A COMPARATIVE STUDY OF GRADES 7-9 STUDENTS' MOTIVATION FOR LEARNING AND COGNITIVE ENGAGEMENT IN MATHEMATICS CLASS AT THE DEMONSTRATION SCHOOL OF RAMKHAMHAENG UNIVERSITY, BANGKOK

Leila Alimohammad

I.D. No. 6329570

A Thesis Submitted in Partial Fulfillment of the

Requirements for the Degree of

MASTER OF EDUCATION

in Curriculum and Instruction

Graduate School of Human Sciences

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Field of Study: CURRICULUM AND INSTRUCTION

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ABSTRACT

I.D. No.: 6329570

Key Words: MATHEMATICS EDUCATION, MOTIVATION FOR LEARNING, COGNITIVE ENGAGEMENT, SECONDARY EDUCATION, COMPARATIVE STUDY

Name: LEILA ALIMOHAMMAD

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This study aimed to determine whether there was a significant difference in motivation for learning and cognitive engagement in Mathematics class held by Grades 7, 8 and 9 students at the Demonstration School of Ramkhamhaeng University in Bangkok. A conveniently chosen sample of 55 students, enrolled in the target school during the academic year 2022-2023, participated in this study. For the data collection, the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ) and the Student Engagement in Mathematics Classroom Scale (SEMCS) were used. From performing descriptive statistics on the collected data, it was found that the overall level of motivation for learning in Mathematics class held by Grades 7 and 9 students, was interpreted as slightly high, whereas it was interpreted as moderate for Grade 8 students at the target school. The overall level of intrinsic goal orientation for learning in Mathematics class held by Grade 7 students, was interpreted as slightly high, whereas it was interpreted as moderate for Grades 8 and 9 students. The overall level of extrinsic goal orientation for learning in Mathematics class held by Grades 7, 8 and 9 students, was interpreted as slightly high. The overall level of task value for learning in Mathematics class held by Grade 7 students, was interpreted as slightly high, whereas it was interpreted as moderate for Grades 8 and 9 students. The overall level of cognitive engagement in Mathematics class held by Grades 7, 8, and 9 students, was moderate. The overall level of surface strategy in Mathematics class in Grades 7, 8 and 9 students, was moderate. The overall level of deep strategy in Mathematics class by Grade 7, was high, while it was moderate for Grades 8 and 9 students. The overall level of reliance in Mathematics class held by Grades 7, 8, and 9 students, was moderate. From a quantitative comparative analysis, it was found that there was no significant difference in either motivation for learning or cognitive engagement in Mathematics class among Grade 7, Grade 8 and Grade 9 students at the target school. Based on the research findings, recommendations for students, teachers, school administrators, and future researchers are provided.

Field of Study: Curriculum and Instruction

Graduate School of Human Sciences

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Student's Signature: ………………….

Advisor's Signature: …………………

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CHAPTER I

INTRODUCTION

This chapter presents the background of the study, statement of the problem, research questions, research objectives, research hypotheses, theoretical framework, conceptual framework, scope of the study, definitions of terms, and significance of the study.

Background of the Study

Mathematics is one of the most relevant subjects in our lives. Mathematical information can assist people in making better and informed decisions in everyday life, making their lives easier (Prasanna, 2021). A number of real-life domains (e.g., business, personal finance, employment, healthcare, music and sports) are identified with mathematics, and hence, everybody is engaged, consciously or unconsciously and to some degree, with mathematics in their life. Almost every student learns mathematics during school; however, most students are unaware that mathematics is not just a part of many other disciplines, it is part of everyday life (Yavuz Mumcu, 2018). At the moment, there are some key concepts included in the Thai Basic Education Core Curriculum that students learn in school mathematics, whose application in real life is very important. For instance, numbers and percentages (which are learned in Grade 7); proportions and map scales (which are learned in Grade 8); and money exchange, profit and loss (which are learned in Grade 9; Ministry of Education, 2001).

Many teaching approaches that improve student cognitive engagement and motivation (e.g., rewards, utility, and mastery) have been found to also improve academic achievement (e.g., Bobis et al., 2011; Pianta et al., 2012; Stipek et al., 1998).

Active learning requires a high level of student cognitive engagement and motivation for learning in class. That is why motivated students make an attempt to engage in class. As a result, knowing a student's level of motivation is critical for active cognitive engagement in school (Funda, 2017).

Mathematics is widely regarded as a complicated subject (Prasanna, 2021). Baki (2014, as cited in Yuvuz Mumcu, 2018) claimed that the most significant issues in mathematics education is students' typical view of mathematics as a subject comprised of abstract, calculation, algebra, and formulas that have little to do with the needs of routine life, rather than seeing mathematics as a tool that can be defined in a variety of cases. Students holding this viewpoint are likely unaware of the connection between mathematics and real life. Hence, they will not engage and motivate themselves in mathematics, so they will find mathematics uninteresting and unnecessary, and will perform poorly academically in mathematics. As a result of these beliefs, many students abandon mathematics studies as soon as it is no longer expected of them. Those students who consider mathematics to be an optional subject may find it acceptable, but it is extremely problematic for society as a whole, because mathematics provides a gateway into a variety of scientific and technological domains.

