

# Learning Mathematics in English Through the Use of the Think-Talk-Write Strategy

Diosa Misme

SMBP Education Hub Program, Phayaopittayakhom School, Phayao, Thailand

Rattana Yawiloeng\*

Department of English, School of Liberal Arts, University of Phayao, Phayao, Thailand

**Abstract**—This study examines the effects of the Think-Talk-Write (TTW) strategy on Thai EFL students' learning mathematics in English. The TTW learning strategy contributed by Pratiwi and Muiz (2016) was used in this study. The participants were 25 Thai EFL students enrolled in a Mini-English Program in which English is used as a medium language in all subjects. During the teaching and learning activities, the researcher conducted three phases of mathematics problem-solving activities, including the Think, Talk, and Write phrases. In this study, a Filipino teacher as the researcher taught a mathematics subject in English since the researcher and the participants used different first languages. Five research instruments were deployed to collect data: a pretest/ posttest, survey questionnaire, observation checklist, and semi-structured interview. The findings of this study revealed that the TTW strategy could enhance Thai EFL students' learning of mathematics in English. In addition, the results showed that the EFL students used English (L2) and Thai (L1) to solve their mathematical problems with their peers. The findings from the semi-structured interview also revealed that the EFL students viewed the think, talk and write as a useful strategy to share ideas with their peers. Therefore, using the TTW strategy is an easy and challenging way to solve mathematical problems in English.

**Index Terms**—think-talk-write strategy, EFL classroom, English writing activities, mathematics in English

## I. INTRODUCTION

English plays an essential role in various fields of work because it is used as an international language. In ASEAN countries, communication in English is crucial since Asian people work in increasingly intentionalised environments. In addition, English is the key to success in many careers and plays a significant role in classrooms where it is used as a foreign language (EFL). This EFL teaching and learning encourages teachers and students to practice working collaboratively through English. English is also essential in Thai EFL high schools since it is a compulsory subject that all Thai EFL students need to study. Particularly, Thai EFL students who enroll in a Mini English Program (MEP) must study all subjects in English, such as mathematics, physics, and chemistry with foreign teachers.

Problematically, EFL students are confronted with a particular barrier when they have to study other English-based subjects, such as Mathematics in the MEP classrooms. Unlike native English-speaking students, EFL students in MEP classrooms are challenged by studying all subjects using English as a medium language. Foreigner teachers in Thailand have also faced challenges in teaching mathematics in English. Another challenge for EFL teachers is to ensure that EFL students gain enough necessary vocabulary knowledge to comprehend English instructions and mathematics concepts. According to Yawiloeng (2020), due to their insufficient L2 vocabulary knowledge, EFL learners have difficulty guessing the meaning of unfamiliar L2 words in the absence of relevant contexts. In addition, traditional teaching approaches in some Asian countries (such as Thailand) rely primarily on the first language (L1) medium and the grammar-translation teaching approach. Nonetheless, this traditional teaching approach can promote students' memory through repetitions, but EFL students' lifelong learning seems to be overlooked.

Learning mathematics in English is viewed as a problematic challenge for EFL students since these students have limited language proficiency to handle mathematical problems in another language (Peter, 2019). As Jourdain and Sharma (2016) stated, an English-medium setting is one of the most significant obstacles for language learners to learn mathematics. That is to say, learners must not only attempt to study in English while learning to speak but also operate English mathematics (Mandy & Garbati, 2014). Another reason that EFL students obstruct learning mathematics in English is that they need to learn more than numbers, and they have to encounter the challenges of learning academic English and mathematics at the same time (Daniel & Zamborova, 2015). In addition, it is not easy to learn mathematics in English since "the learners must recognize and understand the mathematical relationship between the components of words" (Machaba, 2021, p. 1504). Therefore, mathematical English is an extra challenge for English language learners (Jourdain & Sharma, 2016).

