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Improving Prospective Mathematics Teachers' Writing Skills in Drafting Research Proposals Through the Think, Talk, Write (TTW) Learning Model

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Abstract: This research was to improve the prospective mathematics teachers' writing skills in one of the universities in Indonesia. This was classroom-action research to improve students' skills in writing research proposals. The quantitative and qualitative methods were used. Final year students were selected as the subjects. Observation sheets, questionnaires, interviews, anecdotal notes, and student final manuscripts were used as the instruments. The data were analyzed quantitatively to see improvements between cycles and learning completion. Data was also analyzed qualitatively to describe the improvements due to the TTW model after the data reduction and triangulation. The results showed that there were improvements to students' writing skills by using the TTW model. Cycle #1 completion was 45.45%, Cycle #2 was 69.7%, and Cycle #3 was 81.82%. Students' skills were improved because TTW provided exercises for thinking skills. TTW also improving speech skills by training students to speak in front of class forums, and improving writing skills by training the students to compile research proposals and providing opportunities to consult with teachers.

Keywords: Model; think talk write; writing skills.

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INTRODUCTION

Indonesian students' writing skills were still concerning. Preliminary studies in one university in Salatiga, Indonesia showed that about 82.3% of mathematics students still have problems related to thinking, speaking, and especially writing skills. The average writing skill score is still far from the minimum completion criteria, which was 59.36 obtained from the task of compiling a proposal given to 30 mathematics students. Students' skills to find learning problems in the classroom, analyze those problems, choose alternative models, methods, or strategies of learning in

the classroom were not yet optimal. When given problems and asked to criticize and find solutions, 82.3% of 30 students did not yet achieve satisfactory results. Students were unable to distinguish between academic problems from personal problems. Action research proposals compiled are still a cause for concern. The students' problems when compiling action research proposals are as follows: (1) the background of the problem still does not show the results of the preliminary study so that the learning problems raised are only the opinion of the author, (2) not accompanied by data on the results of

learning problems explained by students, (3) problem formulation is not yet clear problem variables and action variables, (4) they were also unable to analyze learning problems, find the causes, and formulate proper solutions. Questionnaire data showed that 69.9% of students were unable to find learning problems in the classroom, 81.81% of students were unable to analyze learning problems, and 93.93% of students were unable to formulate the proper solutions.

In addition to the problems that have been described in paragraph one, the results of interviews with students, they were also unable to combine learning models if complex learning problems occurred. Students were unable to choose proper media and instruments. It became a complex problem, because students that prepared as prospective math teachers, do not understand the skills teachers should have. This also shows that there is a wide gap between the expectation that students who are prepared as prospective Mathematics teachers should already understand how to conduct a classroom action research because starting from this it is expected that prospective Mathematics teachers will be able to improve all forms of learning problems that occur in the classroom.

Apart from the existence of gaps as explained in the previous paragraph, the assignment of the proposal shows that students' subpar writing skills can be caused by many factors, such as learning methods used by teachers. Some learning models are less capable to facilitate students' writing skills (Huda, 2013). If students are allowed to practice writing skills, they will build their arguments based on logical and correct procedures (Van Belle et al., 2022). Learning success tends to be measured by how many concepts students memorize, rather than the skills to think, talk, and write. Learning is also dominated by individualistic and competitive attitudes. Thus idea-sharing was not nurtured. (Ishaya et al., 2018) stated that students will have good skills if they are actively involved in the learning process. Students can be trained through learning models that empower skills, and avoid teacher-centered learnings. In addition, (Bächtold, 2013) also stated, there

needs to be a paradigm shift to student-centered learning and on the interaction between students and teachers. Learning should improve students' skills and facilitate student cooperation so that they can interact, share ideas and ideas. Writing skills can be trained through the Think, Talk, and Write (TTW) model. NCTM stated that using appropriate and innovative mathematical learning models will be beneficial to students (Midgett & Eddins, 2001).