In recent decades, Thailand has encountered rising rates of underachievement in mathematics among students of all ages (Shaikh, 2013). The results of the 2015 Programme for International Student Assessment (PISA) show a significant drop in Thai students' mathematics scores (Armstrong & Laksana, 2016). Thai students are falling below their Asian classmates in performance in mathematic courses, with their scores falling below the international average (Mala, 2016). Thailand's mathematics result was 415 points, which was lower than the mean score of 490, and it was ranked 54th out of a total of 70 countries (Pholphirul, 2016). As a result, Thailand must enhance its mathematics performance, and the

Thai Ministry of Education will undoubtedly require further research to correct this condition.

Motivation is an individual's internal state of mind toward something. It has the ability to strengthen the connection between the input and output of human activity. The reasons for directing behavior toward a specific goal, engaging in a specific activity, or increasing energy and effort to reach the goal, are referred to as motivation. The sorts and intensity of desires, as well as the psychological process, will influence the extents of an individual's motivation (Kleinginna, 1981). Pintrich and De Groot (1990) proposed three general motivational components: value, expectancy, and affect. In this model, value components include intrinsic goal orientation, extrinsic goal orientation, and task value. They claimed that the intensity of people's motivation, rewards, and interest leads them to adopt good or bad learning strategies. Both motivation and learning strategies influence the students learning performance (Lee & Anderson, 1993; Lee & Brophy, 1996); and particularly the aspects comprising the value components of motivation (i.e., intrinsic goal orientation, extrinsic goal orientation, and task value) have been found to be related to students' cognitive engagement and play an important role in their mathematics learning (Garcia Duncan & McKeachie, 2005). Therefore, the researcher focused on the value components of motivation identified by Pintrich and De Groot (1990) in the conduction of this study.

Student engagement in learning is defined as active participation, both psychologically and behaviorally, in the central activities of the classroom environment, and it is another important factor that has been linked to academic achievement (Finn, 1989). Student engagement has become a key concept linked to a variety of educational outcomes (e.g., achievement, attendance, behavior, dropout/completion; Finn, 1989; Jimerson, Campos, et al., 2003). Furthermore, a student's degree of engagement is shaped by both the individual and the environment; hence, there are many elements in the school environment (e.g., interpersonal interactions, recognition) that can help to improve it (Fredricks et al., 2004). Kong et al. (2003) identified the dimensions of cognitive engagement that falls into three categories or strategies: surface strategy (i.e., memorization, practicing, handling tests), deep strategy (i.e., understanding the question, summarizing what is learnt, connecting new knowledge with the old ways of learning; Biggs, 1978), and reliance (i.e., relying on parents, relying on teachers; Marton & Säljö, 1976).

Students need to have cognitive engagement, be motivated in mathematical ideas, and even work with others on mathematical problems (Newman et al., 1992). In fact, there is plenty of research evidence that students should engage cognitively in various areas of mathematics problems on a daily basis, in order to master different mathematical concepts and develop an interest in problem solving (Connell, 1990; Connell & Wellborn, 1991; Finn, 1989, 1993; Miserandino, 1996). Besides, Biggs (1978) suggested that students who are engaged cognitively on getting the best grades are more likely to organize their work.

Academic achievement is considered to be an important indicator of students' school success and knowledge acquisition for a number of reasons. Students with higher levels of academic achievement during adolescence are more likely to complete school and college than their peers with lower levels of achievement (Schernoff et al., 2003). Therefore, a considerable body of literature has emerged in recent years pointing to the significant role of cognitive engagement, motivation, and academic achievement and success (Fredricks et al., 2004). These studies suggest that academic engagement and motivation for learning may not only predict students' academic achievement, school grades, and standardized achievement test scores in the short term (e.g., Finn & Rock, 1997), but also may predict school attendance, retention, graduation, and academic resilience in the long term (Connell, 1990). Successful students were found to have much more motivation for achievement than academic failure, according to Bank and Finlapson (1980). In addition, Johnson (1996) has found a link between academic achievement, engagement, and motivation.

Statement of the Problem

This study attempted to gain insight into the understanding of the motivation for learning and cognitive engagement in Mathematics classes held by Grades 7 to 9 students at the Demonstration School of Ramkhamhaeng University in Bangkok. From the researcher's experience as a mathematics teacher in this school, learners enrolled in Grades 7 to 9 seem to have a low level of curiosity, mastery, competition with other students, and perception of the usefulness of the instructional tasks while learning in Mathematics classes. These might be interpreted as indicators of Grades 7 to 9 mathematics students possibly having a low level of motivation for learning in Mathematics class at the target school. Additional research has found that high motivation in mathematics leads to high performance (Ahmed et al., 2010). As a result, it is worthwhile to conduct research on this phenomenon and investigate Grades 7 to 9 students' low level of motivation for learning in Mathematics class at the target school.

