A CORRELATIONAL-COMPARATIVE STUDY OF GRADE 3 AND GRADE 4 STUDENTS' SELF-EFFICACY FOR AND ENJOYMENT OF LEARNING MATHEMATICS AT A CATHOLIC SCHOOL IN BANGKOK, THAILAND

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Abstract: This study aimed to investigate the levels of Grade 3 and Grade 4 students' self-efficacy for and enjoyment of learning mathematics and to determine whether there was a significant difference or a significant relationship among them at a Catholic school in Bangkok, Thailand. The study was conducted with 46 Grade 3 students and 51 Grade 4 students in the 2019 academic year. The research design was a quantitative correlational-comparative study. The research instrument utilized was the *Self-Efficacy for and Enjoyment of Learning Mathematics Questionnaire* (SEELMQ), adapted from the *Math and Me Survey* (Adelson & McCoach, 2011). Descriptive statistics, dependent samples *t*-tests, independent samples *t*-tests, and Pearson's correlation coefficient analysis were used to analyze the data. The findings revealed no significant difference between Grade 3 and Grade 4 students' self-efficacy for and enjoyment of learning mathematics, but there was a significant difference between students' self-efficacy for and enjoyment of learning mathematics within their Grade level. Students' self-efficacy was in a moderate level and students' enjoyment was in a high level. Moreover, the study revealed a positive strong relationship between students' self-efficacy for and enjoyment of learning mathematics. Recommendations for school administrators, mathematics teachers, students, parents, and future researchers were provided.

Keywords: self-efficacy; enjoyment; motivation; learning mathematics; Bangkok; Thailand

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Introduction

Mathematics is an essential part in daily life and higher academic success (Brockman, 2006). Therefore, learning mathematics is critical to success in both school and in life after school. According to Stipek (1996), enjoyment is essential for the learning process and students' performance. Unfortunately, a study by Gottfried, Marcoulides, Gottfried, Oliver, and Guerin, (2007) in the United States showed age-related declines in enjoyment of learning mathematics.

Moreover, when a student makes a mistake in mathematics and does not receive proper support, she might interpret that mistake as a lack of ability and thus experience low mathematics self-efficacy that will hinder her mathematics learning (Cheema, 2018). In addition, there have been many studies that reported a positive correlation between academic enjoyment and academic self-efficacy (Roseken, Hannula & Pehkonen, 2011; Skaalvik, Federici & Klassen, 2015).

In Thailand, there is a declining trend of students' mathematics performance, which may have resulted from low mathematics self-efficacy (Klainin, 2015). In the research school in the current study, Grade 3 students paid more attention and had longer attention span in mathematics class than Grade 4 students. Moreover, when they faced difficulties, Grade 3 students exerted more effort while Grade 4 students did not want to do the mathematics problems that they thought were difficult to solve. With the differences in Grade 3 and Grade 4 students' behaviors, they likely had different levels of self-efficacy for and enjoyment of learning mathematics. Nevertheless, academic self-efficacy and academic enjoyment are positively related (Roseken et al., 2011). Hence, the students with a high level of self-efficacy will have a high level of enjoyment as well. Therefore, the researcher decided to investigate the levels of Grade 3 and Grade 4 students' self-efficacy for and enjoyment of learning mathematics and identify whether there was a significant relationship or a significant difference among them at a Catholic school in Bangkok, Thailand.

Research Objectives

This study was guided by ten research objectives.

1. To determine the level of Grade 3 students' self-efficacy for learning mathematics at a Catholic school in Bangkok, Thailand.
2. To determine the level of Grade 4 students' self-efficacy for learning mathematics at a Catholic school in Bangkok, Thailand.
3. To determine the level of Grade 3 students' enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand.

4. To determine the level of Grade 4 students' enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand.
5. To determine if there is a significant difference between Grade 3 students' self-efficacy for and enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand.
6. To determine if there is a significant difference between Grade 4 students' self-efficacy for and enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand.
7. To determine if there is a significant difference between Grade 3 and Grade 4 students' self-efficacy for learning mathematics at a Catholic school in Bangkok, Thailand.
8. To determine if there is a significant difference between Grade 3 and Grade 4 students' enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand.
9. To determine if there is a significant relationship between Grade 3 students' self-efficacy for and enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand.
10. To determine if there is a significant relationship between Grade 4 students' self-efficacy for and enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand.