The TTW is a cooperative learning model built through the process of thinking, speaking, and writing (Supandi et al., 2018). The TTW starts from the involvement think with themselves, with their friends, and with their teachers to construct their thoughts. It continued by sharing their ideas with friends and write the results of the discussion for their assignments. The writing activities mean constructing ideas because after discussing or dialogue between friends they express it through writing. In this research, the classroom action research proposal is the final target of learning achievement. Students explore the thinking process through understanding the topics, constructing knowledge instead of memorization when they discuss, communicate and interact with their peers (Qurohman, 2018). Students construct knowledge by formulating problems, designing solutions, searching for answers, expressing ideas, uncovering questions, self-reflection, and finally pouring their ideas into a research proposal. The TTW has been used by previous researchers. (Kuslinar et al., 2019) examined the influence of the TTW on the mathematical communication skills of eighth-grader. (Tajudin & Chinnappan, 2016) examined the relationship between HOTS, representation, and concepts to TIMSS tasks.

The TTW model has three stages (Kemp & Vidakovic, 2021). The first stage is a *Think*: Students are given the materials and problems then asked for possible answers and make small notes about their ideas. The second stage is *Talk*: Students are to discuss, share ideas, and communicate about the learning problems discovery, analysis of learning problems, and choose alternative solutions. The last stage is *Write*: Students write down

the ideas as a research proposal. The TTW was chosen because its stages provide opportunities for students to think about problem-solving as initial understanding or initial thinking (Houston, 2009). It is different from other cooperative learning such as STAD, TGT, jigsaws, NHT, and group investigation that did not have that stage (Tiantong & Teemuangsai, 2013). Also, in TTW, at the beginning of learning, the initial test was conducted to find out students' initial knowledge and their readiness to learn (Kuslinar et al., 2019). Thus, the TTW is suitable model to improve students' writing and communication skills (Huinker, & Laughlin, 1996; Salim, 2019).

The TTW model was chosen because it can facilitate communication both oral and written (Anggraeni & Apsari, 2021). (Hutabarat, 2021) first introduced the TTW model. The progress of communication is seen from students' involvement in dialogue with others, sharing their ideas, and writing the results of interactions and discussions. The TTW model, in which the learning steps include think, talk, and write steps, will guide students before they are expected to be able to write down their ideas and ideas in a PTK proposal, they have carried out the think stage, then carry out the discussion stage (talk).

Based on those descriptions the research problems were: (1) how to improve students the writing skills? (2) How were the students' writing skills in the TTW learning? Thus, this research ought to find out the improvement of the students' writing skills using TTW. This research was to contribute to refining the application of TTW to improve students' writing skills. The research also to be used as a reference to improve students' writing skills in other courses and fields.

METHOD

This research uses qualitative and quantitative approaches (Cresswell, 2009)

with the Class Action Research method according to Kemmis & Taggart. The research was conducted in academic year 2021/2022. The mathematics education students in one university in Indonesia were selected as the participants.

The research consisted of four stages: planning, implementation, observation, and reflection. The planning stage is the process of preparing all PTK instruments, the action stage is carried out by carrying out PTK according to what has been planned, namely carrying out the learning process using the TTW model, the observation stage is carried out to observe the learning activities of lecturers and students to see whether the TTW syntax has been implemented, the reflection stage is carried out by see the learning outcomes, see the shortcomings and successes that have been implemented (Lestari & Yudhanegara, 2015).

The instruments used were written tests, observation sheets for students' and teachers' activities, field notes, student feedback, questionnaire sheets, daily journals of learning, and documentation. The research consisted of three cycles with two meetings each. Learning completions were seen from the tasks given by teachers in each cycle (McNiff & Whitehead, 2016). Indicators of successful learning are the ability to write research proposals, including (a) writing proposal manuscripts, (b) logical flow of writing, and (c) systematic writing. Action research was to stop if 75% or more students got scores of 80 or higher obtained from the average accumulated score for each assessment indicator.

RESULTS AND DISCUSSIONS

Data Descriptions

The syntaxes and activities in learning process were shown in the following Table 1:

Table 1. Description of teacher and learners' learning activities in cycle 1

SYNTAX	ACTIVITIES	
	LECTURER.	STUDENTS.
CYCLE #1.		
The teacher provides learning materials to be read and understood by students.	Provide an explanation of the material that must be understood by learners	• Listen to the teacher's explanation and do the following: a. Find learning problems in the classroom/ b. Do an analysis of learning problems found. c. Choose an alternative solution for the problems. d. Formulate a good action research background, research questions, and objectives.
Students build and construct their own knowledge and ideas.	Give instructions on: a. How to find learning problems in the classroom. b. How to analyze learning problems. c. How to choose alternative solutions for the problems. d. Provide strategies how to formulate research background, research questions, and objectives. e. Give task to conduct observation and preliminary study to the school to find learning problems.	
TALK: Students discuss, interact, and communicate with friends and teachers about learning materials.		
WRITE: Write Chapter I consisting of research backgrounds, formulations, objectives, and benefits of classroom action research.		
CYCLE #2.		
THINK: Learn how to structure the theoretical foundation of a classroom action research proposal.	• Become a facilitator and mediator. • Students were asked to present their work that includes: a. Learning problems found in the classroom. b. Results of learning problems analysis. c. Alternative solutions for the problems	• Presenting their works. • Communicate and discuss with friends and teachers about: a. The problems that arise. b. Learning problems found in the classroom. c. Alternative solutions for the problems.
TALK: Communicating the foundation of classroom action research.		
WRITE: Laying out the theoretical foundation of a class action research proposal		
CYCLE #3.		
THINK: Studying the learning material and compose complete proposal from Chapter I to Chapter III.	• Provide advice, input, and direction about students' proposals.	• Draft a classroom action research proposal based on the results of previous assignments provided by the teacher.
TALK: Discuss, communicate, and interact with friends and teachers.		
WRITE: Construct the action research methodology to complete their research proposal that consists of Chapter I to Chapter III.		

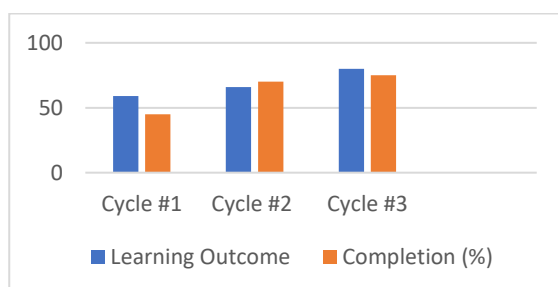
The goals in the first cycle were: (1) Students can find and identify various problems in the classroom. (2) Students can analyze learning problems and find the causes. (3) Students formulated alternative solutions for problems. Some findings in the first cycle were: (a) Many students were unable to distinguish between academic problems with personal problems, even though both will affect attitude and learning achievements

(Yazid, 2013). For example, many students sleep in the classroom, skip school because they have to help their parents, some were late in paying tuition, or have family problems. There are some criteria to find learning problems. The easiest way was the average learning outcome. If below the Minimum Completion Criteria (MCC) then there were problems related to the learning process. After the problems were identified, the causes were

to be traced. It was found that students were unable to express opinions in front of the forum properly. This resulted in their low communication, cooperation, and interaction skills. Students were highly individualistic and competitively competing with each other.

The 1st cycle completion was 45.45%. It was obtained from the calculation of activities conducted by students. There were 54.55% of students who were not yet achieved adequate thinking, speaking, and writing skills. Thus, the completion was not yet achieved satisfactory level, and the next cycle was to be implemented.

Cycle #2 was done by asking students to choose alternative actions and solutions to problems found in Cycle #1. It was found that some students' solutions were not based on the problems they found. For example (a) Choosing STAD to improve learning outcomes, but no problems found about students' cooperation and communication skills, or their interactions. (b) Problems in communication skills were found but choose problem-based learning. (c) The solutions cannot solve the problems. For example, the average learning outcome was low, passive learners, students were not eager to follow the learning and not confident, but choose PBL that did not accommodate improvement of students' skill to cooperate, interact, and communicate; (2) Students did not arrange the theme and title of their proposals based on the problems found. For example (a) Using group learning models, but no information that students have problems with their cooperation and interaction skills. (b) The formulation of research problems was inconsistent with the title, objectives, hypotheses, and research indicators.



The Cycle #2 completion was 69.7%, increased by 24.25% compared to Cycle #1.

This improvement occurred because students were tasked to compile research backgrounds, research questions, research objectives, hypotheses, and indicators of the research success. Tasks were given as a continuation of the tasks in Cycle #1. Students were allowed to discuss and share ideas with others (scaffolding) before wrote them down as research proposals. The results showed that many students still made improper research questions. The idea-sharing activities in this cycle made students confident to communicate and express their opinions. The advice from teachers has been used to revise their proposals. The completion rate of 69.7% was still unsatisfactory, thus third cycle was required. The reflection showed the need to optimize the students' communication skills. Ten students must be accompanied specifically and conducted more in-depth interviews with them.

