Systematic Literature Review:The Effect Of The Teams Games Tournament (TGT) Type Cooperative Model On Students' Mathematical Communication Abilities And Learning Independence

Anisa Rofiah[1*], Nuryadi[2]
[1,2)]Pendidikan Matematika, FKIP, Universitas Mercu Buana Yogyakarta
[*]e-mail : fiahsa2211@gmail.com

Abstrak

Kemampuan komunikasi matematis dan kemandirian belajar sangatlah penting untuk dikuasai oleh siswa. TGT menjadi salah satu model pembelajaran yang dapat digunakan untuk meningkatkan komunikasi matematis dan kemandirian belajar. Penelitian ini bertujuan untuk mengkaji secara sistematis pengaruh model pembelajaran kooperatif tipe *Teams Games Tournament* (TGT) terhadap kemampuan komunikasi matematis dan kemandirian belajar siswa. Metode yang digunakan adalah *Systematic Literature Review* (SLR) dengan mengacu pada pendekatan Kitchenham, mencakup tahap perumusan pertanyaan penelitian, pencarian literatur melalui basis data akademik (Google Scholar, Garuda, ScienceDirect, ResearchGate), serta analisis dan sintesis data. Seleksi dilakukan terhadap artikel terbitan tahun 2013–2025 dengan fokus pada model TGT dalam konteks pembelajaran matematika dan variabel komunikasi matematis maupun kemandirian belajar. Dari 15 artikel yang terpilih, ditemukan bahwa model TGT secara konsisten memberikan dampak positif terhadap kemampuan komunikasi matematis siswa. Melalui kolaborasi dalam tim dan aktivitas kompetitif yang menyenangkan, TGT mendorong siswa untuk aktif berdiskusi, menyampaikan gagasan secara lisan dan tulisan, serta meningkatkan penguasaan representasi matematis. Selain itu, TGT juga berperan dalam menumbuhkan kemandirian belajar dengan meningkatkan tanggung jawab individu dalam menyelesaikan tugas dan pengambilan inisiatif belajar. Meskipun demikian, beberapa penelitian menunjukkan bahwa hubungan antara TGT dan kemandirian belajar bersifat kontekstual dan dipengaruhi oleh faktor internal siswa serta desain pembelajaran. Hasil SLR ini menyimpulkan bahwa TGT merupakan strategi pembelajaran efektif yang mampu meningkatkan dua kompetensi esensial abad ke-21, yaitu komunikasi matematis dan kemandirian belajar. Oleh karena itu, implementasi model ini sangat direkomendasikan sebagai pendekatan inovatif dalam pembelajaran matematika.

Kata Kunci: Team Games Tournament, komunikasi matematis, kemandirian belajar, pembelajaran kooperatif, Systematic Literature Review.

Abstract

Mathematical communication skills and learning independence are very important for students to master. TGT is one of the learning models that can be used to improve mathematical communication and learning independence. This study aims to systematically examine the effect of the Teams Games Tournament (TGT) cooperative learning model on students' mathematical communication skills and learning independence. The method used is the Systematic Literature Review (SLR) with reference to the Kitchenham approach, including the stages of formulating research questions, searching for literature through academic databases (Google Scholar, Garuda, ScienceDirect, ResearchGate), and data analysis and synthesis. The selection was carried out on articles published in 2013–2025 with a focus on the TGT model in the context of mathematics learning and mathematical communication variables and learning independence. From the 15 selected articles, it was found that the TGT model consistently had a positive impact on students' mathematical communication skills. Through collaboration in teams and fun competitive activities, TGT encourages students to actively discuss, convey ideas verbally and in writing, and improve their mastery of mathematical representation. In addition, TGT also plays a role in fostering learning independence by increasing individual responsibility in completing tasks and taking learning initiatives. However, several studies have shown that the relationship between TGT and learning independence is contextual and influenced by internal student factors and learning design. The results of this SLR conclude that TGT is an effective learning strategy that is able to improve two essential competencies of the 21st century, namely mathematical communication and learning independence. Therefore, the implementation of this model is highly recommended as an innovative approach in mathematics learning.