Conceptual Framework

Figure 1 shows the conceptual framework of the research.

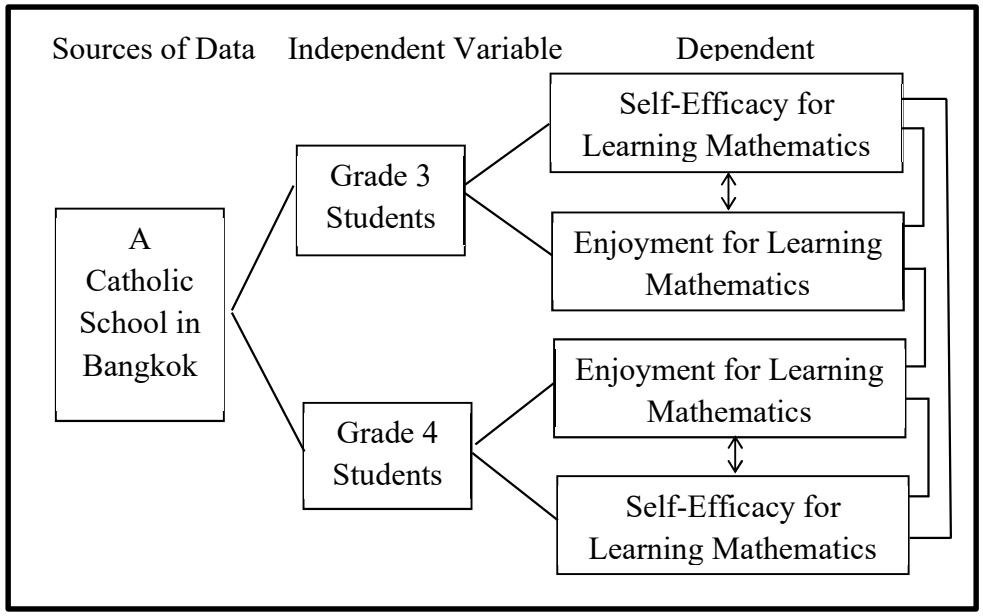

Figure 1. ***Conceptual Framework of the Research.***

Literature Review

Social Cognitive Theory

Social cognitive theory introduced the concept of human agency which posits that "people can exercise influence over what they do" (Bandura, 1997, p. 3). With this theory, teachers may enhance students' emotional states, correct students' faulty self-beliefs, enhance their academic practices, and adjust the classroom structure that will lead to students' success (Pajares, 2002). Two elements of Bandura's social cognitive theory; triadic reciprocal determinism and self-efficacy theory, provided the theoretical framework of this study.

Triadic Reciprocal Determinism

Triadic reciprocal determinism refers to the functional interdependence among three factors: personal factors (which include cognitive, biological, and affective aspects), behavioral factors, and external or environmental factors. These three sets of factors operate as interacting determinants which bidirectionally influence one another (Bandura, 1986).

Self-Efficacy Theory

Self-efficacy is a key component of social cognitive theory and is an important personal factor in triadic reciprocal determinism. Self-efficacy is a person's belief in his or her ability to organize and perform to accomplish a given goal (Bandura, 1997). Self-efficacy plays a critical role in students' motivation to achieve and is a strong predictor of students' motivation and learning along with persistence, emotional reactions, and effort (Zimmerman, 2000). When tasks are difficult, students with high self-efficacy view them as challenges that can be mastered (Bandura, 1986, 1997).

Intrinsic Motivation Theory

Intrinsic motivation theory assumes that humans are innately motivated and will take pleasure in their achievement. Intrinsically motivated people will engage in selected activities by their own choices. With difficult learning tasks, students who enjoy learning tend to exert more effort and persist longer than students who do not enjoy learning (Stipek, 1996).

Self-Determination Theory

Self-determination theory is an approach to human motivation and personality. It investigates individuals' innate growth tendencies and psychological needs which are the basis of personality and human motivation. Generally, self-determination is an internal goal for individuals. Self-determined people are driven by interest, enjoyment, and the inherent pleasure of engaging in specific activities or tasks. In other words, a self-determined person is motivated by intrinsic factors (Ryan & Deci, 2000).