In 2017, the academic department of the Demonstration School of Ramkhamhaeng University confirmed that, in the academic year 2016, junior students (aged 13-15) received an average score of 43.48 on the Ordinary National Education Test (O-NET), while senior students (aged 16-18) received an average O-NET score of 38.63. Even though the school's O-NET grades are a bit higher than the national average, it still falls short of the 50% passing mark. In this case, the school decided to offer extra sessions for private lessons in five O-NET subjects: Social Studies, Thai Language, General Sciences, English, and Mathematics. Following that, the project was halted because many students did not contribute to the various programs and did not consider O-NET was important to them. This also might be interpreted as students possibly having a low level of motivation for learning in Mathematics class at the target school. After the end of this project, the O-NET ranks of the students at the target school have enhanced very little since then.

According to the researcher's observation, students enrolled in Grades 7, 8, and 9 in the Demonstration School of Ramkhamhaeng University, Bangkok, noticeably seem to have a low level of involvement in the mathematical activities of the classroom, as well as a low level of commitment to learn mathematical contents. These are indicators of Grades 7 to 9 students possibly having a low level of cognitive engagement in Mathematics class at the target school. Also, the participants of this study seem to cognitively engage in Mathematics classes mostly using surface strategies (e.g., memorization) rather than deep strategies in learning (e.g., learning and applying in the real life). Mathematics disengagement could be particularly risky for students, who do not see the importance, value, and validity of this subject. Students who are cognitively disengaged are not able to adapt with the level of standard skill, so they become uninterested to participate, anxious of, the tragedy called mathematics (Siu et al., 1993).

Therefore, due to the possible existence of issues with Grade 7, Grade 8 and Grade 9 students at the target school with poor motivation for learning and a low level of cognitive engagement in Mathematics class, the researcher decided to investigate and compare students' motivation for learning and cognitive engagement, in order to help them improve the experience of learning in Mathematics class at the Demonstration School of Ramkhamhaeng, Bangkok. Educational issues in relation to the learning in mathematics classes experienced by secondary students may arise from having a low level of motivation for learning, which can be caused by mathematics anxiety, a lack of commitment, and a lack of cognitive engagement (Siu et al., 1993).

In the target school, according to researcher's observations, there are plenty of elements that can affect students' achievement in Mathematics class, such as intrinsic goal orientation, extrinsic goal orientation, and task value, which are the elements comprising motivation for learning (Pintrich & DeGroot, 1990). Moreover, poor engagement in learning mathematics at any level, such as cognitive (e.g., flexible problem solving), affective (e.g., boredom) or behavioral (e.g., class participation) level, has been found to affect students' knowledge (Finn, 1993). Among other things, it is generally believed that student interest (which is one motivational trigger) and engagement in Mathematics class are essential to their learning (O'Neil & Drillings, 1994).

In order to improve educational outcomes, students must be engaged and motivated to learn (Lawson & Lawson, 2013; National Council of Teachers of Mathematics [NCTM], 2014). Academic engagement is essential since not only motivates kids to learn, but also predicts their educational achievement (Reschly & Christenson, 2012). Unfortunately, a growing body of evidence reveals that during the middle years of school, there is a noticeable fall in students' engagement, particularly in mathematics (e.g., Finn, 1989).

Many students do not devote sufficient time to practice mathematics subjects. Students might be engaged in an educational mathematics task, but they could also use only rehearsal and repeat the tasks that called surface strategy rather than becoming more deeply involved through the use of elaboration or expanding the idea known as "deep strategy" (Marton & Säljö, 1976; Pintrich et al., 1991). The willingness of students in order to accomplish the task and solve problems, demonstrates motivation for learning and cognitive engagement (Corno & Mandinach, 1983).

According to the researcher's observation, Grades 7, 8, 9 students at the target school are taught in a similar manner, and the students appear to be specifically concerned with passing exams with little effort put in to acquire further knowledge. Thus, the problem of this study is that, low mathematic achievement are the concerns for educational organizations (Anderson, 2013). Alzhanova-Ericsson et al. (2017) claimed that students exhibiting a low level of cognitive engagement in mathematics often exhibit a low level of mathematics academic achievement and a lack of practice in Mathematics class.

Therefore, the goal of this investigation was twofold: firstly, to measure the levels of motivation for learning and cognitive engagement in Mathematics class held by Grades 7-9 students at the target school, in order to identify trends in these research variables and spot where critical actions could be needed to promote students' motivation and active engagement in school (Funda, 2017). Secondly, to determine whether there was a significant difference in both motivation for learning in Mathematics class and cognitive engagement in Mathematics class between in Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Research Questions

The following are the specific research questions that were addressed by this study.

1. What are the levels of Grades 7-9 students' motivation for learning in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok?
2. What are the levels of Grades 7-9 students' cognitive engagement in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok?
3. Is there a significant difference in motivation for learning in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok?
4. Is there a significant difference in cognitive engagement in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok?

Research Objectives

From the research questions, four research objectives emerged. The following are the research objectives that guided this study.

1. To determine the levels of Grades 7-9 students' motivation for learning in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok.
2. To determine the levels of Grades 7-9 students' cognitive engagement in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok.
3. To determine whether there is a significant difference in motivation for learning in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.
4. To determine whether there is a significant difference in cognitive engagement in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Research Hypotheses

For this study, the following two research hypotheses were tested.

1. There is a significant difference in motivation for learning in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, at a significance level of .05.
2. There is a significant difference in cognitive engagement in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, at a significance level of .05.