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\* Corresponding Author. E-mail addresses: preaw20002@hotmail.com and rattana.ya@up.ac.th

However, complex linguistic and metalinguistic abilities are required to thoroughly understand the mathematical registers and the capacity to transition between them. These abilities are required for students to communicate with their peers and deal with more sophisticated mathematics (Mandy & Garbati, 2014). Learning to solve mathematical problems with peers can enhance learners' problem-solving abilities. When learning with peers, learners may encounter cognitive conflicts that motivate them to explain and justify their stance and seek additional information to resolve different points of view (Chairinkam & Yawiloeng, 2021). As can be seen, these problems cause studying mathematics to be more difficult than studying mathematics itself because one must read the English texts first before translating them to mathematical ideas. As a result, in an English-medium classroom, English language learners may require more time than native English speakers to master mathematics. As a result of spending too much time attempting to comprehend the questions and mathematical registers, these students may miss out on mathematical learning. Furthermore, to do well, students must be familiar with the highly technical vocabulary required in mathematics. Consequently, learning mathematics in English is very difficult for students, especially EFL students who seldom use English in their daily life.

To solve learning mathematics problems, the Think-Talk-Write strategy is proposed as a learning model in EFL mathematics classrooms (e.g. Afthina, 2017; Setiawan et al., 2017). The TTW is a learning strategy that begins with thinking and continues with discussion, presentation, and independent writing of presentation results (Hariyati, 2013; as cited in Afthina, 2017). Applying the TTW strategy when confronting mathematical challenges, students can acquire proper language skills, particularly in conveying ideas in spoken and written language. Therefore, this current study investigated the effects of the TTW strategy on Thai EFL students' learning mathematics in English and explored the EFL students' attitudes towards using the TTW strategy in the mathematics classroom.

## II. REVIEW OF LITERATURE

### A. *Think-Talk-Write Learning Strategy*

Think-talk-write strategy is viewed as a cooperative learning model comprising thinking, talking, and writing stages (Afthina et al., 2017; Satiwan et al., 2017; Supandi et al., 2018). Regarding the TTW strategy, students are involved in a cooperative learning process, so their problems can be solved. To clarify, engaging in cooperative learning activities provides the students with opportunities to explore the materials provided by the teacher together with other peers since the teacher cannot control all students' activities during the TTW classroom session (Setiawan et al., 2017). Think-talk-write is also viewed as an approach that aids learners in producing spoken and written language fluently (Huda et al., 2020). The TTW method emphasizes thinking, reflection, and organizing time. After engaging in introspective dialogue with themselves, students engage in conversation and exchange ideas with their peers before writing. In classrooms, students are encouraged in the thinking, talking, and writing stages using the TTW tactics. This TTW method is intended to enhance writing fluency and prepare the language for writing. In addition, students gain opportunities for thinking, speaking, and writing on given tasks. Thus, the think-talk-write strategy can enhance learners' writing abilities and assist learners in preparing the target language for written communication.

Using the TTW strategy in classrooms involves three stages, namely, Think, Talk, and Write. Students read the instruction based on the topic given by the teacher and make notes about what they have thought (Think), interact and collaborate with their group to discuss the notes (Talk), and express the result of the discussion in the form of written text (Write) (Yamin & Bansu, 2012; as cited in Setiawan et al., 2017). Moreover, Huinker and Laughlin (1996) stated that in the Think stage of the TTW learning process, students are asked to read the content in the form of questions relating to daily activities or descriptions. At the Talk stage, students are efficiently allowed to discuss the results of their investigation in the thinking stage. At the Write stage, students compose the concepts they have developed through the thinking and talking stages (Pratiwi, 2019). In teaching writing descriptive text, Suminar (2015) mentioned three stages of the TTW strategy, including thinking by reading something clue containing pictures and making small notes of what has been thinking, talking through using their language to present ideas, and writing by constructing the idea of writing after the discussion or dialogues. In sum, the TTW strategy is used to enhance students to develop their thinking, speaking, and writing abilities through cooperative learning activities with their teacher and peers.