***Keywords**: Team Games Tournament, mathematical communication, learning independence, cooperative learning, Systematic Literature Review.*

INTRODUCTION

Mathematics learning should not only emphasize numerical abilities, but should also be able to develop students' logical thinking, critical skills, and mathematical communication skills. However, in reality, many students still have difficulty conveying mathematical ideas, both verbally and in writing (Winarso, 2014). This reflects a weakness in mathematical communication skills which are very important in the learning process. In addition, the low level of learning independence is also a serious challenge in achieving optimal learning outcomes, where many students tend to be passive and dependent on the role of the teacher (Febriansyah & Samin, 2025). The conventional teacher-centered learning model is one of the main causes of this problem.

Therefore, according to research by Kamza et al., (2021), it is necessary to implement a learning model that can encourage students to be more active, create a pleasant learning atmosphere, and facilitate cooperation between students. One of the relevant and widely used learning models is the Teams Games Tournament (TGT), which is a type of cooperative learning. Various studies have shown that the mathematical communication skills of students in Indonesia are still classified as moderate to low. For example, the results of PISA (Program for International Student Assessment) show that the mathematical literacy of Indonesian students is below the average of other participating countries (Stacey, 2011). In addition, the results of observations and evaluations in class also show that many students are not yet able to learn independently without continuous guidance from teachers (Damanik & Handayani, 2023).

Although various learning models have been developed to address this issue, research that systematically examines the effectiveness of the Teams Games Tournament (TGT) cooperative model in improving mathematical communication skills and learning independence is still relatively limited (Muslim, 2020). Previous studies usually discuss both aspects separately or in a limited context, without providing a comprehensive review of the published results.

Along with the increasing demands of learning in the 21st century, the development of mathematical communication skills and learning independence is becoming increasingly important. Both are key competencies needed to face global challenges and play a role in shaping students' character who can overcome everyday problems (Rohmah, et al., 2023). Therefore, a systematic mapping of research related to learning models that can develop both aspects simultaneously is needed.

This study aims to conduct a Systematic Literature Review (SLR) on research that examines the influence of the Teams Games Tournament (TGT) cooperative model on students' mathematical communication skills and learning independence. Through this approach, it is expected to obtain a comprehensive picture of the effectiveness of the TGT model, developing research trends, and opportunities that can still be explored for further development.

METHOD

This study applies the Systematic Literature Review (SLR) method to examine the effect of the Teams Games Tournament (TGT) cooperative learning model on students' mathematical communication skills and learning independence. SLR is a systematic, transparent, and repeatable approach method that aims to identify, evaluate, and combine research results that are relevant to a particular topic. The SLR process in this study refers to the model developed by Kitchenham, which consists of three main stages: formulation of research questions, literature search, and data analysis and synthesis. The main focus of the research question is focused on the extent to which the TGT model has an impact on students' mathematical communication and learning independence based on the results of previous studies.

Literature searches were conducted through academic databases such as Google Scholar, Garuda, ScienceDirect, and ResearchGate. The inclusion criteria used included: (1) articles in the period 2013 to 2025, (2) research that focuses on the TGT model in mathematics learning, (3) discussing the variables of mathematical communication skills and/or learning independence, and (4) published in accredited national or international journals. Meanwhile, articles that were not available in full version or were not relevant to the research topic were excluded from the analysis. The literature selection process was carried out in stages, starting from identifying the title and

abstract, then reviewing the contents of the article as a whole. The selected articles were then analyzed descriptively qualitatively to identify patterns, important findings, and research gaps. The results of the analysis were used to draw conclusions regarding the effectiveness of the TGT model on the development of mathematical communication and students' learning independence

RESULTS AND DISCUSSION

Based on the results of the analysis conducted, there are 15 scientific articles related to the influence of the Team Games Tournament (TGT) type cooperative model on students' mathematical communication skills and learning independence. The scientific articles found are divided into 3 parts, namely 8 scientific articles discussing TGT research on mathematical communication skills, 6 scientific articles discussing TGT research on students' learning independence and 2 scientific articles discussing TGT research on mathematical communication skills and students' learning independence. The research results included in this article are presented in the following tables.

