



Implementation of think pair share model to improve mathematics learning outcomes

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ABSTRACT

The mathematics learning outcomes of students in class X APHP 1 SMKN Pertanian Terpadu Provinsi Riau in the 2022/2023 academic year show that the percentage of classical achievement is only 35.9 percent. From the reflection of the learning process carried out by the teacher, the following conclusions: (1) the learning process was still teacher-centered; (2) during the teaching and learning process, only a small number of students actively participated in the teaching and learning process; (3) there were still students who did not do their work and only copied their friends' work. This study aims to increase students' activity and learning outcomes by applying the Think Pair Share cooperative learning model. This type of research is Classroom Action Research with two cycles. The subjects of this study were 39 students of class X APHP 1 at the SMKN Pertanian Terpadu Provinsi Riau. The results showed that applying the TPS type of cooperative learning model can be active in learning outcomes, as seen by an increase from cycle I to cycle II. The number of students who achieved KKM in the first cycle was 79.5 percent, while in the second cycle, it was 89.7 percent. Therefore, the TPS-type cooperative learning model can be used as an alternative to learning mathematics to improve student learning outcomes.

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ABSTRAK

Hasil belajar Matematika peserta didik kelas X APHP 1 SMKN Pertanian Terpadu Provinsi Riau semester ganjil tahun ajaran 2022/2023 menunjukkan bahwa persentase ketercapaian secara klasikal hanya sebesar 35,9 persen. Dari hasil refleksi proses pembelajaran yang dilakukan guru diperoleh kesimpulan bahwa: (1) proses pembelajaran masih berpusat pada guru; (2) pada saat proses belajar mengajar berlangsung hanya sebagian kecil peserta didik yang melakukan aktif untuk berpartisipasi dalam proses belajar mengajar; (3) masih terdapat peserta didik yang tidak mengerjakan pekerjaannya dan hanya selalu meniru pekerjaan temannya. Penelitian ini bertujuan untuk meningkatkan aktivitas dan hasil belajar peserta didik melalui penerapan model pembelajaran kooperatif tipe Think Pair Share (TPS). Jenis penelitian ini adalah Penelitian Tindakan Kelas dengan dua siklus. Subyek penelitian ini adalah 39 peserta didik kelas X APHP 1 SMKN Pertanian Terpadu Provinsi Riau. Hasil penelitian menunjukkan bahwa penerapan model pembelajaran kooperatif tipe TPS dapat aktivitas dan hasil belajar, terlihat dengan adanya peningkatan dari siklus I ke siklus II. Jumlah peserta didik yang mencapai KKM pada siklus pertama 79,5 persen, sedangkan pada siklus II 89,7 persen. Oleh karena itu, model pembelajaran kooperatif tipe TPS dapat dijadikan salah satu alternatif pembelajaran Matematika untuk meningkatkan hasil belajar peserta didik.

Kata Kunci: hasil belajar; pembelajaran kooperatif; penelitian tindakan kelas; think pair share

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INTRODUCTION

Mathematics is a basic science that plays an essential role in everyday life and is needed to master, study, and develop science and technology. Mathematics is also essential in forming quality students because it equips them to think logically, analytically, systematically, critically, and creatively and work together (Nurfadhillah et al., 2021). As a subject, Mathematics aims for students to have the ability to understand mathematical concepts, explain the interrelationships between concepts, and apply concepts or algorithms in a flexible, accurate, efficient, and precise way in solving problems. The achievement of the objectives of learning Mathematics can be seen from the level of success and completeness of the Mathematics learning outcomes obtained by students based on the Minimum Completeness Criteria (KKM) determined by the educational unit regarding Graduate Competency Standards (SKL), taking into account the characteristics of students, subjects, and the condition of the education unit (Septiani, 2019).