Theoretical Framework

This research was supported by two major theories.: the student motivation model and the dimensions of cognitive engagement.

Student Motivation Model (Pintrich & DeGroot, 1990)

Student motivation, according to this model, can be thought of as a three-dimensional construct that describes learners' actions, desires, and needs. Student motivation is defined in this model as a motivating force generated from three sorts of sources or motivational components: value components (i.e., according to Fosmire [2014], are defined as important factors in the learning process, engaging in a task or not), expectancy components (i.e., according to Betts et al. [2010], are about students' approximation of their performance in the learning process), and affective components (i.e., according to Pintrich et al. [1991], the motivation for engaging in learning strategies and the test-taking skills could be influenced by the degree of test anxiety). The researcher will focus on the value components for this study, because it will examine the general components of student motivation rather than the subjective ones, such as expectancy and affective components, due to the nature of the current research (Pintrich & De Groot, 1990). There are three types of value components: intrinsic goal orientation, extrinsic goal orientation, and task value (Pintrich et al., 1991).

Intrinsic Goal Orientation

The intrinsic goal orientation relates to a student's understanding of the self-determined motives for participating in a learning activity. The students' participation in the work is an end in and of itself, rather than a means to an end, if they have an intrinsic goal orientation toward the task (e.g., students would be reading a book if they enjoy reading it; Pintrich et al., 1991).

Extrinsic Goal Orientation

Extrinsic goal orientation refers to the extent to which students believe they are participating in a task for reasons such as grades, prizes, performance, evaluations, and competition (Pintrich et al., 1991).

Task Value

The task value is defined as the students' assessment of the learning assignment's interest, importance, and effectiveness (e.g., I like every topic in mathematics class). As a result, the higher the task value a student has in a learning assignment, the greater the students' involvement in that work (Pintrich et al., 1991).

Dimensions of Cognitive Engagement (Kong et al., 2003)

This theory is grounded on the fact that cognitive engagement has been found to be closely related to students' learning strategies. According to Biggs (1978), there are three approaches to learning: surface, deep, and achieving. The fundamental dimensions of surface and deep approaches were defined by Marton and Säljö (1976). Kong et al. (2003) found that students' learning strategies in mathematics include methods such as memorization, practicing, processing tests, comprehending questions, summarizing what might be studied, relating new and old information, relying on parents, and relying on teachers. They classified these learning factors into three groups, which were then adopted and expanded upon the construct of cognitive engagement (Biggs, 1978; Marton & Säljö, 1976): surface strategy, deep strategy, and reliance (Kong et al., 2003).

Surface Strategy

The surface strategy refers to memorizing formulas, practicing, and handling tests, so the learner cognitive engagement on the task components' physical and literal qualities rather than their meaning or understanding the concepts, and handles them as if they are unrelated to one another or to other activities. Students who take this technique must find the right balance between avoiding failure and studying too hard. Limiting the target to those fundamentals that can be learned by practicing is an appropriate-method for achieving that goal (Kong et al., 2003).

Deep Strategy

A student who takes a deep engagement views the activity as engaging and personal, concentrates on the understanding the questions instead of the descriptive details, and attempts interconnection between elements as well as integration with other tasks, then they try to connect the new knowledge to the old one. Students using deep strategy are able to read widely and engages in group discussions (Kong et al., 2003).

