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Enhancing Tangent Lines Learning Achievement through STAD Cooperative Learning for 8th Grade Students at SMPN 2 Dawarblandong, Mojokerto Regency, Academic Year 2023/2024

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Abstract

This study is a Classroom Action Research aimed at enhancing Mathematics learning achievement through the application of the STAD cooperative method. The subjects of this study are 8th-grade students in class C at SMP Negeri 2 Dawarblandong. The research consists of two cycles, and the collected data are analyzed using percentage and simple statistical tables. The results indicate that the application of the STAD cooperative method in learning can motivate students to understand the material, improve cooperation among students, encourage students to ask questions, express opinions, suggestions, proposals, thus enabling students to improve their mathematics learning achievement, particularly in the topic of internal and external tangent lines of two circles.

Keywords– *Achievement, Learning Success, STAD Cooperative*

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1. Introduction

The advancement of science and technology must be positively responded to by the education sector. One form of positive response from the education sector is through curriculum changes. This attitude is manifested in schools' efforts to provide the best services for all their students.

Schools, as educational institutions, continuously strive to make improvements in various areas, including facilities, administrative services, information dissemination, and overall teaching quality. In the teaching and learning process, teachers must have strategies so that students can learn actively, innovatively, creatively, effectively, and enjoyably according to the desired objectives. One step to have these strategies is to master teaching techniques or methods.

Fundamentally, the goal of teaching is to bring about desired changes in students' behavior. Teachers make these changes using teaching strategies to achieve goals by selecting appropriate methods and approaches. Efforts to improve the quality of education do not only rely on teachers but various other factors also influence the quality of teaching outcomes. However, teachers remain the primary key factor, as they significantly influence education within the education system.

Learning mathematics requires skill from a teacher so that students can easily understand the material provided by the teacher. If a teacher lacks mastery of teaching strategies, students will find it difficult to fully grasp the lesson. Teachers are required to innovate and be creative in conducting teaching, thus achieving satisfactory student learning outcomes (Junistira, 2022); (Anisensia, Bito, & Wali, 2020); (Rostika, 2020).

Observations by the teacher (researcher) indicate that the learning motivation of 8F class students at SMPN 2 Dawarblandong, Mojokerto Regency, appears to be decreasing, and they seem less enthusiastic about receiving the subject matter. Only a few students seem enthusiastic about participating in lessons. This situation results in their low classical learning achievement. Initial reflection data obtained shows that many students are not happy with the

methods applied by the teacher so far. They desire a change so that they feel interested in attending classes. From the initial reflection, the following data was obtained: 58.06% (16 students) are not satisfied with the methods applied so far and want a change to a more enjoyable method. 64.51% (20 students) express dissatisfaction with the test results obtained. Students assess that the methods applied so far do not motivate them to be more active. This is estimated to be the cause of their low learning achievement. More than 50% of students say that mathematics is a difficult subject. This situation should be positively responded to by finding alternative effective learning models that make it easy for students to understand mathematical concepts (Meriyati, 2023); (Wijaya, 2022); (Fajriah, Sumartono, & Suryaningsih, 2020).

Teachers as facilitators are required to modify or even implement new methods preferred by students and increase their activity. One of the most important roles of teachers is how they can educate and prepare the future of students through truly creative, open, and enjoyable learning activities (joyful learning) (Sumilat, 2021); (Andrian, Wahyuni, Ramadhan, Enabela, & Zafrullah, 2020).

Based on the previous description, the author wants to provide an alternative to address these issues. The alternative is through cooperative learning management. Cooperative learning is chosen because it is designed to enhance student learning motivation, as the class is designed in such a way as to foster positive interactions among students. Furthermore, teachers must create a social system in the learning environment characterized by democratic and scientific procedures. The responsibility of the teacher is to motivate students to work cooperatively to solve problems as they arise. Some experts argue that cooperative learning can provide benefits for both high-achieving group students and low-achieving group students who work together to complete academic tasks (Aprilianingrum, & Rahajeng, 2020); (Fitri, Zulkarnain, & Anggraini, Pekanbaru, 2022).