Yusuf (2023) states that efforts or strategies are needed to streamline and optimize functions and interactions between students and components in a learning activity to achieve teaching objectives. Efforts are made to improve the quality of learning to increase the quality of education in certain levels of education that are comprehensive, centralized, or national, but also to improve certain aspects that can be carried out by schools and teachers in the classroom (Ristianah, 2022). One problem that schools often face is the problem of weak learning processes that impact low learning outcomes.

The results of learning Mathematics in the 2013 curriculum require students to achieve SKL, including attitude, knowledge, and skills. Learning outcomes' completeness is the minimum achievement level of attitudes, knowledge, and skills competencies. The completeness of the learning outcomes can be seen from the completeness of students in each Basic Competency (KD) and fulfilling the specified KKM. The achievement of KKM for each basic competency is analyzed from the results of the tests conducted by the teacher. Cooperative learning can improve student learning outcomes (Hasibuan & Wahyudin, 2023). Based on data on Mathematics learning outcomes for class X APHP 1 SMKN Pertanian Terpadu Provinsi Riau in the odd semester of the 2022/2023 school year, there are still many students who have not reached the KKM score set by the school, which is 75. Out of 39 students, only 14 students have reached KKM. This means that the percentage of KKM achievement in that class is only 35.9%.

Researchers, as teachers, see students' low Mathematics learning outcomes and try to find the causes of the low learning outcomes by reflecting and asking students questions. From the results of reflection on the learning process carried out by the teacher, the following conclusions are 1) the learning process is still teacher-centered; 2) when the teaching and learning process takes place, only a small number of students active to participate in the teaching and learning process; 3) there are still students who do not do their work and only always imitate the work of their friends. According to the reflections made by the teacher regarding the learning process carried out, it was found that 1) Teachers still end up using the lecture method; 2) Teachers have not used innovative models or approaches; and (3) Teachers have not implemented learning activities according to the standard learning process (Dakhi, 2020).

To improve Mathematics learning outcomes, the TPS learning model has improved student learning outcomes at the elementary school level (Masana, 2022). The research was conducted by applying the. Based on the problems above and the results of previous research, teachers as researchers are interested in conducting similar research on students at the vocational school level in order to improve the learning process so that students' Mathematics learning outcomes at SMKN Pertanian Terpadu Provinsi Riau can increase.

LITERATURE REVIEW

Mathematics is a subject that must be taught to students from elementary, middle, and tertiary levels in Indonesia's education system. Mathematics learning is believed to train students to think critically, creatively, and logically, involving calculations or formulas and improving students' problem-solving reasoning abilities (Intan et al., 2020; Haryanto et al., 2024). The verse above implies the importance of learning mathematics in the education system in Indonesia from the elementary to tertiary levels. Mathematics education is about understanding concepts and formulas and developing students' critical, creative, and logical thinking abilities. Understanding mathematical concepts and their application in various situations can train students to think analytically, solve problems, and develop strong reasoning. Thus, Mathematics learning involving problem-solving and active application of formulas can improve students' reasoning abilities, prepare them to face intellectual challenges and improve skills that are relevant in everyday life and the future.

Student learning achievement is one measure of educational success, especially in the context of the learning process in the classroom (Saihu, 2020). Good learning success can indicate an effective learning process (Maulidya & Negraheni, 2021). Therefore, teachers should pay primary attention to student learning achievements in class. Learning achievement includes behavioral changes in the cognitive, affective, and psychomotor domains (Gunawan et al., 2023). Because Mathematics involves abstract skills such as thinking, cognitive learning achievements can reflect the entire learning process. Learning outcomes can also be seen from students' ability to apply concepts (Erni et al., 2023). This sentence means that learning achievement can also be assessed from students' ability to apply the concepts they have learned in practical contexts or real situations. This means that learning outcomes are not only reflected in students' ability to master theories or concepts theoretically but also in their ability to implement these concepts in relevant contexts, for example, in solving problems, projects, or everyday life situations. Therefore, evaluating learning outcomes measures students' conceptual understanding and ability to apply this knowledge in practical situations.