Reliance

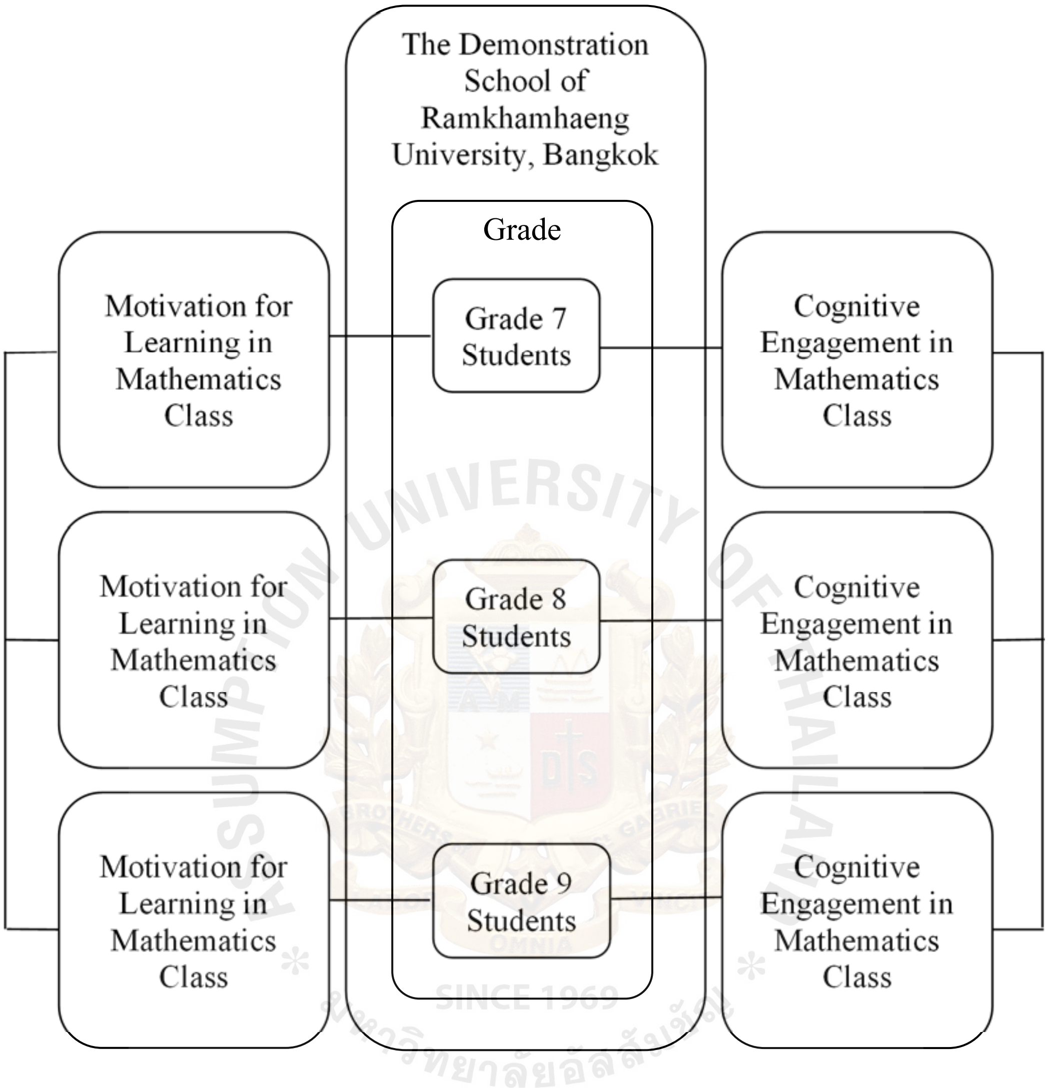
According to Kong et al. (2003) the other factor comprising cognitive engagement is reliance, which is defined as the students' confidence in the teacher's and parents' instructions. The student believes the best way to engage cognitively in learning mathematics is to trust on teachers' and parents' guidance, and follow it accordingly.

Conceptual Framework

Figure 1 shows the relationship among the variables addressed in this study. The researcher targeted Grades 7-9 students enrolled in Mathematics class at the target school to investigate whether there was a significant difference in motivation for learning and engagement in Mathematics class among the participants in this study.

Figure 1

Conceptual Framework of This Study



Scope of the Study

In this section, the boundaries of this study are clearly described, in relation to the following five aspects: theoretical scope, variable scope, research design scope, demographic scope, and instrumental scope.

Theoretical Scope of This Study

This research was driven by Pintrich and DeGroot's (1990) student motivation model, and Kong et al.'s (2003) dimensions of cognitive engagement.

Variable Scope of This Study

This study addressed the following three research variables: students' grade (Grades 7-9), which served as the independent variable, and motivation for learning and cognitive engagement in Mathematics class, which were the dependent variables.

Research Design Scope of This Study

The research used a quantitative comparative survey research design, in order to learn about the Grades 7-9 students' motivation for learning and cognitive engagement in Mathematics class at the target school.

Demographic Scope of This Study

The participants for this study were a population sample comprised of 31 Grade 7, 14 Grade 8, and 21 Grade 9 students, all enrolled in the Demonstration School of Ramkhamhaeng University, Bangkok, Thailand, during the academic year 2021-2022.

Instrumental Scope of This Study

Motivation for learning in Mathematics class was assessed using the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ), which was adapted from the Motivated Strategies for Learning Questionnaire (MSLQ), originally developed by Pintrich et al. (1991). The MSLQ includes 31 items on three motivational components: value, expectancy, and affective components. In this study, the researcher has focused on the value components, and therefore used the 14 items from the original MSLQ. The value components contain three elements: intrinsic goal orientation (four items), extrinsic goal orientation (four items), and task value (six items).

Cognitive engagement in Mathematics class was measured using the Student Engagement in the Mathematics Classroom Scale (SEMCS), originally developed by Kong et al. (2003). The total number of items in the original SEMCS is 57, arranged on three constructs: cognitive engagement, behavioral engagement, and affective engagement. In this research, the researcher focused on cognitive engagement, and therefore used 21 out of the 57 items of the SEMCS (i.e., the 21 items comprising the cognitive engagement dimension of the SEMCS).

Definitions of Terms

For a better understanding of the current study, the following concepts are defined.

Cognitive Engagement in Mathematics Class

It refers to the engagement of the students' mental resources, psychological feature structures to the memorization, practicing, and preparing for tests, learning material, process the follows mathematics procedures, and exploitation of metacognitive methods to confirm learning. In this study, 21 items from the Student Engagement in Mathematics Classroom Scale (SEMCS) were used to assess cognitive engagement in Mathematics class. In this research the researcher administered the shortened version of SEMCS that consists of three subscales of cognitive engagement, including surface strategy (Items 1-7), deep strategy (Items 8-14), and reliance (Items 15-21).

