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Original Article

The Influence of Cooperative Learning Models Think-Pair-Share and Jigsaw on the Mathematical Communication Skills of Grade X Students at SMKN 1 Gegerbitung in Terms of Self-Confidence

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Abstract:

An important ability in learning mathematics is communication skills where by communicating we can express ideas or ideas, in learning mathematics a student is expected to interact actively with each other during the learning process so that learning takes place effectively, one of the things that can be sought to improve students' mathematical communication skills is to implement cooperative learning. This study aims to determine the influence of the Think-Pair-Share and Jigsaw type cooperative learning models on mathematical communication skills from the perspective of self-confidence. The research method uses a quasi-experiment with a post-test only control group design. The sampling technique uses sample purpoship. The population in this study is Class X students majoring in Light Vehicle Engineering with research samples in Class X TKR1,2 and 3 SMK Negeri 1 Gegerbitung. The instruments in this study consisted of 10 linear program material description questions to measure mathematical communication skills and 20 questionnaire statements to measure students' self-confidence in mathematics learning. Based on the results of the descriptive analysis of the research, the mathematical communication skills of students who were given Think-pair-share type cooperative learning with the research subjects obtained an average score of 30.20, standard deviation of 1.79. The Jigsaw group with 32 research subjects, obtained an average score of 28.97, standard deviation of 1.80. The Conventional Group with 28 research subjects, obtained an average score of 26.64, standard deviation of 2.16. Meanwhile, the results of the descriptive analysis for the self-confidence of the High Think-Pair-Share group amounted to 10 or 33.3, medium amounted to 19 or 63.3% and Low amounted to 1 or 3.33%, the self-confidence of the High Jigsaw group amounted to 4 or 12.5%, medium amounted to 24 or 75% and Low amounted to 4 or 12.5% and the self-confidence of the Conventional group amounted to 19 or 67.9%, while Low amounted to 9 or 32.1%. The results of hypothesis testing with Two-Way ANAVA found that there was an influence

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of the learning model on mathematical communication with a sign value of 0.002, there was an effect of self-confidence on mathematical communication with a sign value. 0.000, and there was no interaction between the learning model and mathematical communication. From the results of the study, it can be concluded that the Think-pair-share and Jigsaw type cooperative learning models have an influence on mathematical communication skills, there is an influence of self-confidence on mathematical communication and there is no interaction between the learning model and student self-confidence on students' mathematical communication skills.

Keywords: Think-Pair-Share, Jigsaw, Self-Confidence, Mathematical Communication

Introduction

Education is one of the essential components in the development of individual abilities and the improvement of the quality of human resources. In this modern era, the learning process is not only focused on knowledge transfer, but also on the development of 21st century skills, such as critical thinking, communication, collaboration, and creativity. Especially in the realm of mathematics education, mathematical communication skills are one of the most important aspects to pay attention to. This ability includes students' ability to convey ideas, concepts, and mathematical solutions both orally and in writing (Fendrik, 2019).

The development of science and technology (IPTEK) at this time mathematics has a very important role both in terms of material and application. Mathematics is one of the disciplines that underlies the development of modern technology, because mathematics has an important role in various other disciplines and has a great influence in advancing human thinking (Indriani & Imanuel, 2018).

By using a creative, innovative, and imaginative mindset in learning mathematics, students are prepared to compete (Utami, 2017). Because mathematics is a very important subject in the education system of all countries in the world. Countries that neglect mathematics education as a top priority will lag behind in all fields, compared to other countries that give place to mathematics as a very important subject.

National Council of Teacher of Mathematics NCTM (2018) which states that 5 process skills that students need to have are: (1) *Problem Solving*; (2) Reasoning and Proof; (3) Communication; (4) Connection; (5) Representation.