Students' cognitive learning achievements in Mathematics can be the results of tests that measure ability, understanding, and mastery of the material after undergoing Mathematics learning for a certain period (Nuriati et al., 2021). Many factors influence student learning achievement, both internally and externally. Internal factors include verbal and non-verbal aspects, interest and motivation to learn, and other affective elements. Meanwhile, external factors include the learning environment, the role of teachers, school facilities, and the use of effective learning models. As facilitators and class controllers, teachers must choose effective learning models to apply during the learning process to achieve good learning outcomes (Hita et al., 2021). This sentence emphasizes the importance of the role of teachers who are not only tasked with delivering material but also must choose effective learning models to guide the learning process. The other sentence also emphasizes the need to choose a suitable learning model to help increase learning effectiveness and create a conducive learning environment for students (Moko et al., 2022). Teachers can maximize students' learning potential by implementing appropriate learning models and strengthening opportunities to achieve optimal learning outcomes. Therefore, selecting an effective learning model is an essential strategy to improve the quality of education and student learning outcomes.

One learning model is the cooperative learning model. Some of the main characteristics of the cooperative learning model include collaboration, shared responsibility, social interaction, sharing roles, and joint problem-solving (Moningka & Sahetapy, 2019). Collaboration means students work together in groups to achieve a common goal. They support each other, share knowledge, and learn from each other. In this collaboration, each group member is responsible for their group's success. Individual success is closely related to group success. Social interaction between students is needed to communicate, collaborate, and

learn from each other through discussion and teamwork. In some cooperative models, specific roles may be distributed among group members to ensure that all members are actively involved and responsible. Students learn to solve problems together, considering their group members' different points of view and ideas.

Various educational experts have developed Several cooperative learning models (Barus, 2020). Student Teams-Achievement Divisions (STAD) is a model developed by Robert Slavin. In this model, students work in small and heterogeneous groups. Each group member has the responsibility to understand and master the learning material. After studying, students take tests, and individual and group success is considered. Elliot Aronson developed the Jigsaw model. This model divides learning material into small parts that are given to each group member. Each member is responsible for studying and mastering this part of the material. Then, they share this information with other group members in one team to understand the material. Robert Slavin also developed the Teams-Games-Tournament (TGT) model. At TGT, students work in small, heterogeneous teams. They then participate in games or tournaments to test their understanding of the learning material. The team that succeeds in the game is rewarded.

TPS type cooperative learning, introduced by Spencer Kagan, is a technique that provides opportunities for students to work alone and in collaboration with others. Research on the application of TPS to increase student collaboration was conducted by Moningka and Sahetapy (2019). This study concluded that the TPS method can improve student cooperation in Integrated Science subjects. This is also the advantage of this model, which gives eight chances times more for each learner to be recognized and show participation to others (Hastuti et al., 2020). This follows the problem found by the researcher, which is that only a small number of students are active in learning when the learning process takes place.

Research on the influence of the TPS learning model on learning outcomes was carried out by Khoirudin and Supriyanah (2021) on economics subjects in high school. The results of this study concluded that higher learning outcomes were achieved by applying the TPS model. Research on applying the TPS model to students in vocational schools was conducted by Praditya and Haryana (2020). This study concluded that student cognitive learning outcomes in automotive basic technology subjects increased when applying the TPS learning model. Research on applying the TPS type cooperative learning model to Mathematics subjects has also been carried out by Latifah and Luritawaty (2020), who concluded that this model is quite effective in increasing students' mathematical problem abilities. At the same time, research on the effectiveness of applying the TPS learning model to student activities was carried out by Khoirudin and Supriyanah (2021). The results of this study concluded that the application of the TPS learning model can increase student learning activities.

This type of TPS cooperative learning begins with thinking independently (*think*), then exchanging opinions and information with a partner that has been determined by the teacher (*pair*), and finally, exchanging opinions and information with a large group consisting of 4 students (*square*) (Nurussofi et al., 2022). General stages in the application of learning This type of TPS cooperative consists of several stages, starting with students divided into groups of four and given a task for each. In this large group, students are given time to think about and do the task alone and continue in pairs with one colleague in their groups to discuss this task in pairs (Apriyanti, 2020). Furthermore, students can share work in four groups for the last stage.