In this study, the researcher used the Student Team Achievement Division (STAD) cooperative learning model because STAD is the simplest type of

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cooperative learning, and the teaching teacher has never implemented this type of STAD cooperative learning before. Additionally, the STAD cooperative learning model is not only excellent in helping students understand difficult concepts but is also very useful for fostering interaction between teachers and students, student-to-student interaction to enhance cooperation, creativity, critical thinking, and willingness to help classmates (Ibrahim, 2000); (Lastia, 2020); (Sukerti, 2020); (Suardiana, 2021).

The aim of this research is to improve the learning achievement of 8F grade students on the topic of determining the lengths of internal and external tangent lines of two circles at SMPN 2 Dawarblandong, Mojokerto Regency, in the academic year 2023/2024.

2. Method

This research falls under the category of Classroom Action Research (CAR). CAR is a series of cyclic research aimed at solving problems until they are resolved. Its purpose is to improve performance contextually, and its results are not for generalization. This action research is collaboratively participatory, involving cooperation between researchers and teachers or peers in the field. Researchers are directly involved in planning, implementation, observation, and reflection.

The research is conducted in class 8C of SMPN 2 Dawarblandong, Mojokerto, with a total of 32 students, consisting of 16 male and 16 female students. Class 8F was chosen because the students' learning achievement in this class is low, as seen from the results of the first daily test where only 10 students (31.25%) mastered the material.

The research was carried out in the second semester of the academic year 2023/2024 at SMP Negeri 2 Dawarblandong, located in Sumberwuluh Village, Dawarblandong District, Mojokerto Regency. It was conducted for one month, starting from January 4th to January 31st, 2024, with 5 teaching hours per week, each lasting 40 minutes.

This research was designed as Classroom Action Research (CAR) consisting of two cycles, each comprising 4 stages: planning, action, observation, and reflection. The planning stage involves preparing teaching materials such as syllabi, lesson plans (RPP), teaching scenarios, observation sheets, and evaluation tools. The action stage is the implementation of the prepared teaching plan, conducted in two cycles with various activities such as group discussions and the application of cooperative learning strategies. The observation stage involves observing student activities and learning outcomes, as well as evaluating the teaching process. The reflection stage includes analyzing observation and evaluation results to assess the success of the teaching and plan improvements for the next cycle. Classroom Action Research (CAR) is a series of cyclic research with four main stages: planning, action, observation, and reflection.

The research is conducted in two cycles, with stages of planning, action, observation, and reflection. The researcher is responsible for implementing the actions and detailing the research. In this study, the researcher is assisted by Didik Purwanto S.Pd. in observing the activities of students and teachers. The researcher is also responsible for action planning, executing the actions, collecting data, analyzing data, and preparing the report.

The collected data includes the results of students' daily tests and data on the management of cooperative STAD learning. The main data source is 32 students from class 8i. Research instruments used include questionnaires, daily tests, and observation sheets.

Data analysis is performed by calculating the average ability of teachers in managing cooperative STAD learning and determining the level of student success in daily tests based on a minimum score of 65%. Student learning achievements are considered good if there is an improvement from cycle 1 to the following cycles.

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3. Result and Discussion

Introduction Stage

Before starting the research, the researcher identified the problems that occurred in class 8F during the learning process. To obtain more in-depth information, the researcher held discussions specifically with teachers, especially the mathematics teacher. Then, the researcher gave students a questionnaire as an initial reflection that would be used as the basis to determine the focus of the problem in this study.

Before presenting the results of the classroom action research, the initial reflection data obtained from the student questionnaire will be presented first. The initial reflection results are shown in Table 1.

Table 1. Initial Reflection Results from Student Questionnaire

No	Aspect	Assessment	
		Yes	No
1.	Mathematics is a difficult subject.	51.61%	48,39%
2.	The teacher has used cooperative learning models.	0%	100%
3.	You are satisfied with the methods used by your teacher.	58.06%	41,94%
4.	You feel motivated to learn when your teacher teaches.	51.61%	48,39%
5.	You want new learning models.	100%	0%
6.	Are you satisfied with the daily test results you received?	51.61%	48,39%

From Table 1, it is evident that the majority of students in class 8F at SMPN 2 Dawarblandong, Mojokerto Regency, expressed that mathematics is a difficult subject (51.61%), and 51.61% of students are dissatisfied with their test results. Additionally, 58.06% of students feel bored with the teaching methods that have been applied. All students (100%) expressed a desire for various teaching models, and they feel less motivated to learn with the methods used so far.

