# The Primary School Learners' Mathematics Communication Skill Improvement through PBL and TGT Models

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| Article Info | Abstract |
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| | This research aims to find out the primary school learners' mathematics communication skills through PBL and TGT models. This research is a quantitative approached research. The research method is a quasi-experimental method with a *non-equivalent pre-test and post-test control group design.* The technique of collecting data was *cluster random sampling.* The sample consisted of the fifth graders of Primary School in Jatinangor. The school has applied the 2013 curriculum. The fifth graders of Sinargalih Public Primary School were taken as the experimental group while the fifth graders of Mekarsari Public Primary School were taken as the control group. The data collection were done by distributing the Mathematics Communication Skill Test (MCST), observation sheet, and interview. The applied data analysis was *an Independent simple T-test* and hypothesis test. The findings showed that there was the learners' mathematics communication skill improvements taught by PBL or TGT, and the significant improvement the learners taught by PBL. The results obtained an average score of students taught by PBL was higher with 70.23 than TGT with a score of 65.30. It could be concluded there was significant improvement of learners' mathematics communication skills taught by PBL or TGT models. |

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**INTRODUCTION**

The importance of learners' mathematics communication skills is one of the 21st century skills. It deals with 4C skills required by learners. They consist of *critical thinking, collaboration, communication*, and *creativity* skills. Besides that, the importance of communication skills becomes the primary capital to develop the other skills such as problem-solving, critical thinking, collaborating, and creating creative idea skills. It is in line with Istikomah's statement (2014). She argues that mathematics communication supports the other mathematics skills such as problem-solving skills. When the communication skill is better then a problem would be more easily interpreted correctly. This matter also supports learners so they could solve their engaged problems. In solving problems, an excellent and accurate communication skill while being engaged with problems is required. It is also important to analyze the problem so it provides the result representation as the solution of the problems solved by the learners (Sofiyah, 2017). Higher mathematics communication skill leads to higher problem-solving communication skill (Rolensia, 2017). It could be concluded that communication is required. Thus, learners could apply it in the problem-solving process (Pane, 2018).

The communication does not only deal with spoken communication but also the written communication. However, in the reality, based on the observation and the interview results of the fifth graders and the teachers, showed the learners' mathematics communication skills were low. The learners could not fluently share their ideas or notions in the form of written text properly. It is also clarified by Marina et al (2014). They state that complex mathematics factors such as difficulties to communicate the ideas into mathematics language while working concerning the daily lives.

Several influential factors toward the low mathematics communication skills of the learners are such as the learning method implementation. It was found that lecturing dominated the learning with a percentage of 61%. The mathematics learning activity was also still dominated individually with a percentage of 44%. Thus, the learning was teacher-centered learning that made the learners less active and interactive, either to their teachers or among the learners.

It is in line with Hidayat (2014). He revealed the lack of learners' understandings about the mathematics concept and the difficulties for the learners to speak mathematically. Therefore, an effective method to improve the learners' mathematics communication skills with the supportive elements such as learner-centered learning and collaboration to encourage the learners activeness are required to create a meaningful learning atmosphere for the learners. *Problem-Based Learning* model and *Team-Game-Tournament* model were chosen as the attempts to improve the learners' mathematics communication skills. Both models have *student-centered* and collaborative natures.

The principles of the models are constructivism and sociocultural theories. Thus, learners are expected to construct their knowledge such as by learning in groups. Although they had similar principles and elements, those models were applied because they had specific characteristics to motivate active learners' participation during the learning process. Besides that, based on several previous studies such as Kodariyati & Astuti (2016), Respati et al (2016), and Nurbaiti et al (2016, found that PBL could improve the mathematics communication skills. The studies conducted by Sanusi & Widyaningsih (2014), Devita (2017) also found that PBL could improve the mathematics communication skills. A study conducted by Nanda Noor Fadjrin, Budiyono, and Dewi Retno Sari Saputro (2015), concerning PBL and TGT, found that PBL was better to improve the learning achievement than TGT. The differences of those researches were only about the research targets, focusing on the learners' creative thinking skills, and carried out in SHS level. Thus, the materials are suggested to be different for further researches.

PBL is a problem-based model while TGT is a model that has competitive and playing game elements.