1. Research on TGT towards Mathematical Communication Ability

   TGT type cooperative learning provides students with the opportunity to communicate actively with team collaboration. The team collaboration process requires students to communicate with each other, explain symbols, images, mathematical operations used in the context of the material, this will have a permanent impact on each student if they work together to find new knowledge from the material being studied (Sulisto & Haryanti, 2022). The following are some articles that review this research which are presented in the following table:

Table 1.TGT Research on Mathematical Communication Ability

Journal	Author	Research Result
ASYMMETRICS: Journal of Mathematics and Science Education: Volume 4 Number 1	The film stars Deva Setiawati and Della Safira.	The research results obtained from data analysis show that learning using the Teams Games Tournament (TGT) learning model can improve students' communication skills.
Journal of Communication: Volume 2 Number 11	Tiana Octaviani, Syahrul Anwar, Yusuf Juanedi (2024)	Based on the results of the study, it can be concluded that the testing conducted with the Paired Sample Test obtained output from both. This means that if a comparison is made between the two classes of pretest and posttest results, a significant difference in value is obtained, namely 7.34, where the experimental class is superior by 7.34 using the Teams Games Tournament learning model compared to the control class using the conventional learning model.
Journal of Classroom Action Research: Volume 6 Number 1	Fakhrian Nur Anisa, Muhammad Turmuzi, Tabita Wahyu Triutai, Amrullah (2024)	Based on the results of the study, there is an influence of the cooperative learning model of the Teams Games Tournament (TGT) type on the mathematical communication skills of class VIII students. This can be shown by the average posttest score of the experimental

		class, which is 13 while the control class is 11.6, indicating that the TGT type cooperative learning model is more effective and has a greater effect in influencing students' mathematical communication skills compared to conventional learning model methods.
Euclid's Journal: Volume 3 Number 2	The Legend of Zelda (2016)	The results of the instrument, the category of high qualification experimental class and medium qualification control class. So it is concluded that the increase in mathematical communication skills of students who receive cooperative learning type Teams Games Tournament is better than students who receive conventional learning.
MathEdu Journal (Mathematic Education Journal) Volume 1 Number 2	Pearls of Dame Sihombing (2018)	Based on the results of the study, students' mathematical communication skills in the material of spatial figures taught after using the Teams Games Tournament learning model showed very satisfying results and were better than conventional learning. This is evidenced by the average value obtained after using the TGT learning model, which was an average of 87.63 and before using the TGT learning model, which was an average of 54.83. In addition, the results of the answer sheets filled in by students showed that students were more active, developing and increasing students' mastery of cognitive processes, providing opportunities for students to move forward according to their abilities and also raising students' spirits.
Journal of Mathematics Education and Science: Volume 7 Number 2	Anisa Wulandari, Zuida Ratih Hendrastuti, Dita Aldila Krisma (2024)	The results of this study are that the mathematical communication skills of students who applied the TGT learning model assisted by Kahoot and the mathematical communication skills of students who applied the direct learning model achieved classical completeness of 90%. Meanwhile, the mathematical communication skills of students who applied the TGT learning model assisted by Kahoot were better than the mathematical communication skills of students who were taught with the direct learning model with a value of$th\ itung$=2,230>$ttabel$=1,671