In Cycle #3, students were tasked to complete their proposal consisting of Chapters I through Chapter III that contains the research background, theoretical foundation, and methodology. It was found that: (1) many proposals did not yet have the interrelated background, theoretical foundation, and methodology. (2) Most students have presented their proposals, and when the teacher conducts Q&A and interviews, the students have been able to maintain their arguments regarding their proposals. Students' communication skills were improved, they can explain their arguments according to the logical flow, and their sentences were also good. (3) Students' writing skills were improved. Mistypes, informal sentences, and disjointed paragraphs have been corrected and become better.

The completion of Cycle #3 was 81.82%. There were still six students who have not finished. Six students were unable to obtain significant improvements because they still did not understand the concept of action research with quantitative and qualitative approaches. One of them still gave Ha and Ho when compiling the hypothesis. Their proposals' titles still use the words "influence" or "effectiveness." It showed that they did not understand what classroom action research

was. Those students, some were introverts, feel embarrassed, insecure, and reluctant to interact with friends or teachers in class.

Think Talk Write (TTW) was proven to improve prospective mathematics teachers' writing skills. The TTW facilitates the thought, communication, and writing processes of mathematics education students (Supandi et al., 2018). (Anggraeni & Apsari, 2021) stated that the process of writing starts from the student's interaction in thinking and communicating with themselves, their friends, and teachers, then talking and sharing ideas. This learning model has three stages. In the first stage, students are given material cases or problems that can motivate them to think and instruct their minds about how to find learning problems in the classroom, find the cause, and choose alternative solutions. Students' ability to construct their knowledge is done starting from the *THINK* stage, continued at the *TALK* and *WRITE* stages. In Cycle #1 45.45% of students can perform all three stages. This showed that students did not yet have high levels of thinking skills. When faced with problems, students did not automatically look for the truth, logical flow, or discrepancy between the cases and the ideal conditions. (Kang et al., 2010) stated that the classroom conditions can be influenced by the legacy of previous learning conditions. If teachers are very dominant, students are not allowed to explore the ability to think and speak before students write them down for their tasks. The previous learnings resulted in passive students, they were content to just listen, resulting in unoptimized skills. They did not reach the potential development zone, and new knowledge did not stored in long-term memory region.

Cycle #2 completion was 69.7%, increased by 24.25% compared to Cycle 1. Students have made improvements based on the advice and input from teachers. Students became more understanding and ready to continue on the next subject matter. But many solutions chosen by students were still mismatched with the problems they found. This occurred because students did not have enough initial knowledge related to various learning models, strategies, methods, and

techniques (Karagiorgi & Symeou, 2005) Students did not understand the need for conformity between their solutions with the problems. The mismatch caused the learning stages to become useless to solve the problems and improve learning quality. Interviews were conducted on students who experience problems like this. It was found that in addition to students not understanding various models, strategies, and approaches, many of them were confused by the differences and definitions of these terms. Students also did not dare to choose or were not confident about their choice, so their solutions were based on approximations or based on the trend. This was improper because choosing and implementing models, strategies, and learning approaches cannot be done based on trends alone. The reasons were: (1) Each class has unique and distinctive learning dynamics and problems not found in the other class. (2) The selection of models cannot be generalized to the population because the problems were internal. (3) The improper model cannot fix the problems and improve the learning process.

In Cycle #2, many students were unable to construct good theoretical foundations. Students translate the theoretical foundation based on their research title, thus it should be defined word for a word contained in the title. Theoretical foundations were relevant theories that can corroborate the theoretical truth of research until the establishment of hypothesis. Therefore, the theoretical foundation must support the theme of research. For example, a research title by students A was improving the math learning outcomes of seventh-graders on the geometry using the STAD-based inquiry learning model. The theoretical foundations compiled by student A were: (1) improvement, (2) learning outcomes, (3) the inquiry model, (4) STAD, and (5) the concepts of geometry. If the theoretical foundation is structured only as mentioned in the previous sentence, it was not enough. The theoretical foundation created must be meaningful and support what will be done in the research. The theoretical foundations should be formulated as follows: (1) Learning outcomes, which include: (a) definition of learning outcomes, (b) the condition of learning outcomes in research