The researcher prepared data consisting of daily test scores from previous concepts (Appendix 2). Based on these scores, the teacher and observer divided

the students into study groups. Group formation aims to create a learning community or students learning in groups (Nurhadi et al., 2004).

Subsequently, the researcher and observer prepared the teaching materials for cycle 1. The steps taken in preparing the teaching materials are as follows: (1) preparing observation sheets for cooperative learning management (Appendix 3), (2) preparing lesson plans (Appendix 4), creating question cards (Appendix 5), and answer keys (Appendix 6).

Following the learning schedule at SMPN 2 Dawarblandong, Mojokerto Regency, which adheres to the KTSP Curriculum, data collection commenced from January 4 to January 31, 2024. The weekly schedule consists of 5 teaching hours, with each teaching hour lasting 40 minutes.

Cycle 1

In cycle 1, there are four stages of action. The action stages in cycle 1 are as follows:

a. Action Plan

In cycle 1, the action plan includes preparing teaching materials such as Lesson Implementation Plans (RPP), cooperative learning management observation sheets (STAD), student worksheets, and answer keys. Additionally, tasks are divided between the researcher and observer, and teaching equipment preparation such as media, rulers, marker pens, paper, and writing tools.

b. Action Implementation

The action implementation in cycle 1 consists of two meetings. The first meeting focuses on the introduction, with the teacher opening the lesson and checking students' prior knowledge. The core activity involves group distribution, class presentations, group discussions, presentation of work results, and reflections. The second meeting follows a similar pattern with an introduction, core activity, and conclusion, culminating in a daily quiz.

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c. Observation

During the learning process, observations are made of both the teacher and students. The observation results show that the teacher's implementation of learning is quite good, although there are some areas that need improvement such as lack of motivation and guidance for students. Observations of students indicate that not all students are active in learning, especially in the first meeting.

d. Reflection

Based on the observation results, there are several things that need to be improved for the next cycle, such as increasing teacher motivation and student participation in group learning. Feedback from the observer and researcher will be used to improve the action plan for the next cycle.

Table 2. The results of learning in cycle 1

No.	Score	No.	Score	No.	Score	No.	Score
1	75	9	70	17	90	25	50
2	70	10	70	18	70	26	75
3	70	11	75	19	40	27	70
4	75	12	50	20	75	28	60
5	60	13	50	21	60	29	70
6	85	14	60	22	85	30	80
7	80	15	80	23	80	31	80
8	75	16	70	24	70	32	70

Cycle 2

After the incomplete success of cycle 1 with a mastery rate of only 40.62%, the researcher proceeded with cycle 2, which also comprised four action stages:

a. Action Plan: Based on the reflections from cycle 1, the action plan for cycle 2 included preparing lesson plans, research instruments such as daily quiz cards and answer keys, observation sheets for managing cooperative learning of STAD type, and preparing teaching aids.

b. Action Implementation: Cycle 2 consisted of two meetings. In the first meeting, the teacher checked students' prior knowledge about painting

angles, presented the learning objectives, and engaged students in group activities. The second meeting followed a similar structure, focusing on group discussions, completing tasks in the workbook, and summarizing the lesson.

c. Observation: During the lessons, observations were made regarding student engagement and teacher guidance. While most students actively participated, some were less engaged. The teacher provided guidance to ensure all groups were working together effectively.

d. Reflection: Reflecting on cycle 2, it was noted that most students were actively involved in group activities, and the teacher provided adequate guidance. However, there were still areas for improvement, particularly in ensuring equal participation among all students and reinforcing cooperative learning principles.

Table 3. Summarizes the learning outcomes of cycle 2.

No.	Score	No.	Score	No.	Score	No.	Score
1	75	9	78	17	90	25	70
2	80	10	80	18	75	26	75
3	85	11	75	19	75	27	70
4	75	12	80	20	75	28	65
5	80	13	85	21	80	29	70
6	85	14	78	22	85	30	80
7	80	15	80	23	80	31	80
8	75	16	75	24	75	32	80

Throughout the learning activities, observations and assessments were conducted on both teachers and students. The teacher's performance was evaluated by observers using the STAD cooperative learning management observation sheet. The observations revealed that the implementation of STAD cooperative learning had proceeded smoothly. The teacher had effectively fulfilled all aspects of cooperative learning, fostering student motivation and providing comprehensive guidance to all groups. The average score for daily quizzes reached 78 with a mastery rate of 87.59%.