The purpose of mathematics learning based on Permendikbud Number 22 of 2016 is for students to understand mathematical concepts, be able to describe the relationships between concepts, and apply concepts or algorithms efficiently, flexibly, accurately, and precisely in solving problems (Hidayat, 2019). In addition, students are expected to be able to reason mathematical patterns and properties, develop or manipulate mathematical concepts in compiling arguments, formulating evidence, and

describing mathematical statements clearly. The ability to solve problems is also a focus, including understanding problems, preparing solution models, solving mathematical models, and providing the right solutions. Finally, students are expected to be able to communicate their arguments or ideas using diagrams, tables, symbols, or other media to clarify the problems or circumstances they are facing.

Mathematical communication skills are important for students because they are needed to solve mathematical problems, problems in other disciplines, and problems in daily life, which is the vision of developing mathematics learning to meet today's needs. Students are said to communicate mathematically when they are already able to express situations - pictures - diagrams into language, symbols, ideas, mathematical models; explain ideas, situations, and mathematical relationships orally or in writing; listening, discussing, presenting, writing math; reading mathematical representations; and re-express mathematical descriptions in their own language.

At the Vocational High School (SMK) level, students are expected not only to have an understanding of mathematical concepts, but also to be able to apply these concepts in their vocational context. However, based on the results of initial observations, the mathematical communication skills of vocational school students are still relatively low. This is indicated by the low ability of students to explain the process and results of their work, both verbally and in writing, as well as in collaborating with their peers and it can also be seen that when students are asked to draw a diagram, students still find it difficult to describe it and vice versa. In addition, in the subject of the Linear Program, there are still students who are not accurate in representing from graphs to mathematical models, presenting story solutions to mathematical models, determining the maximum and minimum values of the presented images or vice versa.

Based on this, it can be seen that the ownership of Shiva's mathematical communication skills is still lacking, so that mathematical communication skills need to be honed and grown in students with the help of teachers as facilitators. Noviyana, (2019)says that Mathematical communication skills are the ability to convey information or ideas that a person has related to mathematics in the form of mathematical language.

Based on the results of observations in the classroom and observations, at SMKN 1 Gegerbitung it can be seen that students' mathematical communication is still low. This can be seen in the results of Daily Exam Analysis, Mid-Semester Assessment, School Exams, Especially on the Subject of the Linear Program. The average completeness score of the last 2 years is less than 50% of students who have completed with a score above the Minimum Completeness Criteria (KKM), with a student's mathematics score that has been set at 70. Overall it can also be seen from the Last Three Years School exam scores shown in the following table:

Table 1. SMKN 1 Gegerbitung School Exam Score Data

Indicator	Year 2019-2020	Year 2020-2021	Year 2021-2022

Number of Participants	196	220	232
Total value	10.979	12.718	13.552
Maximum	77	80	78
Minimum	30	30	25
Average	56.01	57,80	58,41

Students also look difficult and make mistakes when stating problems into mathematical models or expressing them in symbols, graphs, tables, etc. in Linear Program materials in particular. Apart from that, *self-confidence* still seems to be lacking. When students are asked to express their opinions, turn story problems into mathematical models, and put mathematical models into graphs, students are not sure of their abilities so that when teachers give assignments to students, they prefer to see the results of the discussion of problems that have been discussed by the teacher.

Noviana (2019) explain low mathematical communication skills and *self-confidence* Students need to be taken seriously by educators, because students' confidence not only predicts most of the future development of self-confidence, but also the development of success and achievement orientation. *Self-confidence* as an affective aspect in students cannot be taught, but must be trained actively and continuously until students are convinced that they have *self-confidence* who are strong to face their future lives. Therefore, to help grow *self-confidence* As well as improving students' mathematical communication, an innovation in learning is needed that can motivate and make students active in learning. (p.7)

Improving student learning outcomes can be done by choosing the right learning techniques and models to create a conducive teaching and learning process. One of the learning models used is the cooperative learning model. Cooperative learning in mathematics will be able to help students to improve students' positive attitudes in mathematics. Students build confidence in their ability to solve mathematical problems, so that it will reduce the anxiety about mathematics that many students experience. Cooperative learning emphasizes the presence of friends who interact with each other as a team in solving problems.