There are many advantages of the TTW strategy to students' learning development. First, utilizing the TTW strategy permits students to engage in cooperative learning (Afthina, 2017; Setiawan et al., 2017; Supandi et al., 2018). Second, the TTW approach can enhance the development of students' writing abilities (Setiawan et al., 2017). Using the TTW strategy in descriptive writing activities provides students with opportunities to gain ideas and necessary information for writing, constructing, and sharing ideas with other students (Setiawan et al., 2017). Third, by engaging in mathematics learning activities through the TTW model, students can improve language skills effectively, particularly in expressing ideas when solving mathematical tasks (Afthina et al., 2017). The students are encouraged to learn actively by gaining opportunities to think, talk, and write during learning processes. While engaging in the TTW activities, the learning goal is accomplished through the collaborative efforts of the students working together in groups (Setiawan et al., 2017). Moreover, Aziz and Maaliah (2016) mentioned that the TTW strategy could sharpen all visual thinking skills, enhance comprehension and a relevant solution, and promote critical and creative thinking skills. Lastly, using the TTW strategy can encourage students to actively participate in solving a problem; consequently, this TTW strategy can enhance

students' writing development (Tamara & Rusfandi, 2021). Thus, learners become more actively involved in their learning activities through interaction and discussion with the group.

Many studies revealed the effects of the TTW technique in Mathematic classrooms (Afthina et al., 2017; Jaber & Daana, 2020; Nasrulloh & Umardiyah, 2020; Supandi et al., 2018). Afthina et al. (2017) compared the effects of the TTW and the think-pair-share model. The researchers found that utilizing TTW with a realistic mathematics education strategy can assist students in gaining better mathematics achievement than TPS with a realistic mathematics education approach. The researchers also elaborated on the comparison that students with high mathematical-logical intelligence outperform students with poor mathematical-logical intelligence in mathematics achievement. Furthermore, the researchers also mentioned that students with low mathematical logical intelligence struggled to understand new materials and were weak in calculating, reasoning, and thinking logically (Afthina et al., 2017).

## *B. Previous Studies*

### *(a). Studies on the Use of Think-Talk-Write to Enhance Writing Abilities*

Many scholars have examined the effectiveness of using the think-talk-write method to improve learners' writing abilities (Pratiwi, 2019; Setiawan et al., 2017; Suminar, 2015; Tamara & Rusfandi, 2021). Suminar (2015) investigated the effectiveness of the TTW method while practicing students to write descriptive texts. This study required students to take notes, explain, listen, share opinions with peers, and write their thoughts. This study's pretest and posttest results showed the positive influence and effectiveness of the TTW strategy. In addition, Suminar (2015) also suggested that the TTW strategy can be effective in large classrooms since it allows students to work in a group, enjoy, and have fun learning to write in English. Setiawan et al. (2017) investigated the effectiveness of the TTW strategy in teaching descriptive writing. The findings of this study uncovered that using the TTW technique to teach writing descriptive text provided positively influences the students rather than the production technique. Setiawan et al. (2017) mentioned that the TTW technique gives opportunities for learners to gain ideas and information needed to write. Moreover, Pratiwi (2019) explored the effect of the TTW strategy in enhancing high school students writing narrative text. After learning through this learning strategy, the findings indicated that the TTW model could assist students in narrative paragraph writing. The results from Cycle Two of this study revealed that the students succeeded in developing their ideas through writing with the TTW strategy. In addition, the students felt more confident in conveying their thoughts in descriptive writing, and the class conditions were more active. Lastly, a study by Tamara and Rusfandi (2021) investigated the effectiveness of the TTW technique applied with audiovisual media in enhancing the descriptive writing skills of students. The study's findings uncovered that the TTW technique encouraged students to develop creative thought, be more active in seeking knowledge in class, add material they missed from audiovisual mediums, and discuss ideas within their groups. In sum, these previous studies confirm that the TTW strategy can effectively enhance students' writing abilities.

### *(b). Think-Talk-Write Research in EFL Mathematics Classrooms*

Recently, many studies have investigated the implementation of the TTW approach in mathematics classrooms for students learning English as a foreign language (Afthina et al., 2017; Ishaya et al., 2018; Nasrulloh & Umardiyah, 2020; Supandi et al., 2018). Wulan and Khotimah's (2015) study aimed to enhance students' mathematics communication using a scientific approach and the TTW strategy. According to the findings of this study, utilizing the TTW technique can increase students' mathematical communication skills, and students become more active in the mathematics classroom. According to the observation from the classroom activities, the results uncovered that the students were able to express mathematical ideas by speaking and writing, utilize mathematical notation to communicate ideas, define relationships and model situations, and visually illustrate mathematical concepts.