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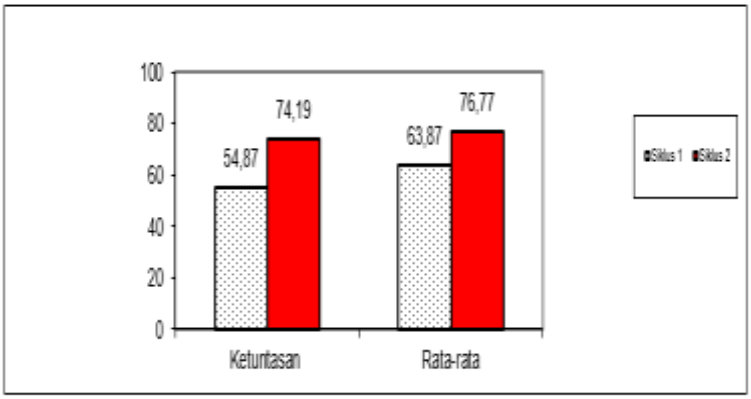
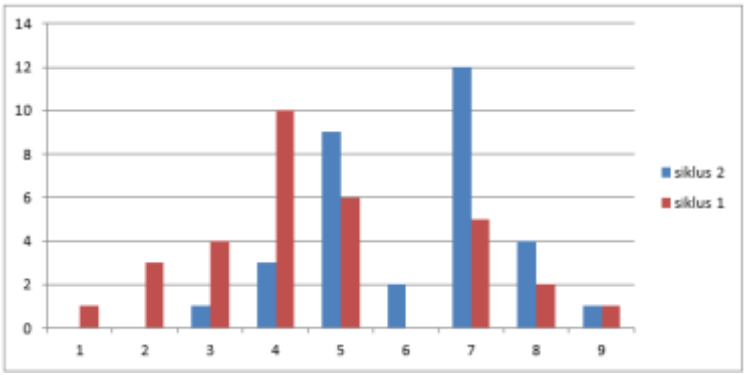
Based on the observations and cognitive tests conducted during cycle 2, it was evident that the teacher had successfully implemented STAD cooperative learning. The implementation of STAD cooperative learning was categorized as good (B). There was notable improvement from cycle 1, which was categorized as fair (2.80), to cycle 2, which was categorized as good (3.81).



Picture 1. Chart of Cooperative Learning Management in STAD Type in Cycle 1 and 2



Picture 2. Chart of Cooperative Learning Management in STAD Type in Cycle 1 and 2

The management of cooperative learning in cycle 1 has not fully run smoothly. It is evident that the teacher is unable to manage the learning process well, and the students are not yet accustomed to cooperative learning. The students do not understand their tasks in this cooperative learning setting. This is due to a lack of motivation and guidance from the teacher, resulting in most students being passive. Only a small number of students are actively engaged in the learning activities, both during group work and class discussions. The

allocated time in the lesson plan is not utilized effectively, as the teacher fails to efficiently transition when forming groups, resulting in insufficient time.

Picture 3. Activities in cycle 1

Picture 4. Activities in cycle 1

Picture 5. Activities in cycle 1

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In cycle 2, the teacher has been able to manage the learning process quite well, and students seem to have adapted to cooperative learning. The teacher has successfully fostered students' learning motivation, and guidance has been provided evenly to all students. Only a small number of students appeared passive during learning activities, both during group work and class discussions. Time management has been excellent, ensuring that teaching and learning activities run according to the schedule. In this cycle, the teacher has addressed all obstacles to teaching and learning by making improvements to several aspects that were previously lacking. Overall, cooperative learning activities have been conducted effectively, indicating that the management of learning activities has been efficient.

Picture 6. Activities in cycle 2

Picture 7. Activities in cycle 2

Picture 8. Activities in cycle 2

The data from daily assessments showed an improvement from cycle 1 to cycle 2, both in terms of classical mastery percentage and class average. There was an increase of 19.32% in classical mastery and 12.9% in class average. This improvement can be attributed to the effective implementation of cooperative learning management. This aligns with Ibrahim's (2000) assertion that this model excels in helping students understand difficult concepts, and the cooperative reward structure has been shown to enhance student assessment in academic learning and normative changes related to learning outcomes. Supported by Nur et al. (2000), the benefits of cooperative learning for students with low learning outcomes include increased task completion time, higher self-esteem, improved attendance, lower dropout rates, greater acceptance of individual differences, reduced disruptive behavior, decreased interpersonal conflict, reduced apathetic attitudes, deeper understanding, greater motivation, higher learning outcomes, longer retention, and increased kindness, sensitivity, and tolerance.