Sembiring & Surya, n.d., (2020) argues that the learning model in its application needs variations in order to accommodate differences in student abilities and differences in student characteristics. One of the models that can respond well to the diversity of students is *cooperative learning*. Cooperative learning type *think pair share* dan jigsaw It is felt that it can accommodate this goal.

Shoimin, (2021) That said, "*Think Pair Share* (TPS) is a cooperative learning model that gives students time to think and respond and help each other". argued that this model introduces the idea of "thinking time or waiting time" which is a strong factor in improving students' ability to respond to questions. This learning trains students to dare to have opinions and respect the opinions of friends. Stages in engineering Saragih

(2020) *Think Pair Share* Is *Think* (thinking), the teacher asks questions/problems and gives the opportunity to think before students answer the problems asked. *Pair* (in pairs), the teacher asks students to answer problems in pairs. *Share* (sharing), the teacher asked students in pairs to convey answers to other problems.

The jigsaw-type cooperative learning model is designed to achieve a very different set of goals, exchanging the instructor's understanding of the material and facilitating students' understanding of a number of topics through a structure *particapotory highty*. According to Huda, (2013) That "one of the assumptions underlying the development of cooperative learning (*cooperative learning*) is that the synergies that arise through cooperation will increase motivation to a much greater extent than through an individual competitive environment. Integrative social groups have a greater influence than groups formed in pairs. Feelings of interconnectedness (*feelings of connectedness*), according to them can produce positive energy.

Anggraini, (2019) stated that the Jigsaw model is a cooperative learning model in which students learn in small groups of four to six people heterogeneously, this group is called the origin group. The number of members in the group is adjusted to the number of parts of the subject matter that students will learn according to the learning objectives to be achieved. All students with the same learning materials study together in a group called an expert group (*counterpart group*). In the expert group, students discuss the same part of learning material, as well as decide on a plan on how to convey it to their friends if they return to their original group. Meanwhile, this learning model provides opportunities for students to work alone and work together. Students think independently to solve a problem calmly. Students then pair up and share their thoughts or solutions with friends nearby (p.16).

Based on the results of observations in class, it can be seen that students' mathematical communication skills are still low. This can be seen when students are asked to draw a diagram, students still find it difficult to draw it and vice versa. In addition, in the subject of the Linear Program, there are still students who are not accurate in representing from graphs to mathematical models, presenting story solutions to mathematical models, determining the maximum and minimum values of the presented images or vice versa. Based on these two things, it can be seen that the ownership of Shiva's mathematical communication skills is still lacking, so that mathematical communication skills need to be honed and grown in students with the help of teachers as facilitators. Noviyana et all (2019)said that mathematical communication skills are the ability to convey information or ideas that a person has related to mathematics in the form of mathematical language.

According to research conducted by Hidayat (2017), a structured cooperative learning model can improve students' mathematical communication skills. The study showed that students who participated in learning with the *Think-Pair-Share* model had better mathematical communication skills compared to students who participated in conventional learning. The results of this study show that the use of a learning model that involves active interaction between students can improve their understanding of concepts and communication skills (Hayati et al., 2023; Purba & Rajagukguk, 2024).

One of the factors that affects mathematical communication skills is *self-confidence*. Students who have low self-confidence tend to be less active in asking questions and conveying their ideas, which can ultimately affect their learning achievement, especially in mathematics subjects that require good analytical and problem-solving skills. According to Santrock (2011), *high confidence* is positively related to students' academic skills and motivation to learn.

A lack of confidence in students can be caused by several factors, including previous negative experiences, fear of failure, and lack of support from the learning environment. Students who have experienced significant difficulties in understanding mathematical concepts or have received low grades may feel anxious and unconfident when faced with a new mathematical task. This fear of failure makes students reluctant to actively participate in class discussions or ask questions when they do not understand the material. Additionally, a less supportive classroom atmosphere, such as a lack of emotional support from teachers or peers, can exacerbate these self-confidence issues. A competitive and non-inclusive learning environment also contributes to students' feelings of isolation and inability to compete healthily in the learning process. In the long run, this low self-confidence can lead to a continuous cycle of failure, where students continue to doubt their abilities and are less motivated to achieve better results.