Mathematics Education in Thailand

Although Thailand has worked to improve mathematics education, evidence indicates a decline in students' performance (Klainin, 2015). According to The Program for International Student Assessment (PISA), the average score in 2015 was the lowest score Thai students got comparing to previous scores in 2000 - 2012. Although the average score slightly increased in 2018, it did not show a significant improvement (PISA Thailand, 2019).

The reasons for the low mathematics scores have been attributed to the nature of the mathematics curriculum and the students' low mathematics self-efficacy. The Thai mathematics curriculum does not explicitly link the content taught to the students' real life. Therefore, students are not motivated to study and may lose interest in future mathematics study. Moreover, PISA 2003 and 2012 assessed students' mathematics self-efficacy and reported that Thai students' mathematics self-efficacy was below the international average in both years (Klainin, 2015).

Previous Research Findings on Self-Efficacy for Learning Mathematics

A study of 207 students' development of mathematics self-efficacy in Finland, during 2016-2018, found that students had higher levels of mathematics self-efficacy in Grade 2 than when they were in Grade 1 (Lähtevänoja & Penttinen, 2008). A similar result was found in a study of 339 students in Grades 3 and 4 in Sydney, Australia, which indicated that students' self-efficacy for learning mathematics increased over time (Phan 2012).

Previous Research Findings on Enjoyment of Learning Mathematics

A study of 114 students aged between 9-17 in the United States showed that mathematics intrinsic motivation and enjoyment of learning mathematics, significantly declined in older students (Gottfried et al., 2007). Another study of Grade 2 and Grade 4 students' enjoyment of learning mathematics in Germany reported that Grade 2 students had a higher level of enjoyment. This result is consistent with other studies that there is a decline in students' enjoyment for learning mathematics during transition from earlier years to later years of school (Raccanello, Brondino, Moè, Stupnisky & Lichtenfeld, 2018).

Relationship Between Self-Efficacy and Enjoyment

A study of Grade 8-10 students in Norway (Skaalvik et al., 2015), and a study of Grade 11 students in Finland (Roseken et al., 2011) both reported a positive correlation between mathematics self-efficacy and mathematics enjoyment. Another study of 305 Grade 7 students in Turkey showed a positive strong relationship between self-efficacy and intrinsic motivation and suggested that

intrinsic motivation was a predictor of self-efficacy level which indicated that intrinsic motivation came first, and self-efficacy followed (Kılıçoğlu, 2018). Moreover, if students have low mathematics self-efficacy but enjoy doing mathematics, their enjoyment will encourage them to persist in activities and eventually do it successfully and gain self-efficacy (Liu & Koirala, 2009)

Method

The research design was a quantitative correlational-comparative study. Descriptive statistics were used to analyze the levels of Grade 3 and Grade 4 students' self-efficacy for and enjoyment of learning mathematics. Dependent samples *t*-tests and independent samples *t*-tests were used to compare whether there was a significant difference among the levels of Grade 3 and Grade 4 students' self-efficacy for and enjoyment of learning mathematics. Pearson's correlation coefficient analysis was used to determine whether there was a significant relationship between students' self-efficacy for and enjoyment of learning mathematics within their grade level.

Population and Sample

The population was 48 Grade 3 students and 51 Grade 4 students. Since 2 of the Grade 3 students were absent on the data collection date, the research sample was 46 Grade 3 students and 51 Grade 4 students.

Research Instruments

The research instrument utilized was the Self-Efficacy for and Enjoyment of Learning Mathematics Questionnaire (SEELMQ), adapted from the Math and Me Survey (Adelson & McCoach, 2011), by renaming the Mathematical Self-Perceptions Scale and Enjoyment of Mathematics Scale as the Self-Efficacy for Learning Mathematics Scale and Enjoyment of Learning Mathematics Scale, combined, and translated into the Thai language. Table 1 shows the internal reliability of the M&MS

Table 1. *The Internal Consistency Reliability of M&MS*

Scale name	Cronbach's alpha (Adelson & McCoach, 2011)	Internal consistency (Adelson & McCoach, 2011)	Cronbach's alpha of this study	Internal consistency of this study
Mathematical Self-Perceptions	.92	Excellent	.88	Good
Enjoyment of Mathematics	.94	Excellent	.89	Good

All items used a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Each subscale consisted of 2 negatively worded items which were reverse coded during data entry.
The interpretation of the scales is given in Table 2.