Through this type of TPS cooperative learning, students are expected to be able to develop knowledge and understanding of the Mathematics subject matter provided, as well as training to be confident in expressing opinions and exchanging information and involve themselves by participating when discussing with a partner and also in a large group consisting of 4 students. So it is hoped that after implementing the TPS type cooperative learning model, students can solve test questions, exam questions, and other questions given by the teacher independently, which increases student learning outcomes. Based on the background of the problems described above, it is necessary to conduct research related to the application

of the TPS type cooperative learning model to improve Mathematics learning outcomes for students of class X APHP 1 at SMKN Pertanian Terpadu Provinsi Riau.

METHODS

This research was conducted in Class X APHP 1 at SMKN Pertanian Terpadu Provinsi Riau in the 2022/2023 academic year. The type of research used is Classroom Action Research (CAR), which is carried out collaboratively and participatively. Collaborative means the teacher in his research collaborates with other peer-to-peer Mathematics teachers at the Integrated Agricultural Vocational School in Riau province. Participatory means that the teacher is assisted by several fellow teachers directly involved in research activities. CAR is an action research conducted to improve the quality of learning practices in the class. CAR focuses on the class or on the teaching and learning process that occurs in class, not on class input (syllabus, materials, etc.) or output (learning outcomes). CAR must be focused on or about things that happen in the classroom (Oktaviani, 2020).

In other words, PTK aims to improve learning quality by identifying problems in the classroom and designing appropriate solutions or strategies to overcome these problems. CAR involves continuous reflection and concrete action to change or improve existing learning practices. By focusing on things that happen in the classroom, PTK allows teachers to understand better the dynamics of learning occurring in their learning environment. This allows them to make more effective and sustainable changes to improve the student learning experience. Researchers have conducted similar class action research by applying the NHT cooperative learning model (Hasibuan & Wahyudin, 2023). The results of this study show that applying the NHT type cooperative learning model can increase the learning activeness of class students so that the impact on student learning outcomes also increases.

Classroom action research that applies the Think types cooperative learning model Pair Share to improve social studies learning achievement in elementary school students (Sadipun, 2020). In this study, the planned action is applying Mathematics learning through the TPS type cooperative learning model to improve students' Mathematics learning outcomes in class X APHP 1 SMKN Pertanian Terpadu Provinsi Riau. This study consisted of 2 cycles. In cycle I, an action referred to as TPS type cooperative learning. Furthermore, in cycle II, the actions taken were based on the reflection results from cycle I. Arikunto, in the book "*Penelitian Tindakan Kelas*" stated that in general, CAR was carried out through four stages, namely 1) planning, 2) implementation, 3) observation, and 4) reflection. For the research to run well, learning tools were prepared according to the learning characteristics that would be applied: syllabus, lesson plans, worksheets, teacher and student activity instruments in the form of observation sheets, and math learning achievement test instruments.

The data obtained through observation and tests of students' Mathematics learning outcomes were then analyzed. The data analysis technique used is the descriptive statistical analysis technique. The descriptive statistical analysis in this study aims to describe data about the activities of students and teachers during the learning process and about the completeness of students' Mathematics learning outcomes. If the conditions after the action are better, then it can be said that the action has been successful, but if there is no difference or even worse, the action has not succeeded. The intended better situation is if there is an improvement in students' process and learning outcomes after applying the TPS type cooperative learning model.

The criteria for the success of this study's action are improving the learning process and student learning outcomes. The learning process is improved based on the reflection results obtained through observation sheets of teacher and student activities. Improvement occurs if the learning process follows the lesson plan and the quality of learning improves.

RESULTS AND DISCUSSION

This chapter presents the results of developing the TPS learning model for use in the classroom and its effectiveness in improving student learning outcomes. **Table 1** shows the results of developing the TPS learning model for Mathematics learning in the classroom in stages.