From the learning stage aspect, their characteristics are different. PBL has 5 stages. Stage 1 is the orientation or problem definition for the learners. Stage 2 is organizing learners to learn autonomously (*self-learning).* Stage 3 is guiding the individual or group investigation while the learners

exchange their knowledge. Stage 4 is developing and presenting the works. Stage 5 is analyzing, evaluating, and assessing the problem-solving process. On another hand, the TGT learning process consists of, stage 1, class presentation; stage 2, team learning; stage 3, playing games; and stage 4, recognizing the teams.

Based on the backgrounds, the formulated questions are: 1) how the improvements of the learners taught by PBL and TGT models are?; 2) Is the mathematics communication skills of the learners taught by PBL better than those taught by TGT?

This research aims to find out: 1) the influence of PBL and TGT models that indicate the learners' mathematics communication skill improvement, and 2) the average differences of learners' mathematics communication skills taught by PBL and TGT with a purpose to find out which learning model implementation is effective.

## METHOD

This is qualitative research with a quasi-experimental design. The applied design is a non-equivalent pretest-posttest control group design as presented in Table 1.

**Table 1.** Research Design

| Pretest | Treatment | Post-test |
|---------|-----------|-----------|
| $O_1$ | $X_1$ | $O_2$ |
| $O_3$ | $X_2$ | $O_4$ |

The applied population in this research was the fifth graders of the whole Jatinangor district. They were two school samples, Sirnagalih and Mekarsari Public Primary Schools, in the academic year of 2019/2020. The applied sampling technique was *cluster random sampling*. After being sampling, Sirnagalih Public Primary School was taken as the experimental group while Mekarsari Public Primary School was taken as the control group. The numbers of the participants of both groups were 30 learners.

The data collection method applied documentation, observation, and test. Documentation was applied to obtain the initial skill data of the research sample learners. The test method was used to obtain mathematics communication skill data before being

disseminated. The learners' mathematics communication skill scores were then processed to examine the research hypothesis. The observation method was applied to observe the learners' activities during the learning process.

The applied data analysis techniques were 1) normality test with the Kolmogorov Smirnov, (2) homogeneity test with the Levene statistic test, (3) one-sample t-test, and independent-sample t-test.

## RESULTS AND DISCUSSION

Based on the analysis results of the pre- and post-stages, examined by *Kolmogorov-Smirnov* with alpha 5% and assisted by *SPSS* 22, the significant score of the groups taught by PBL and TGT was $0.2 > 0.05$. It showed the samples were normally distributed. Then, the homogeneity test, based on the *Test of Homogeneity of Variance output* table with a significant score of 5% showed that the group taught by PBL had a score of $0.814 > 0.05$. In another hand, the group taught by TGT obtained a score of $0.589 > 0.05$. It meant they were homogeneous. Therefore, the samples were from a homogeneous condition.

**The Learners' Mathematics Communication Skill Improvement taught by PBL Model**

The improvement of the learners taught by PBL could be seen from the pretest, the learning process, and the post-test result. The pre-test was a test conducted before applying the PBL model while the post-test was a test conducted after applying the PBL. From the pretest, the average score was 40.77 while the post-test obtained an average score of 70.23.

Besides referring to the obtained test result, the PBL model could improve the learners' mathematics communication skills. It was due to the learning process that involved the problem orientation in which the presented problem concerned the learners' daily lives. Therefore, it could foster the learners' motivations in the learning and the motivations were entailed by the learners' curiosities. Curiosity is the characteristic and the initial capital for learners that encourages them to be interested in searching, finding, and solving problems (Ameliah, 2016; Fauzia, 2018).

Besides that, the discussion and the presentation made the learners interested to not

only complete the given task but also to train their mathematics communication skills. Thus, they could communicate and help each other to solve the given problem by the teachers. However, to introduce, to make them understand, and to make them capable of solving the problems with scientific procedures still required further guidance because the learners were still not confident with what they were and had been doing.

Even so, started from the learners' motivations, interests, and communication skills after being taught by PBL model stages could improve the fifth graders' mathematics communication skills. It is as Mulia, Coesamin & WIdyastuti (2018) state. They revealed that PBL could provide better opportunities to improve learners' mathematics communication skills through its learning stages.

Another matter that supported the improvement of the PBL model toward the communication skills, seen from the observation result, was the implementation of PBL. It was categorized as excellent with a score of 85.71. It meant the PBL model had been very properly promoted by the teachers so that the learners' mathematics communication skills were improved.