Afthina et al. (2017) compared the effects of the think-talk-write and think-pair-share models in the mathematics classroom in Indonesia. The researchers reported the students who engaged in the TTW model using a realistic mathematics teaching method could get higher mathematical accomplishment than those who utilized the think pair share model. The researchers explained that after comprehending the lesson in the Talk stage, learning through the TTW model entails individually reflecting on and explaining mathematical concepts through writing. In terms of the comparison results, students who have a mathematical-logical intelligence that is above average can achieve higher success in mathematics than students whose mathematical-logical intelligence is poor. Therefore, children with high mathematical intelligence can better comprehend lessons than those with ordinary or low intelligence; that is, they seek to solve problems independently.

Later, Supandi et al.'s (2018) study uncovered how the TTW strategy could improve eighth-grade students' abilities in mathematical representation in an Indonesian high school. This study uses the TTW strategy as a cooperative learning model. During the TTW stages, students learn the material (Think), discuss the results of the learning material (Talk), and write the ideas obtained from the talk phrase (Write) (Supandi et al., 2018). The researchers uncovered that the students were enthusiastic, asking questions actively, addressing mathematical problems and answers, and developing ideas of answers to solve mathematical problems. The study of Supandi et al. (2018) also revealed that Indonesian students with high self-efficacy gained higher scores on the mathematical representation ability after participating in the TTW learning processes.

Nasrulloh and Umardiyah (2020) investigated the effect of the TTW method on the critical thinking and mathematical communication of learners. Researchers found that the TTW learning strategy enhances students' active learning, expressing their ideas, sharing opinions with peers, problem-solving, and promoting enthusiasm and confidence in solving math problems. Nasrulloh and Umardiyah (2020) suggest that traditional learning is less effective than the TTW learning strategy regarding critical thinking and mathematical communication. Moreover, Kruawong and Soontornwipast (2021) examined Thai EFL students' Science vocabulary knowledge of 9th-grade students through science vocabulary crossword puzzle (SVCP) practices. In the study, the Thai students improved their science vocabulary by practicing crossword puzzles. The results after implementing SVCP practices revealed that the students' science vocabulary knowledge scores increased significantly (Kruawong & Soontornwipast, 2021).

Many studies focus on teaching and learning strategies to promote EFL students in English-medium classrooms. However, there has been less previous evidence for EFL research in Thailand that focuses on Think-Talk-Write teaching techniques to promote learning other subjects in the MEP programme, such as teaching mathematics through using English as the medium of instruction. Nevertheless, few studies focus on practical teaching approaches to help EFL students better comprehend mathematical concepts by using the TTW strategy through English in MEP classrooms. Consequently, the present study examines the effectiveness of the Think-Talk-Write strategy by Thai EFL students learning mathematics in English. Thus, there is a need to consider effective teaching approaches to help EFL students better understand mathematical concepts while simultaneously improving their English communication abilities. Therefore, this research aimed to investigate the effectiveness of the TTW in enhancing EFL learners' learning of mathematics in English.

### III. METHOD

#### A. An EFL Mathematics Classroom Setting

This study was conducted in an EFL mathematics classroom where English is used as a medium language between a Filipino EFL teacher and Thai EFL students. In this study, the researcher's roles were the mathematics teacher, the observer, and the interviewer. Twenty-five Thai students who studied in grade seven were registered in a mathematics subject for five weeks. These EFL students studied mathematics in English for five hours per week. Since the foreign teacher could not speak Thai, it was compulsory for the students to communicate with the teacher and peers in English.