Journal : Macca Science Edu Journal : Volume 2 Number 1	Muhammad Idris Jafar, Rahmadani, Asriadi (2025)	The results of the study showed significant differences in students' mathematical communication skills before and after using the TGT cooperative learning model. This finding reinforces that the TGT learning model can encourage cooperation, independence, and active involvement of students in the learning process, which in turn improves their mathematical communication skills. Overall, this study shows that the TGT learning model has a significant positive effect on students' mathematical communication skills more effectively than conventional methods in learning mathematics.
Dikdactics: Journal of Elementary School Teacher Education	Muhammad Taufik Maulidin (20216)	Research Results on the achievement of mathematical communication skills of students who receive cooperative learning type Team Games Tournament is better than the achievement of mathematical communication skills of students who receive conventional learning. Based on the results of the analysis of student responses to the cooperative learning model type Teams Games Tournament that has been implemented, it shows that students respond well and have a positive attitude towards mathematics learning with cooperative learning type Teams Games Tournament
Algebra: Journal of Education, Social and Science: Volume 1 Number 3	Siti Chatijah, Fibri Rakhmawati (September, 2021)	The results of the study showed that there was a difference in the mathematical communication skills of students who were taught using the cooperative learning model of the Team Games Tournament (TGT) type, which was better than students who were taught using the Problem Solving learning model on Trigonometry material. Where it is known that the average mathematical communication skills of students who used the TGT learning model were 74.09 while the average value of critical thinking skills of students who were taught using the Problem Solving learning model was 59.40.

The Teams Games Tournament (TGT) Cooperative Learning Model is a method that combines group collaboration with academic competition through interesting games. In this approach, students are grouped into small, diverse teams to learn the material together. After

that, they compete in a quiz game in the tournament session. Each student plays a role in collecting points for their team, so this strategy not only improves academic ability but also strengthens mathematical communication skills and learning independence with good social interaction and healthy competition. In this way, the TGT model successfully creates an active, fun learning environment and is able to increase student participation in the material being taught.

In general, the results of the literature review show that the cooperative learning model with the Team Games Tournament (TGT) approach has been proven to have a positive impact on the development of students' mathematical communication skills. TGT encourages students to be more active in discussing, expressing ideas, and explaining their way of thinking when solving mathematical problems. Through teamwork and a competitive atmosphere, students not only understand the material, but are also trained to convey their understanding both verbally and in writing more regularly. The results of the data analysis show that students who learn using the TGT model have higher mathematical communication scores when compared to students who follow conventional learning methods.

Overall, the results of this study concluded that TGT is an effective learning method in improving students' mathematical communication skills. This model not only improves learning outcomes in terms of numbers, but also strengthens the learning process through social interaction and active participation of students. These findings indicate the importance of implementing organized collaboration strategies as an option in teaching mathematics that emphasizes the ability to think and communicate in a logical manner.

2. Research on TGT towards Student Learning Independence

In this study, the author presents the results of research that has examined the application of the cooperative learning model of the Teams Games Tournament (TGT) type on student learning independence. A summary of the journal articles that have been analyzed is presented in the following table:

Table 2. TGT Research on Student Learning Independence

Journal	Author	Research Result
Juring (Journal for Research in Mathematics Learning): Volume 4 Number 1	Annisah Kurniati, Nurul Jannah, Depi Fitriani (March 2021)	Based on the research results, there is a difference in the average understanding of mathematical concepts between students who use the cooperative learning model of the Teams Games Tournament type and students who use direct learning based on independent learning. This can be seen from the valuet_{hitung} = 2.4841> 2.36 or > then Ho is rejected and Ha is accepted. Thus, it can be concluded that there is a difference in the ability to understand mathematical concepts between students who follow learning with the cooperative learning model of the Teams Games Tournaments type and students who follow direct learning based on student learning independence.$t_{hitung}t_{tabel}$
Journal of Mathematics Education: Volume 8 Number 1	Murniati, Fahinu, Wayan Somayasa (January 2017)	The results of the study showed that students with high and moderate learning independence who were taught using the TGT cooperative learning model had better algebraic reasoning than students who received conventional learning.
Journal of	The Last Supper	The results of the study provide an overview