Especially at SMKN 1 Gegerbitung, some of the common problems that are often faced by students are low active participation in mathematics learning, difficulty in understanding the material taught, and low involvement in group discussions. Based on the results of interviews with teachers and observations in the classroom, many students seem hesitant to ask questions or share their thoughts, especially when asked to explain mathematical concepts in front of the class. This phenomenon shows that students' confidence still needs to be improved.

The conventional learning model that is often applied in vocational schools tends to be *teacher-centered*, where the teacher is the center of learning and the student is only the recipient of information. This is less effective in improving students' mathematical communication skills. Alternatively, the *Think-Pair-Share* and *Jigsaw-type* cooperative learning models offer a more *student-centered* approach, where students are invited to actively think, share, and work together in groups to complete mathematical tasks.

The Think-Pair-Share *model* consists of three main stages: *think, pair,* and *share*. In the *think* stage, students are given time to think about a problem individually. In the *pair* stage, students pair up to discuss their thoughts. Then in the *share stage*, pairs of students share the results of their discussion with the whole class. With this approach, it is hoped that students can be more active in the learning process and improve their mathematical communication skills.

Meanwhile, *the Jigsaw* model involves dividing students into small groups, where each group member is responsible for learning a specific part of the material. After understanding the material, students return to their home group and teach what they have learned to their group mates. This approach not only encourages students to delve deeper into the material provided, but also improves their ability to communicate the knowledge that has been acquired.

Research conducted by Slavin (1995) revealed that the use of cooperative learning methods such as Jigsaw can significantly improve student learning outcomes. Students who learn with the *Jigsaw* not only understand the material better, but also develop better social and communication skills (Slavin, 2018).

In this regard, this study aims to improve student learning outcomes that are still low in the aspect of mathematical communication, by considering the confidence factor in Vocational High School (SMK) students. The focus of this research is to examine the influence of the *Think-Pair-Share* and Jigsaw type cooperative learning models on the mathematical communication skills of vocational school students, reviewed from the aspect of self-confidence by taking the subject of the Linear Program. In this regard, in order to improve student learning outcomes that are still low at the level of mathematical communication of vocational school students reviewed from *Self-Confidence*, the author tries to carry out research related to cooperative learning with the title: "The Effect of *Think-Pair-Share* and *Jigsaw Type Cooperative Learning Models* on the Mathematical Communication Ability of Vocational School Students Reviewed from *Self-Confidence*". To find out whether there is an influence of the Think *Pair Share Type*, jigsaw and conventional cooperative learning models on students' mathematical communication skills and whetherthere is an interaction between the learning model and *self-confidence* on students' mathematical communication.

Methods

This study uses a quantitative approach with the *Quasi Experimental research method*. The independent variables in this study are the learning model and *student self-confidence*. Meanwhile, the bound variable is the student's mathematical communication ability. *The design* in this *Quasi Experimental* study uses *Posttest Only Control Group Design* because the researcher wants to see how the results of the students' mathematical communication skills test in the experimental class and the control class (Suratno et al., 2019). The experimental class is a class that is given treatment in the form of a think-pair-share type cooperative learning model, *Jigsaw,* while the control class is a class without treatment and only uses the learning model that is commonly used by teachers in the previous semester, namely the conventional learning model.