Table 2. *The Interpretation of Self-Efficacy for Learning Mathematics Scale and Enjoyment of Learning Mathematics Scale*

Frequency level	Score	Scale	Interpretation level
Strongly agree	5	4.51 – 5.00	Very high
Agree	4	3.51 – 4.50	High
Neutral	3	2.51 – 3.50	Moderate
Disagree	2	1.51 – 2.50	Low
Strongly disagree	1	1.00 – 1.50	Very low

Findings

Research Objective 1

Grade 3 students had a moderate level of self-efficacy for learning mathematics. The mean score was 3.43. The standard deviation was .86. Four items fell within the low level of self-efficacy. These items were item 3 (I can solve difficult math problems), 6 (Math comes easily to me), 7 (I can tell if my answers in math make sense), and 8 (Doing math is easy for me).

Research Objective 2

Grade 4 students had a moderate level of self-efficacy for learning mathematics. The mean score was 3.49. The standard deviation was .76. Three items fell within the low level of self-efficacy which were item 3 (I can solve difficult math problems), 7 (I can tell if my answers in math make sense), and 8 (Doing math is easy for me).

Research Objective 3

Grade 3 students had a high level of enjoyment of learning mathematics. The mean score was 4.05. The standard deviation was .82. The two lowest scoring items were item 4 (I do math problems on my own “just for fun.") and item 10 (Solving math problems is fun.).

Research Objective 4

Grade 4 students had a high level of enjoyment of learning mathematics. The mean score was 4.03. The standard deviation was .70. The two lowest scoring items were item 4 (I do math problems on my own “just for fun.") and item 10 (Solving math problems is fun.).

Research Objective 5
The paired samples *t*-test revealed a significant difference between Grade 3 students' self-efficacy for and enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand, at a significance level of .05. Grade 3 students' self-efficacy for learning mathematics (M = 3.43, SD = 0.86, N = 46) was significantly lower than Grade 3 students' enjoyment of learning mathematics (M = 4.05, SD = 0.82, N = 46) at a Catholic school in Bangkok, Thailand, $t(45) = 6.53$, $p < .001$, two-tailed.

Research Objective 6
The paired samples *t*-test revealed a significant difference between Grade 4 students' self-efficacy for and enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand, at a significance level of .05. Grade 4 students' self-efficacy for learning mathematics (M = 3.49, SD = 0.76, N = 51) was significantly lower than Grade 4 students' enjoyment of learning mathematics (M = 4.03, SD = 0.70, N = 51) at a Catholic school in Bangkok, Thailand, $t\ (50) = 6.83$, $p < .001$, two-tailed.

Research Objective 7
The independent samples *t*-test revealed no significant difference between Grade 3 (M = 3.43, SD = 0.86, N = 46) and Grade 4 (M = 3.49, SD = 0.76, N = 51) students' self-efficacy for learning mathematics at a Catholic school in Bangkok, Thailand, $t\ (95) = .37$, $p = .71$, two-tailed.

Research Objective 8
The independent samples *t*-test revealed no significant difference between Grade 3 (M = 4.05, SD = 0.82, N = 46) and Grade 4 (M = 4.03, SD = 0.70, N = 51) students' enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand, $t\ (95) = 0.12$, $p = .90$, two-tailed.

Research Objective 9
Pearson's correlation coefficient revealed a significant high positive relationship between Grade 3 students' self-efficacy for and enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand, $r = .70$, $p < .001$.

Research Objective 10
Pearson's correlation coefficient revealed a significant high positive relationship between Grade 4 students' self-efficacy for and enjoyment of learning mathematics at a Catholic school in Bangkok, Thailand, $r = .70$, $p < .001$.