Education and Teacher Training: Volume 1 Number 4	(2014)	that cooperative learning of the Teams Games Tournament (TGT) type can further improve students' mathematical reasoning and connection abilities compared to direct learning, although it does not achieve perfect results. This is due to the high learning independence of students who participate in cooperative learning of the Temas Games Tournament (TGT) type so that students have a sense of curiosity when facing difficulties.
UMS Repository	Luh Paramawarti, Masduki (2013)	Based on the results of the study, it was concluded that there was an influence of student learning independence on mathematics learning outcomes. The higher the student's learning independence, the higher the achievement achieved and vice versa. There was no influence of learning models and independence on mathematics learning outcomes, this was based on the analysis of data obtained.t_{hitung} = -19.232 < = 3.105. The effect of using the TGT learning model on mathematics learning outcomes does not always depend on the level of student learning independence, where the level of student learning independence on student learning outcomes on mathematics learning outcomes also does not depend on the learning model.t_{tabel}
Sigma Journal of Learning and Mathematics: Volume 6 Number 2	Noble, Nuraina (2020)	The results of this study indicate that the increase in mathematical communication skills of students whose learning uses the cooperative learning model of the teams-games-tournaments type assisted by teaching aids is better than that of students whose learning uses ordinary learning.

The Team Games Tournament (TGT) learning model clearly shows a significant impact on improving students' ability to learn independently. The findings of this research indicate that the collaborative and competitive strategies implemented in TGT successfully encourage students to take more responsibility for their learning activities, manage their time efficiently, and proactively find solutions when faced with obstacles. Students' capacity for independent learning has improved along with the increasing relationships between group members, lively conversations, and self-evaluation after participating in the competition. From this literature review, it can be concluded that TGT is effective in shaping students to be more independent in learning activities.

The literature review that I reviewed confirms the opinion that learning methods that use teams, such as TGT, not only have a positive impact on increasing academic insight, but also play a role in forming independent characters in students. During the competition, students are challenged to improve their communication skills, find solutions to problems individually, and be actively involved in discussions and conveying ideas to teammates. This condition creates an opportunity for students to hone their thinking and feeling skills which are very crucial in fostering independence.

In general, it can be concluded that the Team Games Tournament (TGT) learning method has proven effective in encouraging students' learning independence. The use of TGT not only encourages cooperation and interaction between students, but also helps them to be more independent in managing their own learning process. The competitive activities contained in TGT encourage students to be more responsible for their learning, while increasing their motivation from within. Therefore, TGT can be a very useful option to be applied in the educational process, so that it can increase student independence at various levels of education.

3. Research on TGT on Students' Mathematical Communication Skills and Learning Independence

Based on the results of a study of a number of articles that examine the application of the Teams-Games-Tournaments (TGT) learning model, it was found that this model consistently has a positive influence on students' mathematical communication skills. In addition, several studies also reviewed the relationship between the TGT model and learning independence, although the results showed that the direct influence on this aspect tended to vary and was not always significant. To provide a clearer picture of the findings, a summary is presented in the following table.

Table 3.TGT Research on Students' Mathematical Communication Skills and Learning Independence

Journal	Author	Research Result
Repository of Sultan Syarif Kasim State Islamic University of Riau	Raisa Shahila (2018)	There is a difference in mathematical communication skills between students who receive TGT type cooperative learning and students who receive conventional learning and there is no interaction between learning model factors and learning independence factors on students' mathematical communication skills. The results of this study can be used by teachers to improve the quality of learning in the classroom.

Based on literature review, the Team Games Tournament (TGT) learning model has been proven to have a significant impact on students' mathematical communication skills by also considering the learning independence factor. The results of this study indicate that there is a significant difference in mathematical communication skills between students who take part in learning using the TGT model and those who use conventional learning models. This indicates that the TGT model is superior in encouraging students to develop the ability to convey mathematical ideas, both verbally and in writing.