classes, (c) variations in students' learning outcomes; (2) inquiry strategy: (a) definition of inquiry, (b) the characteristics of the inquiry strategy, (c) the steps of the inquiry strategy, (d) the advantages and disadvantages of the inquiry strategy; (3) STAD model: (a) understanding of STAD model, (b) characteristics of STAD model, (c) syntaxes of STAD, (d) advantages and weakness of STAD; (4) STAD-based inquiry model: (a) definition of STAD-based inquiry model, (c) foundation of STAD-based inquiry model, (d) advantages and disadvantages of STAD-based inquiry model; (5) improvements of learning outcomes using the STAD-based inquiry model; (6) the concept of geometry applied in research; (7) The relevant previous research; (8) Research frameworks. Students were directed and trained to construct and arrange the theoretical foundation according to the needs in their research. It was done by training them to think logically and purposefully. It was to ensure that their frameworks were based on the correct logical flow. The same thing was done by Supandi, et al (2018) to improve students' writing skills. Jumrawarsi & Suhaili (2020) state that this is in accordance with the role of a lecturer who must be able to create a conducive learning atmosphere and environment so that students learn something new without feeling pressure and compulsion. Burns (2004) states that students' writing skills can be trained from procedural learning such as the steps in the TTW model.

Cycle #3 obtained the completion of 81.82%. It was increased 12.12% from Cycle #2 to Cycle #3. In Cycle #3, some students not yet able to compose sentences properly. Their sentences layout did not use correct spelling, and many use hyphens at the beginning of the sentences. In one paragraph it was not clear which one was the main sentence and which one the explanatory sentence. Some paragraph consists of only one sentence, or consists of two sentences but it is not clear which one was the main sentence and which one the explanatory sentence. Many paragraphs did not link to each other. This resulted in the writing becoming "cut off" and lack clear logical flows. It solved by ask students to write submit them to their friends for review. It will be easier to give advice, input and find the

errors. Lusi, A. S. (2014) also corroborated the results of Nurapriani, F. (2016)'s research on Improving Communication and Mathematical Connection Skills of Middle School Students Through Think Talk Write Strategies.

Indicators of research success have been achieved in the third cycle, therefore the treatments were stopped and the study was declared as complete. Cycle #3 has reached 81.82% completion. Most of the students have been able to write clear, logical research background, formulate the, research questions, goals, and benefits (Rubin & Graham, 1988). Those have been consistent with the background of the issues they found. Their theoretical foundation already represents references about the learning theories and the results of the latest relevant research (Rivard & Straw, 1999). Each sub-point was thoroughly summarized. Their methodology have include proper participants, time-table, instruments, and methods to analyze the data. The instruments were varied including paper-based tests, observation sheets for teachers and students, questionnaires, and daily journal to record any research findings not identified in other instruments (Pratiwi, V., & Lidinillah, D. A. M., 2016).

Cycle #3 has reached the indicator of success. The results showed that the TTW model can improve prospective mathematics teachers' writing skills. The TTW train students to think logically and purposefully so that their writings are logic and coherent. Students are also trained to communicate and maintain their thought processes. They also trained to communicate and interact with friends, thus minimize students' low self-esteem, lack of confidence, and passivity. The final product was that students can write good classroom action research proposals. Husnah & Surya, 2017; Huggins & Maiste, 1999) with the results of his research on the TTW model which proved effective for empowering mathematical communication skills in his learning classes, this is in line with research findings.

CONCLUSIONS AND RECOMMENDATIONS

The results of the study indicate that the application of the Think, Talk, and Write learning model can improve the writing skills of prospective teacher students majoring in mathematics education at IAIN Salatiga Indonesia. Students' writing skills start from the Think stage, which is when students are asked to read lecture materials and construct their own thoughts, followed by the Talk stage, which is the stage where students interact, discuss, and collaborate with friends or teachers, or people who are considered competent who can help. provide scaffolding, the last is the Write stage.

In the writing stage, students write the results of the think stage and talk stage in the form of a final project of compiling a class action research proposal. This writing stage is still being discussed with friends and teachers to review student writings, find gaps and weaknesses in each writing. The completeness of the research obtained in the 3rd cycle is 80% with an average completeness of 75. The first cycle of completeness obtained is 59% with an average learning outcome of 45, the second cycle of completeness obtained is 65% with an average score - average learning outcomes of 70.

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