community. *Jurnal Pendidikan Ekonomi Undiksha*. 12(1): 36-49

Laksmita, R. (2019). Upaya Untuk Meningkatkan Hasil Belajar Matematika dan Keterampilan Berpikir Kritis Siswa Melalui Penerapan Kontekstual dengan Model Learning Community. *Journal of Education Action Research*. 3(2):167-172

Mardliyah, S. Z., Salsabilla, A. P, & Herianingtyas, N.L.R. (2023). Strategi Peningkatan Kemampuan Berpikir Kritis Siswa Melalui Learning Community. *Awaliyah:Jurnal PGMI*. 6(2):103-109

Mengist, W., Soromessa, T, & Legese, Gudina. (2020). Method for Conducting Systematic Literature Review and Meta-analysis for Environmental Science Research. *MethodX*. 7, 100777. doi:10.1016/j.mex.2019.100777

Rini, A. P. (2021). Lesson Study for Learning Community (LSLC*). Jurnal Ilmu Agama Islam* 3(1): 25-38. https://doi.org/10.36269/tlm.v3i01.376

Samura, A.O. et al. (2021). Improving the Creative Thinking Ability of Junior High School Students Through Geogebra Assisted Learning Community in Mathematics. *International Journal of Interactive Mobile Technologies*.15(22). 84-98

Saputra, A. & Sugianto, R. (2023). Peningkatan Kemampuan Berpikir Kritis Siswa Melalui Kegiatan Lesson Study for Learning Community di SMAN 3 Selong. *Jurnal Pendidikan dan Konseling*. 5(1): 2772-2777

Sofie, D. A. et al. (2023). Peningkatan Kemampuan Berpikir Kritis Siswa Dengan Pendekatan RME Berbasis LSLC. *Jurnal Program Studi Pendidikan Matematika*. 12(1):2773-2784

Sukarjita, I. W. (2020). Learning Community dalam Perkuliahan Untuk Membangun Kemampuan Berpikir Kreatif Mahasiswa. *Lentera Sains: Jurnal Pendidikan IPA*. 10(1):11-24

Woods, F. M. (2022). Building a Math-Talk Learning Community Through Number Talks. *Journal of Mathematical Behavio*r.67:1-2

Yulian, V. N., Wahyudin, Darhim. Students' Mathematical Communication Through Math-Talk Learning Community: Describing Levels and Components. *Aljabar: Jurnal Pendidikan Matematika*. 14(1):121-132

Zunarni, A., et al. (2022). Pengaruh Belajar dalam Meningkatkan Kemampuan Siswa dalam Memecahkan Masalah Soal Matematika di Kelasa V. *Jurnal Ilmiah Mandala Education (JIME)*.8(4): 3053-306.:10.36312/ jime.v8i4.4079/ http:// ejournal.mandalanursa.org/ index.php/ JIME