**The Learners' Mathematics Communication Skill Improvement taught by TGT Model**

The learners' mathematics communication skill improvement taught by TGT could be seen from the pretest and the post-test. The pretest was conducted before applying TGT in the learning process while the post-test was conducted after being intervened by the TGT learning model. The obtained pre-test score was 44.33 while the post-test score was 65.30.

The learners' skills could improve after being taught by TGT due to its learning process. There were several learning processes such as team learning, playing games and recognizing team discussion process, and peer-material explanation. The peer-material explanation could occur since the promoted game tested the learners' communication skills as what a presentation could do. However, in this game, there was a competitive atmosphere so every learner was motivated and responsible to understand the materials because they would be tested and competed so it could score a point for

their teams. By having this recognition, it attracted the learners' interests to learn the materials by training their communications through discussion and competition. Game is a favorite thing to do by learners. It is also stated by Harahap (2018) and Rohmah (2016). They argued that playing games or games were a basic necessity or the right for children. They are also interesting and joyful matters for them. Thus, the learners' interest to understand the materials and train their skills through discussion and competition could appear

However, since the group formation, the roles of the team leaders until the members required the teachers' guidance because they were still not confident to be the leaders. They were not feeling confident to carry out their roles in explaining the materials for their members although that team synergy was an important part of this TGT learning. It is as stated that teams (group or individual works) are the important components or orientation in TGT-typed cooperative learning (Hadi, R. F, 2017; Ulfia & Irwandani, 2019).

Besides that, not all learners could explain the materials properly so the discussion was not very optimal. The competition was also dominated by those who had high skills. Even so, the learners were still motivated in the learning process and training their skills and communications. This communication improvement was also supported by the proper applied learning model by the teacher. It obtained a score of 83.48 based on the conducted observation.

**The Learners' Mathematics Communication Skill Improvements Taught by PBL and TGT Models**

From the test after the treatment, the group taught by PBL or TGT had mathematics communication skill improvements. The test results from both groups are presented in Table 2.

**Table 2.** Results of Experimental and Control Groups' Post-test

| Class | Learning Model Definition | Scores |
|---|---|---|
| Experimental Group | PBL | 70.23 |
| Control Group | TGT | 65.30 |

From the table, the experimental group taught by PBL has a higher score than the control group taught by TGT. It was due to PBL had several strengths for the learning. They were such as problem-orientation in which presented daily real-life problems and discussion and presentation. After being applied in mathematics lessons with geometry material, focused on block and cube, it was more appropriate than the TGT although there were also improvements of the learners' motivation and interest. They were such as due to game, competition, and recognition. Other supportive things for a better PBL model were due to the given problems that facilitated learners to develop their critical thinking, skills to solve and complete problems, and intellectual skills that require adult role participation through factual experiences and learning autonomies (Utami, 2019). A similar thing is also stated that problem-based learning could improve learning success, skills, and individual knowledge construction. Therefore, it could create more joyful, fun, and meaningful learning (Fauzia, 2018).

Using problem orientation, discussion, and presentation, they could motivate and foster the learners' learning interests although they still required further guidance from the teachers. It was due to their lack of confidence in solving the problems scientifically. However, team communication and cooperation could reduce their self-doubt. Thus, they would not always need the teachers' guidance, especially to ensure their answers or solutions. Even so, the TGT model also had strengths such as its game, tournament or competition, and recognition in addition to discussion activity.

Although playing a game is something loved by children, especially while learning mathematics with geometry material, however, during the discussion with a purpose to understand the competed materials, not all learners could explain it to their peers. During the competition, learners with high skills dominated the game. Thus, the learning was not optimal because there were intense competitions that influenced the learning atmosphere.

## CONCLUSION

Based on the findings about the primary school learners' mathematics communication skills taught by PBL and TGT, it could be concluded that: 1) the learners' mathematics communication skills taught by PBL had improvements. They were proven by the mathematics communication skill test average scores. It was 40.77 and improved into 70.23. It also went the same way for TGT model with the learning characteristics. It could improve the primary school learners' mathematics communication skill from 44.33 into 65.30. 2) the learners' mathematics communication average score of the PBL model group was better than the group taught by TGT.

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