However, the interaction between the learning model and learning independence did not have a significant effect on students' mathematical communication skills. This means that the level of student learning independence does not directly strengthen or weaken the influence of the TGT model on mathematical communication. This shows that the TGT model works effectively in general without being greatly influenced by the level of student learning independence.

Based on the research of fifteen scientific articles that have been systematically studied, it can be concluded that the cooperative learning model of the Teams Games Tournament (TGT) type has a significant positive impact on improving students' mathematical communication skills and learning independence. In terms of mathematical communication skills, most articles reveal that the application of the TGT model creates a dynamic and collaborative learning atmosphere. In this atmosphere, students not only receive information passively, but are also actively involved in the exchange of ideas, group discussions, and the delivery of mathematical arguments and thoughts. With a diverse team structure and competitive game sessions, students are motivated to express their understanding clearly, use mathematical symbols and representations appropriately, and

practice logical thinking skills systematically. This shows that TGT not only improves learning outcomes quantitatively, but also strengthens communication skills which are part of the competencies needed in the 21st century.

Meanwhile, in terms of learning independence, the TGT model also has a good impact, although some studies show that its influence varies depending on student character and learning situation. The TGT model has been proven effective in encouraging students to take the initiative in learning, be responsible for both individual and team tasks, and increase internal motivation to complete academic challenges. Social interactions that occur in the team and the positive competitive spirit encourage students to learn more independently, conduct self-evaluations, and find solutions to problems faced. However, there is also research that shows that the influence of learning independence on the success of TGT is not always significant, and is not always directly related to students' mathematical communication results. This shows that the success of TGT implementation is more influenced by learning design, teacher teaching quality, and group work dynamics, not only by internal student factors.

CONCLUSION

Overall, this literature review confirms that the TGT model can be one of the effective teaching strategy choices in mathematics education. The advantage of this model lies in its ability to combine social cooperation with competitive and fun activities, so that students can not only understand mathematical concepts well, but also build interpersonal skills and independent learning traits. Therefore, the application of the TGT model is highly recommended for use by teachers as an innovative approach to improve the quality of the teaching and learning process in the classroom, especially in an effort to develop mathematical communication skills and encourage students' learning independence in a sustainable manne. The suggestion for further research is to find out whether Teams Games Tournament (TGT) based learning is effective in improving students' mathematical communication and learning independence.

REFERENCES

Anisa, FN, Turmuzi, M., & Triutami, TW (2024). The Effect of the Team Games Tournament (TGT) Type Cooperative Learning Model on Students' Mathematical Communication Skills. *Journal of Classroom Action Research,* 6(1), 51-59.

Asnawati, S. (2016). Improving Junior High School Students' Mathematical Communication Skills With Cooperative Learning Of The Teams-Gamestournaments Type. *Euclid*, 3(2).

Chatijah, S., & Rakhmawati, F. (2021). Differences In Students' Critical Thinking Abilities And Mathematical Communication Abilities With Tgt Type Learning And Problem Solving Learning. *Algebra: Journal of Education, Social and Science*, 1(3), 29-34.

Damanik, AS, & Handayani, R. (2023). Students' Mathematical Literacy Skills. *OMEGA: Journal of Mathematics Education Science*, 2(3), 149-157.

Febriansyah, H., & Samin, S. (2025). Implementation of Demonstration Method in Improving Student Learning Motivation in Fiqh Subject of Hajj Material for Grade VI at Annajah Islamic Elementary School, Bekasi. Al-Madrasah: *Scientific Journal of Elementary Madrasah Education*, 9(2), 873-886.

Jafar, MI, & Asriadi, A. (2025). The Effect Of Tgt Type Cooperative Learning Model On Students' Mathematical Communication Ability In Mathematics Subject Of Grade V Elementary School Inpres 3/77 Bajoe 1 Bone District. *MACCA: Science-Edu Journal*, 2(1), 198-205.