#### B. The Participants

The participants of this study comprised 25 Thai students who enrolled in a Mini English Program (MEP) during the 2021-2022 academic year. Their age ranged from 12-13 years old. These grade seven students were selected by purposive sampling from 15 classes with 585 students. Twenty-five EFL students comprised 12 males (48%) and 13 females (52%). Only six students who gained high, intermediate and low pretest scores involved qualitative data collection.

#### C. The Instruments

The instruments used in this study consisted of a pretest and posttest, a survey questionnaire, an observation checklist, and a semi-structured interview. The pretest and posttest were designed in the form of five English words of mathematics problems for secondary students. The pretest was conducted in the first week before the students studied the first mathematics lesson. The students were asked to solve problems of five mathematics problems within one hour. The first two items were easy mathematics problems, the third and fourth were intermediate mathematics problems, and the last was the most difficult mathematics problem. These five mathematics problems in English were aligned with the mathematics curriculum for Thai students studying at a secondary level. Then, the posttest was given in the last session of the fifth week after the students engaged in the Think-Talk-Write (TTW) activities. The posttest aimed to investigate how the EFL students utilised the TTW technique to solve Math problems in the English language.

The survey questionnaire was designed to investigate how English impacts students' English fluency, comprehension, and interest during engaging in Think-Talk-Write activities in the mathematics classroom. The 5-point Likert scale questionnaire was developed in accordance with the study's objectives. That is, five means 'strongly agree', four means 'agree', three means 'neutral', two means 'disagree', and one means 'strongly disagree'. In addition, the ratings for the interpretations were as follows: 4.20 - 5.00 (strongly agree), 3.40 - 4.19 (agree), 2.60 - 3.39 (neutral), 1.80 - 2.59 (disagree), and 1.00 - 1.79 (strongly disagree).

The observation checklist was used to collect quantitative data on the EFL students' behaviours while participating in the Think-Talk-Write activity. This observation checklist includes the students' interactions, participation, manners, and practices during the Think-Talk-Write activities during learning mathematics in English. Six EFL students (high, intermediate, and low) were observed in this study. The researcher conducted the observation checklist, which included ten items using a 5-point Likert scale.

The semi-structured interview was used to elicit qualitative data on how often they use English outside their classroom. The interview was semi-structured so the researcher could clarify and dig deeper into the respondents' responses. The semi-structured interview method promotes two-way communication by allowing both the interviewer and the participant to ask questions, allowing for a thorough discussion of relevant issues. Six students who were

observed by the researcher were interviewed in English. However, these students could answer in both English and Thai language. To ensure reliability, the researcher asked a native Thai speaker to check the transcriptions. This research was approved by the University of Phayao Human Ethics Committee, Thailand. The date and number of the ethical approval are UP-HEC 2.2/006/66.

#### D. The Research Procedures

This study was conducted in an EFL Mathematic class where the Filipino teacher taught Thai EFL students in English. After gaining permission for data collection from the school, the researcher briefly explained the research plan to the participants. Twenty-five participants were asked to sign the consent form and informed that they could withdraw from the research participation at any time. The research procedures were conducted in five steps as follows. (1) In the first week, the *pretest* comprising five items was given to 25 Thai EFL students to solve mathematical problems in English words. The students were allowed to solve the mathematical problems from five English words for 50 minutes. (2) The EFL students participated in the EFL mathematics classroom to study mathematics in English using the TTW strategy for three weeks. From the second to the fourth week, the researcher conducted the observation checklist by observing six intermediate, and low Thai EFL students. (3) In the fifth week, the 5-item *posttest* was given to 25 students. In this session, the students solved the mathematics problems for five English words for 50 minutes. In addition, the 15-item *questionnaire* was administered to 25 Thai EFL students after participating in the Think-Talk-Write activities in the L2 mathematic classroom. (4) After participating in this research, a semi-structured interview was conducted to elicit qualitative data from six students regarding their attitudes toward learning mathematics in English. Each student was interviewed individually for ten minutes.

### IV. RESULTS

#### A. The Effects of the TTW Strategy on Learning Mathematics in English

Table 1 below shows the pretest and posttest scores for five English words in mathematics problems gained by 25 Thai EFL students. The total scores for five English words of mathematics problems were 25 scores.