Surface Strategy

It refers to focusing on lower-order cognitive skills, such as memorizing facts, rather than understanding skills, such as analysis, synthesis, and evaluation. In this study, Items 1-7 from the SEMCS were used to measure engagement in mathematics, in terms of surface strategy.

Deep Strategy

It refers to the student's cognitive participation in learning activities as well as the mental energy invested. It includes the use of deep learning strategies by the student, such as understanding and applying the learning in real life. In this study, Items 8-14 from the SEMCS were used to measure engagement in mathematics, in terms of deep strategy.

Reliance

The term “reliance” refers to a student's belief in the teachers' and parents' directions; that is, the students’ degree to which they believe in trusting and following the instructions of teachers and parents rather than understanding the core of mathematics. In this study, Items 15-21 from the SEMCS were used to measure engagement in mathematics, in terms of reliance.

Grades 7-9 Students

This refers to the 66 students enrolled in five Grades 7-9 classes in the English Program at the Demonstration School of Ramkhamhaeng in Bangkok during the academic year 2021-2022. The students are non-native English speakers and their age ranges from 12 to 14 years old. The participants of this study were 55 students of Grades 7 to 9, from the English Program at the target school, distributed as follows: 31 students from Grade 7, 14 students from Grade 8, and 21 students from Grade 9.

Mathematics Class

Mathematics class is a base course provided to students who are enrolled in Grades 7 to 9 at the target school. In this class, students learn Math Counts skills and contents (i.e., numbers and algebra, geometry and measurement, statistics and probability) along with analysis of contents. Students are required by the school to study this subject for three days per week with one period lasting 50 minutes.

Motivation for Learning in Mathematics Class

Motivation for learning in Mathematics class refers to the driving influence behind students’ efforts to achieve academic success in Mathematics class. In the current study, motivation for learning in Mathematics class will be understood as comprised of the value components of the motivation scale defined by Pintrich and DeGroot’s (1990) student motivation model. Therefore, motivation for learning in Mathematics class can be categorized in terms of intrinsic goal orientation, extrinsic goal orientation, and task value. In this study, 14 items from the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ), a shortened version of the MSLQ, were used to measure motivation for learning in Mathematics class. The MMSLQ is formed by the three subscales comprising the value components: intrinsic goal orientation (Items 1-4), extrinsic goal orientation (Items 5-8), and task value (Items 9-14).

Value Components

It refers to the various reasons that individuals have when engaging in a task or not. It responds to the question ("Do I want to do this task and why?"). Value components includes intrinsic goal orientation, extrinsic goal orientation, and task value.

Intrinsic Goal Orientation. It refers to the action is pursued because it is intrinsically engaging or enjoyable. It applies to motivation that derives mostly from the inside (e.g., being curious, wanting to challenge, wanting to master the content). In this study, Items 1-4 from the MMSLQ were used to measure motivation for learning in Mathematics class, in terms of intrinsic goal orientation.

Extrinsic Goal Orientation. It refers to the main concern the student has regarding grades, rewards, comparing one's performance to others. It is largely concerned with exterior goals and ambition to exercise more in order to look good in front of others, for example, is clearly an extrinsic objective (e.g., grades, rewards, comparing one's performance to others). In this study, Items 5-8 from the MMSLQ were used to measure motivation for learning in Mathematics class, in terms of extrinsic goal orientation.

Task Value. It refers to the students' evaluation of how interesting, how important, and how useful an instructional task is (e.g., interest, importance, and utility). It refers to the reason for participating in the task ("why am I doing this?"), from the point of view of the student. In this study, Items 9-14 from the MMSLQ were used to assess motivation for learning in Mathematics class, in terms of task value.

The Demonstration School of Ramkhamhaeng University, Bangkok

This refers to a government educational institution located in Bangkok, Thailand, providing secondary school instruction from Grade 7 to Grade 12 students in Thai, English, and Chinese. As a demonstration school, this institution promotes the application of new knowledge and research in the teaching and learning process, focusing on building creative, independent, and quality students.

Significance of the Study

The study's findings will benefit teachers, school administrators, students, and future researchers.

For starters, the information from this study will be useful for teachers in motivating and engaging students in learning Motivation is not only important in and of itself; it is also a good determinant of school success. Enabling students to see the worth in their studies can lead to increased interest, engagement, and achievement in the particular topic.

Secondly, knowing the importance of the student's motivation for learning and engagement in mathematics class will be useful for the school administrators to engage students in the learning process and enhance their concentration and awareness, encourage them to use higher-level critical thinking skills, and foster opportunities for learners.

Furthermore, the adjustments and improvements made by the teachers, the school, and particularly student motivation and engagement help students learn managing inside the institution's educational system. This will allow students, staff, and teachers to interact more effectively. Instead of memorizing facts, students who are engaged in active learning typically interact with one another in small groups or participate in big group debates. It enables children to learn and practice skills that will help them achieve in the future.

Lastly, motivation is important because it enables students to change their behavior, learn new skills, be more innovative, set goals, pursue new interests, plan, professional skill, and become more involved. Consequently, it is necessary for future researchers to gain a better knowledge of considering to conduct research on a similar context regarding to motivation and engagement in learning. Future scholars may be focused in determining the most effective techniques to engage students in learning in order to achieve beneficial outcomes.