Table 1. Stages of Implementing the TPS Type Cooperative Learning Model

Stage	Activity
Think	At this stage, the teacher asks questions or problems related to learning. Then, students are asked to think about answers to these problems freely. In this phase, students must develop a cognitive perspective by remembering and understanding the material. Remembering independently is an effort to assign tasks to each student.
Pair	At this stage, the teacher invites students to pair up with other students to discuss their thoughts on the previous phase. Each student conveys his thoughts, provides input, and reacts at this stage. At the end of the discussion, they are believed to formulate a joint conclusion they want to convey in the following structure. The most expected thing to be achieved in this arrangement is the unification of values, concepts, and ideas.
Share	At this stage, the educator asks each participant to share the lesson. Each student takes turns being given time to present the results of their discussion. These stages emphasize the ability to display or demonstrate student performance. Communicating thoughts, listening to friends' conclusions, and working together to understand concepts are essential in learning because they can foster students' learning inspiration.

Source: *Sukelasmini (2019)*

Through these stages, the TPS model encourages active student participation, collaboration, and critical thinking (*Ismail et al., 2023*) while ensuring every student can contribute to class discussions.

Based on the value of student learning outcomes, some students still have not reached the KKM on daily tests I (UH 1) and II (UH 2). The increase in students' Mathematics learning outcomes before and after the action can be seen in **Table 2**.

Table 2. Percentage of Students' KKM Achievement

Learning Outcomes	Base Score	UH 1	UH 2
Number of students who achieve KKM	14	31	35
Percentage (%)	35,9	79,5	89,7

Source: *Research 2021*

Based on **Table 1**, it can be seen that there was an increase in the number of students who achieved KKM from the essential score (before the action) to the value of the first daily test and the second daily test (after the action). A significant increase can be seen in the number of students who achieved KKM after implementing the previous TPS model, which reached 121% or more than doubled. The increase in the number of students who achieved KKM from the essential score to the first daily test and from the first daily test to the second daily test showed that there was an increase in student learning outcomes in class X APHP 1 SMKN Pertanian Terpadu Provinsi Riau with the application of TPS type cooperative learning.

Discussion

Classroom Action Research (PTK) has four steps that must be carried out: planning, implementation, observation, and evaluation or reflection. This shows that the PTK process involves several systematic

stages to achieve research objectives and improve classroom learning quality. In this research, the implementation of the TPS type cooperative learning model consists of two cycles with eight meetings with six actions (learning) and is repeated twice daily. Cycle I was carried out in four meetings, namely, three times the implementation of the action by applying the TPS type cooperative learning model and one daily repetition. Learning activities at the first meeting of the cycle I am about the concept of absolute value, which is guided by RPP-1 and is supplemented by LKPD-1, as well as for observations using observation sheets. This lesson lasts for two hours.

After preparing students to learn, the teacher conveys learning motivation. Providing learning motivation has a positive effect on learning outcomes. Then, the teacher conveys the learning objectives and says that the students will be divided into several groups to discuss today's learning material. Some students are enthusiastic, but some students say they do not like group study. The teacher then explained that students would help each other learn with group discussions. Even so, group discussion in learning must still be carried out to train students' social skills by paying attention to other factors that can influence the sustainability of collaboration in group discussion (Rezaei, 2020; Forsell et al., 2020; Sadiyah, 2023). Then, the teacher explains today's learning process and what will be learned next using the TPS type cooperative learning model. The students looked confused the first time they heard it (Septiani, 2019).

The teacher explains that the learning process is carried out using group learning, where each group member has been determined to consist of four people. Then, students will be given LKPD, which they will work on in stages. The use of LKPD in this research is expected to make learning more effective. The research results show that using Student Worksheets (LKPD) can improve the Mathematics learning achievement of vocational school students (Sinurat, 2022). The cooperative learning model of the TPS type can improve the critical thinking ability of students (Alfian, 2018). The first stage is the thinking stage, where students work on the LKPD individually within a predetermined time. Next is the pairing stage, where participants discuss with one of their friends in their group or a partner whom the teacher will determine. Next, students discuss with their groups, which is called the square or fourth stage, where students discuss in groups and write down the results of their discussions, which will then be presented in front of the class by one of the group representatives. Next, the teacher announces the names and group members and orders the students to sit in the designated groups.