TABLE 1  
THE PRETEST AND POSTTEST SCORES OF THE EFL STUDENTS

Test	Number	Min	Max	Mean	Std. Deviation	Std. Error Mean
Pretest	25	4	20	11.44	3.852	0.77
Posttest	25	16	25	23.48	2.568	0.514

Table 1 shows that Thai EFL students' posttest scores for solving mathematics problems in English were higher than the pretest after participating in the TTW activities. Before engaging in the TTW activities, the EFL students' pretest means and standard deviations were 11.44 and 3.852. After gaining help from the teacher and working with the peers through the TTW strategy, the EFL students gained higher posttest scores, the means and standard deviation were 23.48 and 2.568. The results of this study uncovered that the posttest scores significantly increased after the Thai EFL students studied mathematics in English through the TTW strategy. In sum, using the TTW strategy can enhance the EFL students' understanding of English in the mathematics classroom.

#### B. Thai EFL Students' Learning Strategies Used in the EFL Mathematic Classroom

After the EFL students engaged in problem-solving activities in the EFL mathematics classroom, they were asked to answer a questionnaire to reflect their English learning strategies. The questionnaire included five rated scale questions asking the Thai EFL students' opinions on English learning strategies they used in the EFL mathematics classroom (see Table 2).

TABLE 2  
THE EFL STUDENTS' LEARNING STRATEGIES USED IN THE EFL MATHEMATICS CLASSROOM

Item no.	Statements	(1) Strongly Disagree	(2) Disagree	(3) Neutral	(4) Agree	(5) Strongly Agree	X	SD
1	I do not skip words while reading English because I am familiar with most English.	1 (4%)	0 (0%)	6 (24%)	13 (52%)	5 (20%)	3.84	3.42
2	I rarely use the English dictionary, translator, or other mobile applications to translate my first language (Thai) into English.	1 (4%)	7 (28%)	11 (44%)	3 (12%)	3 (12%)	3	2.65
3	When I read an English text, my first step is to translate it in my mind to my first language (Thai) in order to understand the English text.	1 (4%)	1 (4%)	6 (24%)	8 (32%)	9 (36%)	3.92	3.54
4	When I am solving a Mathematic problem in English, I usually start by drawing it to help me visualise the Math problem.	1 (4%)	5 (20%)	9 (36%)	8 (32%)	2 (8%)	3.2	2.83
5	I find it challenging and exciting to solve math problems using English.	2 (8%)	2 (8%)	6 (24%)	11 (44%)	4 (16%)	3.52	3.17
6	I share my opinions with other classmates using English in the Mathematic classroom.	0 (0%)	4 (16%)	12 (48%)	9 (36%)	0 (0%)	3.2	2.74

Table 2 shows Thai EFL students' attitudes towards learning strategies while solving mathematical problems in English. The highest mean score is shown in Item 3 that most Thai EFL students preferred to translate from their first language (L1) in order to understand English text ( $X = 3.92$ ,  $SD = 3.54$ ). In Item 1, these EFL students did not skip English words when they were familiar with the terms ( $X = 3.84$ ,  $SD = 3.42$ ). However, the lowest mean score was found in Item 2 ( $X = 3$ ,  $SD = 2.65$ ); these Thai EFL students who studied in the MEP programme rarely used English dictionaries to translate their first language (L1) to English (L2).

### C. The EFL Students' Think-Talk-Write Strategies in the EFL Mathematics Classroom

Table 3 shows the analysis results for the qualitative data collected from the semi-structured interviews. Six EFL students were interviewed in the last session of this research to reflect on their use of the think-talk-write strategy in both their first language (Thai) and their second language (English).