Kamza, M., Ibrahim, H., & Lestari, AI (2021). The Influence of Discussion Learning Method with Buzz Group Type on Student Learning Activeness in Social Studies Subjects. *Basicedu Journal*, 5(5), 4120-4126.

Kurniati, A., Jannah, N., & Fitraini, D. (2021). The Effect of Implementing the Teams Games Tournaments Cooperative Learning Model on Understanding Mathematical Concepts Based on Student Learning Independence. *Juring (Journal for Research in Mathematics Learning)*, 4(1), 51-62.

Maulidin, MT (2016). Cooperative Learning Model of Teams-Games-Tournaments Type for Achieving Students' Mathematical Communication Skills. *Didactics: Scientific Journal of PGSD STKIP Subang*, 2(1), 110-121.

Murniati, M., Fahinu, F., & Somayasa, W. (2017). The Effectiveness of the Teams Games Tournaments (TGT) Cooperative Learning Model and Learning Independence on Junior High School Students' Algebraic Reasoning Ability. *Journal of Mathematics Education*, 8(1), 13-24.

Octaviani, T., Anwar, S., & Junaedi, Y. (2024). The effect of the Team Games Tournament (TGT) learning model on students' mathematical communication skills. *Journal of Communication*, 2(11), 877-888.

Paramawarti, L., & Masduki, SS (2013). *Experimentation of Team Game Tournament Learning and Realistics Mathematics Education on Learning Outcomes Reviewed from Student Independence (In Grade IX Students of Mts Suniyyah Selo Tawangharjo in 2013/2014)* (Doctoral dissertation, Muhammadiyah University of Surakarta).

Purnamasari, Y. (2014). The influence of the cooperative learning model of the teams games tournament (TGT) type on learning independence and improving the mathematical reasoning and connection abilities of students at SMPN 1 Tasikmalaya City. *Journal of Education and Teacher Training, 1(1), 209664.*

Rohmah, NNS, Narimo, S., & Widyasari, C. (2023). Strategy for strengthening the profile of Pancasila students in the global diversity dimension in elementary schools. *Jurnal Elementaria Edukasia*, 6(3), 1254-1269.

Setiawati, D., Safira, D., & Kartika, Y. (2023). Application of Cooperative Learning Model of Teams Games Tournament Type to Improve Students' Mathematical Communication Skills. *Asymmetric: Journal of Mathematics and Science Education*, 4(1), 51-58.

Shahilla, R. (2018). *The Effect of Implementing the Teams-Games-Tournaments (TGT) Cooperative Learning Model on Mathematical Communication Skills Reviewed from the Learning Independence of Junior High School (SMP) Students* (Doctoral dissertation, Sultan Syarif Kasim State Islamic University, Riau).

Sihombing, MD (2018). Effectiveness of Using TGT Model on Students' Mathematical Communication Skills at SMP Negeri 4 Sibolga. *MathEdu JOURNAL (Mathematic Education Journal)*, 1(2), 60-64.

Winarso, W. (2014). Building high-level mathematical thinking skills through inductive, deductive and inductive-deductive approaches in mathematics learning. *EduMa: Mathematics education learning and teaching,* 3(2).

Wulandari, A., Hendrastuti, ZR, & Krisma, DA (2024). The Effect of Teams Games Tournament (TGT) Learning Model Assisted by Kahoot on Students' Mathematical Communication Skills. *Journal of Mathematics Education and Science,* 7(2), 155-165

Stacey, K. (2011). The PISA View of Mathematical Literacy in Indonesia. *Indonesian Mathematical Society Journal on Mathematics Education*, *2*(2), 95-126.

Muslim, A. (2020, February). The effect of cooperative learning Type Teams-Games-

Tournaments (TGT) on mathematical connection and communication ability in elementary schools. In *Journal of Physics: Conference Series* (Vol. 1469, No. 1, p. 012170). IOP Publishing.