In this study, the target population is class X of the Department of Light Vehicle Engineering at SMKN 1 Gegerbitung which consists of 5 classes, namely: X TKR-1, X TKR-2, X TKR-3, X TKR-4 and X TKR-5. The sampling technique used *Purposhive sampling* until class X TKR-1, X TKR-2 as the experimental class and class X TKR-3 as the control class were selected based on considerations from the results of equality tests, normality tests, homogenization, and bidirectional anava. The illustration of the treatment is described as follows:

Class	Treatment	Post-test
RE1	X1	Y

RE2	X2	Y
RK	-	Y

Re: Experimental Classes
Rk: Control Class
X1; Experimental treatment, namely learning with a TPS-type cooperative learning model
X2: Experimental treatment, i.e. learning with a Jigsaw-type cooperative learning model
Y : Mathematical Communication students

The instrument used in this study to measure students' mathematical communication skills used a written test containing 10 descriptive questions on linear program material that contained indicators of mathematical communication skills. To measure *self-confidence*, a non-test scale was used at the end of the treatment of the experimental class and the control class. The *student self-confidence* scale is divided into three categories, namely high, medium and low. The hypothesis test used is the Two-Way ANOVA Test. The research design of the learning model and student self-confidence is as follows:

Self-confidence	Class		
	Experiments (A1)	Experiments (A2)	Control (A3)
Height (B1)	A1B1	A2B1	A3B1
Medium (B2)	A1B2	A2B2	A3B2
Low (B_3)	A1B3	A2B3	A3B3

Information:
A_1 : Experimental class group given a TPS-type cooperative learning model

A2; Experimental class group given a jigsaw-type cooperative learning model

A_3 : Control class group given conventional learning model

$A1B_1$: Group of students with a TPS-type cooperative learning model with *high* self-confidence

$A1B_2$: Group of students with a TPS-type cooperative learning model with *moderate* self-confidence

$A1B_3$: Group of students with a TPS-type cooperative learning model with *low* self-confidence

$A2B_1$: Group of students with a jigsaw-type cooperative learning model with *high* self-confidence

$A2B_2$: Group of students with a jigsaw-type cooperative learning model with *moderate* self-

confidence

$A2B_3$: Group of students with a jigsaw-type cooperative learning model with *low* self-confidence

$A3B_1$: Group of students with a conventional learning model with *high* self-confidence

$A3B_2$: Group of students with conventional learning model with *moderate* self-confidence

$A3B_3$: A group of students with a conventional learning model with *low* self-confidence.

Results

The hypothesis test in this study uses a Two-Way ANOVA test assisted by SPSS 21 software. Based on the results of the data analysis that has been carried out, the following results are obtained.

1. The Effect of the Cooperative Learning Model on Students' Mathematical Communication Skills

The two-way ANOVA test was used to find out whether there was a difference in the influence on the results of the mathematical communication ability test of students in the experimental and control classes. The following are the results of the two-way ANOVA test assisted by SPSS 21 with a significance level of $\alpha = 0.05$.

Source	Type III Sum of Squares	df	Mean Square	F	Mr.
Corrected Model	377,200a	7	53,886	33,698	,000
Intercept	32437,574	1	32437,574	20285,441	,000
GROUP	21,424	2	10,712	6,699	,002
SC	112,730	2	56,365	35,249	,000
GROUP * SC	,475	3	,158	,099	,960
Error	131,123	82	1,599		
Total	74411,000	90			
Corrected Total	508,322	89			

Based on Table 3, the results of the two-way ANOVA calculation show that in the

Group (Class) row that applies the learning model, a significance value of =0.02<0.05 is obtained. Thus, the conclusion is that H0 is rejected which means that there is an influence on the application of the learning model in the experimental class and control on the results of the mathematical communication ability test.

2. Interaction Between Learning Models and Students' *Self-confidence* in Mathematics Learning on Mathematical Communication Skills

Based on Table 3, the significance values in the Group and *self-confidence* (SC) rows were 0.02 and 0.00. This shows that there is a significant influence on the application of the learning model in the experimental and control classes on the results of the mathematical communication ability test and there is also a significant influence on the level *of students' self-confidence* in learning mathematics on mathematical communication skills. However, in Table 3, the significance value of the interaction between the learning model and *self-confidence* was 0.96 >α=0.05. This shows that H0 is accepted, which means that there is no interaction between the learning model applied to the experimental and control classes and *students' self-confidence* in mathematical communication skills. Thus, it shows that mathematical communication skills are not influenced by *the self-confidence* possessed by students and the treatment given by teachers, both with the *Think-Pair-Share type cooperative learning model, jigsaws* and conventional learning models. The interaction between the learning model and students' *self-confidence* in mathematics learning is presented in the following figure.