TABLE 3  
THE EFL STUDENTS' THINK-TALK-WRITE STRATEGIES IN THE EFL MATHEMATICS CLASSROOM

Participants	Statements	The EFL students' responses to the semi-structured interview
Advanced EFL students	1	•“I <i>talk</i> to my friends in English but mixed with Thai words.” (Student 13)
	2	•“Yes. I <i>talk</i> to my friends in Thai, but I talk in English to my teachers.” (Student 13)
	3	•“I <i>read</i> it and <i>translate</i> it in Thai in my mind, and I <i>ask</i> myself what question is asked.” (Student 13)
	4	•“Not straight, mixed with Thai.” (Student 06)
	5	•“I <i>think</i> it in Thai first.” (Student 06)
	6	•“Yes. I <i>answer</i> the questions in English when the teacher asks, and when I <i>share</i> my opinions with others.” (Student 06)
Intermediate EFL students	7	•“Sometimes, if they don't understand it, I just <i>explain</i> it in Thai.” (Student 03)
	8	•“Sometimes I <i>draw</i> it.” (Student 03)
	9	•“ <i>Highlight</i> what is the question asked first, then <i>draw</i> , and <i>solve</i> .” (Student 9)
Beginner EFL students	10	•“ <i>Listen</i> first, <i>write</i> the word, and <i>translate in Thai</i> .” (Student 18)

Table 3 shows six EFL students who used the TTW strategy in Thai (L1) and English (L2) to solve mathematics problems. In comparison, the advanced EFL students used the TTW strategy higher than the intermediate EFL students and the beginner EFL students during the English mathematics activities. For the advanced EFL students, they mentioned that they mostly used the Talk strategy to solve mathematics problems. That is, they ‘talk’ with their peers in Thai (L1) and English (L2) (statements 1 and 2), ‘ask’ the self in Thai (in L1) (statement 3), ‘answer’ the teacher in English (L2) (statement 6), and ‘share’ opinions with others (number 6). Regarding the intermediate EFL students, the intermediate EFL students also solved the mathematics problems by talking (‘explain’ in statement 7). In addition, they used the Write strategy by drawing (statements 8 and 9) and highlighting (statement 9) to solve mathematics problems. Lastly, the beginner EFL students revealed the use of the TTW strategy by thinking (‘listen’), writing (‘write’), and talking (‘translating into Thai’), as shown in statement 10.

## V. DISCUSSION

### A. The Effectiveness of the TTW Strategy on Learning Mathematics in English

The findings of this study reveal that using the TTW strategy can enhance EFL students' learning of mathematics in English. Based on the pretest and posttest results, the EFL students gained higher scores after engaging in the TTW strategy while writing the mathematics solutions in English. These findings are in accordance with a study by Jusniani et al. (2020), in which the scholars uncovered that the mathematics communication skills of students who use the TTW learning model with an interactive media aid outperform those of students who use traditional learning models. This present finding also ties nicely with a previous study by Nasrulloh and Umardiyah (2020), who confirmed the positive impact of the TTW instructional method on students' critical thinking and mathematical communication. This is also consistent with Ishaya et al. (2018) and Supandi et al. (2018), who uncovered that the learning method with the TTW model affects the achievement of students' mathematical communication ability and mathematical representation. Regarding using the TTW strategy in a writing context, the results of this study confirm the studies of Tamara and Rusfandi (2021) and Setiawan et al. (2017), who revealed that using the TTW technique had positive effects on the students' descriptive writing abilities and had a substantial impact on the students' writing abilities.

#### *B. Using the Think-Talk-Write Strategy to Solve Mathematical Problems*

Considering the application of the TTW strategy to solve mathematics problems, the findings revealed that the EFL students used the TTW strategy to solve problems by communicating in English and Thai in the mathematics classroom. The EFL students mostly used the Talk strategy while they attempted to solve mathematical problems with their peers. In line with a previous study by Anisah et al. (2020), their findings demonstrated that the students engaged in cooperative learning with the TTW to enhance their mathematical writing ability. Anisah et al. (2020) elaborated that students gained opportunities to think by using abstract mathematical symbols to facilitate solutions. The Talk phase allowed students to discuss steps to solve problems in groups through social interaction. After that, they encountered the Write phase to construct their own knowledge as a result of collaboration from the Talk phase (Anisah et al., 2020). This finding of this study is also consistent with the findings of Setiawan et al. (2017) that the TTW technique affords students opportunities to acquire the concepts and data necessary for writing. They engaged in the Think phase to develop their ideas, participated in the Talk phase to discuss when they lacked information, and encountered the Write phase to express their ideas in written form (Setiawan et al., 2017). Regarding the use of the first language in the EFL mathematical classroom, the findings revealed that the students tended to use the L1 language (Thai) when confronted with complicated mathematical problems. This finding is similar to a study by Jaber and Daana (2020), which showed that using the first language is necessary for Jordanian students who learn mathematics in English.