The implementation of STAD cooperative learning by the teacher has been able to cultivate and enhance student learning motivation, resulting in improved academic achievement for the students of class 8F at SMPN 2 Dawarblandong, Mojokerto Regency. Particularly, the awards given by the teacher to the best-performing groups have had a positive effect on the students. This has been supported by Nur's (2001) suggestion that one way to stimulate motivation in

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students is to highlight the positive aspects, by recognizing students' strengths and using them as the basis for building. Eliminate negativity by not underestimating students' weaknesses but addressing them directly using wise methods.

4. Conclusion

Based on the research findings, it can be concluded that the implementation of the STAD cooperative learning method has a significant impact on the learning achievement of class 8F students at SMPN 2 Dawarblandong, Mojokerto Regency. This teaching method is not only effective in improving students' understanding of the subject matter but also capable of creating a fun and motivating learning environment. The teacher successfully manages the learning process, making students active participants in the learning process and providing recognition to the best-performing groups, which gives an additional motivational boost to the students. The positive impact of this method is reflected in the improvement of students' learning achievements, with a 19.32% increase in classical mastery and a 12.9% increase in class averages. This confirms that the STAD cooperative learning approach is an effective method for enhancing student learning outcomes.

From the results of this study, several recommendations can be provided including the use of cooperative learning with the STAD model as an innovative alternative in the classroom, as well as the potential to develop cooperative approaches using other suitable types. Additionally, this teaching method can also be applied to other subjects, not limited to just one subject. To enhance student motivation, it is suggested that rewards be consistently given with interesting variations such as praise, stars, or other forms of appreciation to boost student learning enthusiasm (Sari, 2016); (Yuliana, Solfitri, & Heleni, Duri, 2022); (Yolanda, 2022).

References

Andrian, D., Wahyuni, A., Ramadhan, S., Enabela, F. R., & Zafrullah, Z. (2020). Pengaruh Pembelajaran Kooperatif Tipe STAD terhadap Peningkatan Hasil Belajar, sikap Sosial dan Motivasi Belajar. *Jurnal Inovasi Matematika (Inomatika)*, *2*(1), 1-11.

Anisensia, T., Bito, G. S., & Wali, M. (2020). Penerapan Model Pembelajaran Kooperatif Tipe STAD untuk Meningkatkan Hasil Belajar Matematika pada Siswa Kelas V SDI Blidit Kabupaten Sikka. *Prima Magistra: Jurnal Ilmiah Kependidikan*, *1*(1), 61-69.

Aprilianingrum, E. B., & Rahajeng, R. (2020). Upaya meningkatkan keaktifan dan prestasi belajar matematika siswa dengan menggunakan model pembelajaran kooperatif tipe jigsaw II. *JURNAL ILMIAH EDUKASI MATEMATIKA (JIEM)*, *6*(1), 1-18.

Arief S Sadiman, dkk. 2006. *Media Pendidikan*. Jakarta: PT Raja Grafindo Persada.

Bloom, Benyamin. ET al. 1981. *Taxonomi of Educational The Classification of Educational Goals: Hand Book I, Cognitive Domayn*. New York: Lamongan

DePorter, Bobbi. 1999. *Quantum Learning*. Bandunf: Kifa

Dikdasmen.2005. *Materi Pelatihan Terintegrasi: Matematika, buku 2.* Jakarta: Departemen Pendidikan Nasional

Fajriah, N., Sumartono, S., & Suryaningsih, Y. Etnomatematika Budaya Banjar di Daerah Aliran Sungai Kota Banjarmasin Untuk Literasi Pembelajaran Matematika Sekolah Menengah.