Discussion

Grade 3 and Grade 4 Students' Levels of Self-Efficacy for Learning Mathematics

Grade 3 and Grade 4 students' levels of self-efficacy for learning mathematics were at the same level, a moderate level, regardless of the differences in Grade 3 and Grade 4 students' behaviors in mathematics class. Grade 3 seemed to have behaviors of high self-efficacy students which were putting more effort and persisting longer when they faced difficulty (Zimmerman, 2000), while Grade 4 students tended to give up and did not want to put effort into doing mathematics problems. Therefore, the level of self-efficacy for learning mathematics could not be assessed only by the observation of students' behaviors in mathematics class. According to previous studies, students had higher levels of self-efficacy for learning mathematics when they were in higher Grade levels (Lähtevänoja & Penttinen, 2008; Phan, 2012). However, the results from this study were different. This may have resulted from the environmental context since the previous studies were conducted in Finland and Australia, not Thailand. The environmental context with the Thai mathematics curriculum that valued the content but did not connect to real life uses of that content might not motivate students to study (Klainin, 2015). Moreover, Grade 3 and Grade 4 students thought mathematics was difficult and they were not able to perform well in mathematics especially in solving difficult mathematics problems. Since students with high ability may perform poorly in solving mathematics problems because a lack of self-efficacy to utilize their ability (Bandura, 1986, 1997), Grade 3 and Grade 4 students should get support from school and family to increase their level of self-efficacy for learning mathematics.

Grade 3 and Grade 4 Students' Levels of Enjoyment of Learning Mathematics

Enjoyment of learning mathematics tended to decline when students moved to higher grades levels (Gottfried et al., 2007; Raccanello et al., 2018). This trend from previous studies was consistent with the Grade 3 and Grade 4 students in the current study. The Grade 3 students seemed to enjoy and engage in learning activities more than Grade 4 students. By the way, the research findings revealed no decrease in Grade 4 students' enjoyment of learning mathematics compared to Grade 3 students' in this study and they were at the same level. The result showed that the level of enjoyment of learning mathematics could be the same regardless of the differences in students' behaviors in mathematics class. It might be possible that the differences in behavior occurred before the differences in the level of enjoyment of learning mathematics, and the level of enjoyment of learning mathematics could not be measured only by the observation of students' behavior. Therefore, an

enjoyment of learning mathematics measuring instrument and classroom observation should be applied together.

Raccanello et al. (2018) suggested that the teacher is a significant factor for a high level of enjoyment of learning mathematics. The teacher can contribute to students' level of enjoyment of learning mathematics by maintaining a good relationship between teacher and students and providing good a positive learning environment that encourages students' engagement. Therefore, the Grade 4 students did not have a lower level of enjoyment of learning mathematics might have resulted from a good relationship between teacher and students. Moreover, Grade 3 and Grade 4 students learned mathematics with the same teacher. Therefore, it is possible that the findings of no difference between Grade 3 and Grade 4 students' enjoyment of learning mathematics may have resulted from the mathematics teacher's classroom manner and use of similar instructional strategies in all Grade 3 and Grade 4 classes.

Enjoyment of learning mathematics affects students' learning process and performance (Stipek, 1996). Therefore, school and parents should intervene and create conditions which enhance students' enjoyment of learning mathematics.

A Positive Relationship Between Self-Efficacy for and Enjoyment of Learning Mathematics

There was a significant positive strong relationship between students' self-efficacy for and enjoyment of learning mathematics within their Grade levels. In addition, this result was supported by many studies that reported a positive correlation between academic self-efficacy and academic enjoyment (Roseken et al., 2011; Skaalvik et al., 2015).

A Difference Between Self-Efficacy for and Enjoyment of Learning Mathematics

Grade 3 and Grade 4 students' level of self-efficacy for learning mathematics was significantly lower than their level of enjoyment of learning mathematics within their Grade levels. This might have resulted from the students' enjoyment of the specific learning activities used in the classes as well as the teacher's positive and pleasant manner in the classroom (Raccanello et al. 2018) even though the students perceived mathematics to be a difficult subject.

However, Liu and Koirala (2009) suggested that enjoyment can encourage low mathematics self-efficacy students to persist in activities and eventually perform them successfully. In addition, enjoyment is a predictor of self-

efficacy which means that a sense of enjoyment can precede increases in self-efficacy (Kılıçoğlu, 2018). The findings in this study may support the previous studies that enjoyment came first and will lead to more self-efficacy. Moreover, there is a positive strong relationship between self-efficacy for and enjoyment of learning mathematics. Therefore, school and parents should enhance students' enjoyment of learning mathematics to increase students' self-efficacy for learning mathematics.