The teacher distributes LKPD-1 to each student and instructs students to work on LKPD-1 individually for 10 minutes. At the *thinking* stage, students must read LKPD-1 as a whole and do as much as possible. You can see the attitude of students who are starting to be lazy when reading LKPD-1 and prefer to ask their friends next to them. The teacher also reminded students to work alone first, and many students asked the teacher how to work on the LKPD-1. The teacher directs students to read the instructions, examine each step and description in LKPD-1, and do as much as possible. The teacher also guides students so they can work on LKPD-1 correctly. At this stage, many students were seen copying the answers from their group mates. Seeing this, the teacher admonished students to be able to work on LKPD-1 at the *Think* stage independently and asked the teacher about the difficulties they were experiencing.

Furthermore, the teacher directs students to discuss LKPD-1 in pairs for 10 minutes at the pair stage. At this stage, students discuss the work results at the *thinking* stage with their partner by discussing and correcting the steps in determining the concept of absolute value based on the teacher's direction. Many students are not severe in discussions. Some students copy their friend's work. There were even some students who used this opportunity to discuss other things. This made the class noisy. The teacher reminds all students to discuss and understand each concept seriously because the teacher will randomly ask group representatives to present in front of the class. Students began to discuss again. Many students ask the teacher about solving problems based on Activity 1 in LKPD-1. The teacher also directs each group pair to help each other and share knowledge, not just copy friends' work.

Next, the teacher asks students to participate in the *square* stage, where the teacher asks each pair to discuss with their group mates to share the results or information obtained at the *pair* stage. At this stage, the teacher gives 10 minutes to discuss the answers and the information they got in the previous stage with their group mates.

After the discussion time is up, the teacher asks the class leader to draw lots to determine which group will present the results of their group discussion. The teacher also reminds other students to pay attention to the presentations shown by their friends, compare them with the results of their respective group discussions, and provide feedback. However, students were silent, and no one gave a response. The teacher evaluates the presentations and praises the groups that have presented the results of their discussions.

At the end of the lesson, the teacher gives formative tests and instructs students to work individually. Furthermore, the teacher reminds students to study the following meeting material: absolute value equations. The teacher closed the lesson by saying thank you and greetings.

Material will be discussed at the second and third meetings. At the second meeting, absolute value equation material will be discussed, guided by RPP-2 and RPP-3 and supplemented by LKPD-2 and LKPD-3. Observation sheets are used for observations. The learning process follows *the think, pair, and square* stages as in the previous meeting.

After completing cycle I, the teacher reflects. The activities of the students at the first meeting did not go well. Students are also still passive in participating in the learning process, which is caused by students not understanding how the teacher implements learning. The activities of the students at the *think* stage did not go well in the first and second meetings. At the first meeting, students still did not have the confidence to work on the LKPD individually, so students were too lazy to read the LKPD and tried to copy answers from their friends. At the next meeting, some students were still seen trying to copy their friend's answers. The teacher warned these students, and there was an improvement in the third meeting.

At the *pair* stage, some students still did not properly carry out the pair discussion. Some students copy their friend's answers. The number of students who copied their friends' answers at the next meeting decreased. Students began to discuss in pairs and share knowledge actively.

At the *square* stage, students have not carried out discussion activities properly. Some students have not participated in group discussion activities. The teacher gives directions so students know the need to participate in group discussion activities. At the next meeting, each student began participating in group discussion activities. At this stage, the teacher guides groups that are experiencing difficulties.

Furthermore, the students' presentations did not go well in the first meeting. Students were reluctant to present the results of their group discussions. At the next meeting, students began to have the confidence to present the results of their group discussions. Students also began actively responding to the results of other groups' presentations.