Fitri, D., Zulkarnain, Z., & Anggraini, R. D. (2022). *Penerapan Model Pembelajaran Kooperatif Tipe Stad dengan Pendekatan Ctl untuk Meningkatkan Hasil Belajar Matematika Siswa Kelas Viiia SMP Negeri 18 Pekanbaru* (Doctoral dissertation, Riau University).

http://journal.unair.ac.id/filterPDF/ Prinsip-Prinsip Kognitif Pembelajaran Multi-media: Peran Modality dan Contiguity terhadap Peningkatan Hasil Belajar.pdf

Ismail, dkk. 2007. *Kapita Selekta Pembelajaran Matematika*. Jakarta Universitas Terbuka

J.S.Badudu. 1996. *Kamus Umum Bahasa Iindonesia.* Jakarta: Balai Pustaka

Literasi Nusantara. vol.4 no. 1, November 2023 – February 2024
ISSN 2746-8208 (Online) and ISSN 2746-3575 (Print)

Junistira, D. D. (2022). Penerapan Model Pembelajaran Kooperatif Tipe STAD untuk Meningkatkan Hasil Belajar Siswa Kelas V Mata Pelajaran IPS. *JIIP-Jurnal Ilmiah Ilmu Pendidikan*, *5*(2), 533-540.

Lastia, I. N. (2020). Penerapan Model Pembelajaran Kooperatif Tipe STAD Untuk Meningkatkan Hasil Belajar Matematika Pada Siswa. *Mimbar Pendidikan Indonesia*, *1*(3).

Meier, Dave. 2000. *The Accelerated Learning Hand Book*. Bandung: Kaifa

Meriyati, H. (2023). Analisis kemampuan pemahaman konsep peserta didik melalui penerapan model pakem berbantuan problem posing ditinjau dari keterampilan metakognitif. *Jurnal Cendekia: Jurnal Pendidikan Matematika*.

Mulyanto. 2007. *Dasar-dasar Pengembangan Multimedia Pembelajaran Interaktif*. Semarang: LPMP Jawa Tengah

Noehi Nasution, Adi Suryanto. 2002. *Evaluasi Pengajaran.* Jakarta: Universitas Terbuka

Ratna Wilis Dahar. 1989. *Teori-teori Belajar*. Jakarta: Erlangga

Rostika, D. (2020). Penerapan model pembelajaran kooperatif tipe STAD untuk meningkatkan hasil belajar kimia. *Indonesian Journal of Educational Development (IJED)*, *1*(2), 240-251.

Samsul Hadi. 2007. *Aplikasi Matematika 2 SMP*. Jakarta: Yudhistira.

Sari, H. P. (2016). *Pengaruh model pembelajaran kooperatif tipe stad (student teams achievement division) terhadap motivasi dan hasil belajar matematika siswa pada pokok bahasan garis singgung lingkaran kelas viii di SMP N 2 Padangsidimpuan* (Doctoral dissertation, IAIN Padangsidimpuan).

Soetardjo, 1998 , *Belajar secara efektif dan efisien*

Suardiana, I. M. (2021). Penerapan Model Pembelajaran Kooperatif Tipe STAD untuk Meningkatkan Hasil Belajar Matematika. *Journal of Education Action Research*, *5*(3), 381-386.

Suharsimi Arikunto. 2001. *Dasar-dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara

Sukerti, N. N. (2020). Penerapan Model Pembelajaran Kooperatif Tipe STAD Untuk Meningkatkan Hasil Belajar Tematik Pada Siswa Kelas III SD. *Jurnal Edutech Undiksha*, *8*(1), 92-101.

Sumilat, J. M. (2021). Model Pembelajaran Kooperatif Tipe STAD (Student Teams Achievement Divisions) Untuk Meningkatkan Hasil Belajar Sisiwa Sekolah Dasar. *Edukatif: Jurnal Ilmu Pendidikan*, *3*(3), 865-870.

Wijaya, S. H. (2022). *Meta analisis model pembelajaran problem based learning dan problem solving terhadap kemampuan pemecahan masalah matematika* (Doctoral dissertation, Jurnal Basicedu).

Yolanda, R. (2022). *Pengembangan Media Pembelajaran Matematika Berbantuan Software Geogebra Pada Materi Garis Singgung Lingkaran Untuk Siswa Kelas VIII SMP* (Doctoral dissertation, Universitas Islam Riau).

Yuliana, Y., Solfitri, T. S. T., & Heleni, S. H. S. (2022). *Penerapan Model Pembelajaran Kooperatif Tipe Student Teams Achievement Division (Stad) untuk Meningkatkan Hasil Belajar Matematika Siswa Kelas Viii. b Mts. hubbulwathan Duri* (Doctoral dissertation, Riau University).