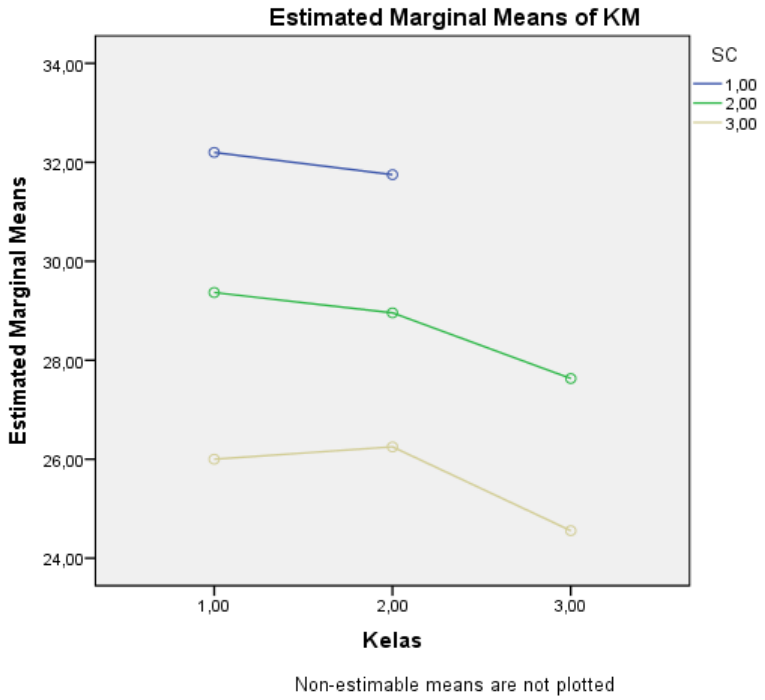

Figure 1. The Interaction between the Learning Model and Students' Self-confidence in Mathematics Learning on Mathematical Communication Skills

Based on Figure 1, the group of students with *high, medium and low self-confidence* obtained the highest average score of mathematical communication ability using the *Think-pair-share type cooperative learning model* rather than with the Jigsaw and conventional learning models. This is supported by the findings from Lestari (2015) which stating that *Think-Pair-Share* (TPS) is a type of cooperative learning that stimulates students' thinking activities in pairs and sharing knowledge with other students. When communication is smooth, students' confidence will grow so that learning becomes meaningful. Likewise, Arlinah (2021) stated that the Think Pair Share (TPS) type cooperative learning model is a learning model in which students are conditioned to be able to explore their potential optimally in carrying out learning activities so that the expected learning completeness can be achieved (Arlinah, 2021). In line with Br. Sembiring, et al. (2020) who said that from the results of the study, it has been obtained that using the think pair share (TPS) learning model can make students active in the learning process in their groups so that they can hone students' mathematical communication skills towards the material taught and the TPS model is better than ordinary learning (Meilana et al., 2020).

In addition, the figure also shows that there is no interaction between the learning model and students' *self-confidence* in learning mathematics on mathematical communication skills. This is shown from the two lines on the graph that connect the learning model with the student's *self-confidence*, almost forming two parallel lines, no intersecting lines.

Conclusion

The Think-Pair-Share and Jigsaw type cooperative learning models have an effect on students' mathematical communication skills. This is evidenced by the average mathematical communication ability of students in the experimental class who use the learning model is higher than that of students in the control class who learn with the conventional learning model. However, there was no interaction between the learning model and self-confidence on students' mathematical communication skills.

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