Recommendations

For School Administrators

Since students' self-efficacy for and enjoyment of learning mathematics affects students' behavior in mathematics class such as their effort and engagement, school administrators should be aware of their levels and their changes. Moreover, the level of self-efficacy for and enjoyment of learning mathematics cannot be assessed only by the observation of students' behaviors in class. School administrators should provide a reliable measuring instrument and a professional development program for mathematics teachers to build awareness, provide deep understanding, and equip mathematics teachers with the skills to enhance students' self-efficacy for and enjoyment of learning mathematics.

For Mathematics Teachers

Mathematics teachers should be aware of students' self-efficacy for and enjoyment of learning mathematics since they will affect students' behavior and performance. From the findings, it is very important to improve Grade 3 and Grade 4 students' level of self-efficacy for learning mathematics as they thought mathematics was difficult and they did not believe in their abilities in solving difficult mathematics problems. In addition, an improvement in Grade 4 students' enjoyment of learning mathematics should be considered since there were signs of lower enjoyment in their behavior. Grade 3 students' enjoyment of learning mathematics should not be overlooked because the better enjoyment will help improve students' self-efficacy for learning mathematics.

Since the Thai mathematics curriculum does not connect the class content to the real life needs, it might be difficult to motivate students to study. Therefore, mathematics teachers should convince students to find the importance of mathematics and reasons why they need to learn mathematics and guide them to link the reason to the usage in their real lives. As an important factor of students' self-efficacy for and enjoyment of learning mathematics, mathematics teachers should maintain a good relationship with their students and should attend professional development sessions as often

as possible in order to know how to be a role model of a high self-efficacy for and enjoyment of learning mathematics person and how to design instruction that will create a good learning environment to promote students' self-efficacy for and enjoyment of learning mathematics. Teachers should develop such behaviors as giving supportive efficacy feedback when students engage in mathematics activities, especially when students face difficulty, encouraging them to expand more effort, and expressing faith in their abilities to succeed in mathematics learning.

For Students

The findings showed that students thought mathematics was difficult and they did not believe in their abilities in doing difficult mathematics problems. Instead of giving up, students should seek help from teachers, parents, or friends. Students may do extra mathematics exercises with friends or parents to gain more confidence. Moreover, students may gain more self-efficacy for learning mathematics by having personal learning goals and evaluation instead of comparing themselves to others. Student should reflect on their effort by focusing on skills they have developed and are in the process of developing.

For Parents

Parents should regularly observe and talk with their children about how they think or feel about learning mathematics, so that they may help them develop the right attitude and feeling toward learning mathematics. Moreover, parents can help improve their children's self-efficacy for learning mathematics by modelling self-efficacy traits and avoid comparing their children's performance to others. Parents may also help their children by giving good feedback on their progress, encouraging them to reflect on their effort by focusing on developing skills, supporting them when they faced difficulties or need help, and expressing faith in their abilities. The findings showed students thought mathematics was difficult and they did not believe in their abilities in doing difficult mathematics problems. Therefore, parents may find supplemental mathematics practice and help guide their children to find the strategies to solve problems and gain more confidence.

Parents may enhance their kids' enjoyment of learning mathematics by being a role model of enjoyment traits and convincing them to find the reasons why they need to learn mathematics and guide them to link the reasons to the usage in their real lives.

For Future Researchers

This study was conducted on only 97 students in one school and with the same mathematics teacher. The findings showed no significant difference between

Grade 3 and Grade 4 students' self-efficacy for learning mathematics and no significant difference between Grade 3 and Grade 4 students' enjoyment of learning mathematics. This might be because they all had the same mathematics teachers and the sample size was too small. The researcher would recommend future researchers who are interested in the same area of study to conduct studies on larger sample sizes. The future research may be done across multiple schools in Thailand.

Moreover, it would be useful if a future researcher could conduct a study on students in a wider grade range to get a bigger picture and deeper understanding of changes in and differences between students' self-efficacy for and enjoyment of learning mathematics. Finally, the researcher believes that a combination of quantitative and qualitative methodologies would yield a deeper, richer understanding of the roles played by students' cognitive engagement through their self-efficacy for and enjoyment of learning mathematics.

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