#### *C. Thai Students' Attitudes Towards Using the TTW Strategy During the EFL Mathematic Classroom*

Based on the semi-structured interview results, the findings show the EFL students' positive attitudes towards using the TTW strategy as a strategy for sharing ideas, a helpful learning strategy, and an easy and challenging way to solve mathematics problems in English with their peers. The results of the present study confirm the finding of Nasrulloh and Umardiyah (2021), who investigated the effects of the TTW learning strategy in mathematical communication. In terms of improving critical thinking and mathematical communication, the researchers revealed that the TTW technique was more effective than traditional learning. Nasrulloh and Umardiyah (2021) highlighted that using the TTW learning activities provides students with opportunities to think and talk together with their peers. Generally, students with great mathematical skills can communicate and collaborate to solve mathematical problems (Nasrulloh & Umardiyah, 2021). In addition, this finding is consistent with the findings of Katawazai and Saidalvi (2020) and Alghamdy (2019) that learning together with peers can enhance learners learning easier. This result also supports a study by Zohrabi and Jafari (2020), which focused on the role of think-pair-share in enhancing Iranian EFL learners' communication. Zohrabi and Jafari (2020) view the think-pair-share as a collaborative teaching activity, and they claim that this think-pair-share activity is useful for Iranian EFL learners since they become aware of collaborative activities and respond to different ideas by challenging themselves. In addition, Chan and Idris (2017) also mention that a learning technique in mathematics should be involved cooperative learning. Since the TTW technique not only helps students find solutions to difficult mathematics issues, but also assists them in overcoming the challenges they face on daily life.

## VI. CONCLUSION

This study revealed the effects of the TTW strategy on Thai EFL students' learning mathematics in English. Using the think-talk-write strategy can facilitate the EFL students' ability to solve mathematical problems in English. The EFL students revealed that they mostly translated mathematical problems from their first language to English. In addition, the EFL students used the think-talk-write as a learning strategy to help them overcome learning mathematics in English by thinking to solve mathematical problems, talking with peers to discuss the mathematics solutions, and writing to transform their ideas into English written forms.

In conclusion, learning mathematics in English through the use of the think-talk-write can enhance mathematics communication in English. In other words, EFL students gain opportunities to learn mathematics in English with their teacher and peers to solve mathematics problems by thinking, talking, and writing in English effectively. This suggests that think-talk-write should be used to assist EFL students in learning mathematics in English.

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**Diosa G. Misme** was born in Central Tabao, Valladolid, Negros Occidental, Philippines. She attended undergrad at La Carlota City College, La Carlota City, Philippines and received a Bachelor's degree in Secondary Education, majoring in Mathematics in 2010. She had her first teaching job at Phayao Municipality School 5 and taught English for three years. This was one of the most challenging times in her life. She was wrapped up in the differences and similarities, especially in cultural backgrounds and languages. Then, she moved to one of the prominent schools in the Northern Part of Thailand, namely, Sarmakhiwittayakhom School, Chiangrai and worked there for a year. After that, she decided to return to Phayao and work at Phayaopittayakhom School as a math Teacher.



**Rattana Yawiloeng** is a lecturer and the Head of Program Master of Arts in English at the School of Liberal Arts, the University of Phayao, Thailand. She pursued her B.Ed (English) and M.A. (English) in Thailand. She received her doctoral degree (PhD in Education) from the University of New South Wales, Sydney, Australia in 2013. Her teaching and research interests include second language (L2) vocabulary acquisition, EFL writing, second language acquisition (SLA), teacher and peer scaffolding, self-regulation in sociocultural theory (SCT), and communication strategies in EFL context.