The activity of guiding students in concluding the material they have learned has been carried out in the first and second meetings. The teacher conveys general conclusions and involves students even though some students are still confused in concluding learning. When giving the formative test, the teacher has to apply it with sufficient time. In giving formative tests at the first meeting, many students did not finish working on formative tests. This happens because students are not used to working on questions in a short time.

The following is an analysis of the deficiencies and weaknesses in cycle I:

1. The low response of students in the preliminary activities.
2. Teachers have not entirely directed all students to actively discuss with their group members in working on LKPD.

3. Students have not fully worked on the LKPD at the *Think* stage individually, then with their partners at the Pair stage, and in groups at the Square stage as a whole, so the stages in this learning model are not yet visible.
4. Student activeness in group presentations was still lacking, and other groups gave only a few responses regarding the results of the group presentation work.
5. Teachers are still not firm in dealing with students because many noisy students joke and cheat in learning.

Based on the weaknesses in cycle I, the teacher makes the following improvement plan.

1. The teacher must actively motivate students to respond to questions during preliminary activities.
2. Pay more attention to students in the discussion process and give directions to students regarding the importance of working on LKPD independently.
3. The teacher directs high-ability students to be able to guide their group mates who still cannot understand the material well.
4. The teacher must motivate students to be more active in responding to the work of their group of friends and for the group.

Cycle II was carried out in four meetings, namely, three times the implementation of the action by applying the TPS type cooperative learning model and one daily repetition. RPP-4, RPP-5 and RPP-6 guide the second cycle's material and use LKPD-4, LKPD-5, and LKPD-6.

In cycle II, based on the results of observation sheets of teacher and student activities, the implementation of the second cycle was better than the first cycle. The teacher provided better motivation and apperception in the preliminary activities at the fifth and sixth meetings. In addition, the teacher also conveyed the learning objectives and the scope of the material. Most of the students listened to what the teacher explained, began to be active, and responded to what the teacher asked when giving apperception.

In the core activities at the *thinking stage*, students are aware and more confident in working on their worksheets. At the pair stage, students actively discuss with their partners. Likewise, students are already actively involved in discussion activities at the square stage and can share knowledge with other group members. When making presentations, some students could explain the results of group work discussions.

In the closing activity, students convey conclusions, which the teacher reinforces. The teacher also gives formative tests to assess students' understanding. Some of the weaknesses that are still visible are that the teacher still reprimands some students because they are noisy when completing formative tests.

Based on the data above, we can see that the learning process has increased. Some of the deficiencies and weaknesses in the previous cycle have been corrected. For example, students responded actively and worked independently in the preliminary activities. Then, they actively discussed and collaborated with group members to work on LKPD, and the learning process took place more orderly (Setyowati et al., 2024). Even so, there are still some weaknesses in the learning process, namely, some students play or chat in the learning process (Idayani, 2021).

CONCLUSION

Based on the results of the research that has been done, it can be concluded that the TPS-type cooperative learning model can improve the Mathematics learning outcomes of students in class X ATPH 1 at SMKN Pertanian Terpadu Provinsi Riau for the 2022/2023 academic year. Therefore, the TPS type cooperative learning model can be used as an alternative to learning Mathematics to improve student learning outcomes. For further research, digging deeper into strengthening these aspects is recommended, which

may still pose challenges in implementing the TPS type cooperative learning model. Attention must also be given to the solution to increase student motivation in discussing and solving the presented problems. Furthermore, future research can focus on in-depth analysis regarding the impact of implementing the TPS type cooperative learning model on students' critical development, analytical skills, and problem-solving. Thus, future research can contribute further to developing and implementing this innovative learning model in the context of mathematics learning.

AUTHOR'S NOTE

The author declares that there is no conflict of interest related to the publication of this article. The authors emphasize that the data and content of the article are free from plagiarism. They also appreciate all those who have helped in writing this article.

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