CHAPTER II

REVIEW OF RELATED LITERATURE

The purpose of this chapter is to review the background information on motivation for learning mathematics, intrinsic and extrinsic motivations, task value, cognitive engagement in mathematics class, surface and deep strategies, and reliance. Previous studies conducted on motivation for learning and cognitive engagement are also summarized in this chapter. Finally, a background of the target school is provided.

Student Motivation Model

This research focused on students' motivation for learning mathematics from the framework outlined by Pintrich and DeGroot (1990). Students' motivation is directly related to their ability to engage in their classroom instruction, and hence to being metacognitively and behaviorally engaging in their own learning process, in order to achieve their own personal learning goals (Eccles & Wigfield, 2002). According to this model, there are three motivational components that can be related to the three different components of motivation scales: (1) a value component that includes students' aims and opinions about the task's relevance and interest, (2) an expectancy component, which includes students' opinions about their ability to complete a task, and (3) an affective component, which includes students' emotional responses to the task (Pintrich et al., 1991). For this study, the researcher focused only on the value components of motivation, because she examined the general components of student motivation rather than the subjective ones (i.e., expectancy and affective components), due to the nature of the current research.

Value Components

Although this motivational component has been defined in a variety of ways (e.g., intrinsic vs. extrinsic, task value), it primarily concerns students' motives for performing particular tasks, and hence to the individual responses of students to the question "why am I performing this task?"

Value components represent one of the motivation scales identified by Pintrich and DeGroot (1990), which is formed by three subscales: intrinsic goal orientation, extrinsic goal orientation, and task value. This value component of motivational belief, according to Palmer (2005), relates to inherent enjoyment in an activity and is strongly linked to the conceptions of intrinsic motivation and interest. Students' goals for the task, as well as their opinions about the relevance of interest in and worth in the task, are examples of intrinsic value. Students who are motivated by a common goal incorporate mastery goals, challenges, rewards, grades, and a belief that the task is engaging and important will be able to control their effort more successfully, according to the research (e.g., Ames & Archer, 1988).

Pintrich and DeGroot (1990), on the other hand, believed that issues of value components would be impacted by intrinsic goal orientation, extrinsic goal orientation, and task value, while issues of expectancy components would be inspired by control beliefs and self-efficacy for effective learning. Finally, test anxiety will have an impact on the affective components.

Motivational beliefs provide as a conceptual framework for students in a subject area, guiding their thoughts, feelings, and behaviors (Boekaerts, 2002). Students who are motivated to learn mathematics have the tendency to show a higher level of work engagement in mathematics classrooms (Brophy & Lee, 1996).

Motivation is a key condition that initiates, guides, and supports the activity (Green, 2002). The value component of student motivation is comprised of the following constructs: intrinsic goal orientation, extrinsic goal orientation, and task value.

Intrinsic and Extrinsic Goal Orientations

A number of researchers have defined goal orientations (e.g., Ames, 1983; Covington & Beery, 1976; Nicholls, 1984), but the one developed by Harter (1981) distinguished between students who offer intrinsic rationales like challenges, curiosity, and mastery and students who are more focused on extrinsic considerations like grades, rewards, and approval from others.

Intrinsic Goal Orientation. The approach of achieving a function for the pleasure and satisfaction of doing the activity itself is defined as intrinsic motivation (Baranek, 1996). Intrinsic goal orientation refers to the action being pursued because it is intrinsically engaging or enjoyable for the learner. It applies to motivation that derives mostly from the inside (e.g., being curious, wanting to challenge, wanting to master the content). Learners want to learn mathematics, for example, because they find it fascinating, and they are motivated to satisfy their curiosity, they gain confidence and grow, and all of these factors contribute to intrinsic motivation. According to Nelson and Debacker (2000), intrinsic value is defined of one's intrinsic levels of pleasure from participating in educational activities.

Extrinsic Goal Orientation. Baranek (1996) determined that the approach of doing tasks in terms of getting benefits from others is referred to as extrinsic motivation. Extrinsic goal orientation refers to the main concern the student has to learn is driven by grades, rewards, or comparing his or her own performance to the one of others. It is largely concerned with exterior goals and ambition to exercise more in order to look good in front of others, for example, is clearly an extrinsic objective (e.g., grades, rewards, comparing one's performance to others). For example, when children attempt to achieve their parents' approval, professor's praise, or prizes such as money or goods they want, their behaviors might be classified as driven by extrinsic motivation, because their actions are guided for compensation rather than for the pleasure and satisfaction of doing the learning activity itself. Outer praise and prizes, according to Kong (2009), motivate and engage students to study more actively. Students can be highly motivated to learn if they want to gain the approval of their teachers or parents, according to Ryan and Deci (2000). In other words, even if students are motivated to learn in order to please their teachers or parents, this is still referred to as "motivation." So, intrinsic motivation is defined as a student's drive to do something because it engages or inspires him or her, whereas extrinsic motivation is defined as a student's drive to do something because he or she desires praise from teachers, parents, or a favorable grade. Furthermore, it has been reported that if a teacher provides extrinsic motivation and knows how to extrinsically motivate and encourage students to study, they will be more successful in the learning process (Ryan & Deci, 2000).

Task Value

In this model, the component of task value refers to the importance and significance of the task to the individuals. Task value is understood as the students' evaluation of how interesting, important, and useful an instructional task is (i.e., students' evaluation of a task in terms of interest, importance, and utility, respectively). It refers to the student's source of motivation for active participation in the assignment ("why am I doing this particular task?"). Mathematics courses or tasks may be considered crucial to students' self-esteem or self-schema (Pintrich & Schrauben, 1992).

The term "utility value" relates to the student's academic achievement (Eccles, 1983). The utility value of a task is determined by the outcome of its effectiveness to the learner. It is critical to assess academic achievement on these types of academic activities if we are to develop models of academic motivation and personality learning that are applicable to the majority of academic work in classrooms (Pintrich et al., 1991).

According to Mills (1991), both the instructional tasks and teaching strategies used by a teacher have a significant impact on students' motivation for learning. As a result, task value is a unique type of motivation that requires cognitive engagement from students, as well as a desire to take control of the learning process, which is likely to translate into strong academic performance.

Dimensions of Cognitive Engagement

Student engagement has grown in importance as both a component of the school curriculum (Huebner, 1996). While analyzing students' learning strategies (i.e., the methods that students use to study materials, which have been found to be closely related to cognitive engagement), Kong et al. (2003) developed the dimensions of cognitive engagement, that were identified as surface strategy, deep strategy, and reliance. They proposed that the construct of cognitive engagement is closely related to approaches to learning. This theory proposes that the learning strategies are composed of three constructs: cognitive engagement, affective engagement, and behavioral engagement. The current study focuses on the first of these constructs.

Cognitive Engagement

Learning, thinking, and problem-solving skills have all been highlighted as elements in cognitive engagement (Connell, 1990; Pintrich & Schrauben, 1992).

The concept of cognitive engagement encompasses conscious, intellectual activities such as thinking, reasoning, or remembering. Cognitive engagement is defined as the extent to which students are willing to engage. The majority of cognitive engagement is related to the student's mental resources, information processing, and the adoption of metacognitive methods in order to ensure learning (Connell & Wellborn, 1991). Cognitive engagement involves being thoughtful, strategic, and willing to put in the work required to master complicated ideas or master difficult abilities (Corno & Mandinach, 1983; Fredricks et al., 2004).

After investigating signs of cognitive involvement in mathematics classes (e.g., self-monitoring, having discussions, making suggestions, and attempting to justify answers), Helme and Clarke (2001) found that activities that require from students to link an instructional task to past knowledge and ask for explanations are indicators of cognitive engagement.

Greene and Miller (1996) found that preservice teachers who had high learning goals had also high levels of meaningful relevant cognitive engagement, which had a direct influence on achievement, since they performed better in terms of academic achievement.

In this model, Kong et al. (2003) proposed that cognitive engagement and learning strategies fall into three dimensions: surface strategy (that includes methods of memorization, practicing, and handling tests; Ramsden, 1988), deep strategy (that includes understanding the questions, summarizing what is learned, elaboration of learning material, and connecting new knowledge with the old ways of learning), and reliance (that includes trust or confidence in parents as well as on teachers; Kong et al., 2003).

Surface and Deep Strategies

Some researchers have categorized cognitive engagement into sub-components such as surface-level strategy, in which students do not bother to do research and findings, and deep-level engagement, which includes students performing in-depth strategies for seeking support or attempting to avoid conflict while dealing with the task (Kong et al., 2003). Surface strategy refers to focusing on lower-order cognitive skills, such as memorizing facts and applying methods of memorization, practicing, and handling tests, rather than formulation and analytical and observational skills, which are examples of understanding abilities (Kong et al., 2003).

Deep strategy refers to the degree of cognitive involvement of the student within the learning activities and therefore the mental effort spent. It includes the student's use of deep learning methods, such as understanding and applying the learning in real life, understanding questions, summarizing what is learned, and connecting new knowledge with the old ways of learning (Kong et al., 2003).

The concept of cognitive engagement has been found to be linked to the nature of the learning methods by many researchers. For example, Biggs (1978) found, through the use of factor analysis, three approaches to learning: surface, deep, and achieving. Marton and Säljö (1976) extracted the basic dimensions of surface and deep, although with a distinct theoretical and methodological framework.

According to Biggs (1987), surface and deep strategies define how students engage with the task itself, whereas the achieving strategy describes how students organize the time and environmental situations in which the task is completed. It is, therefore, possible for students to combine an achieving approach with either a surface or a deep strategy (Craik & Lockhart, 1972).

In mathematics, surface strategy is associated with memorization formulas and the desire to achieve a decent grade (Draper, 2009). Accordingly, the use of deep strategy instead involves a consideration of critical thinking skills (e.g., Bloom's taxonomy evaluation level), which reflects a student thoroughly learning with individual intrinsic motivation rather than simply learning just for trying to pass an examination (Ramsden, 2003).

Deep strategy is linked to greater clarification of the material to be learned. Deep strategy entails connecting new information with existing knowledge, resulting in a more dynamic learning system (Anderson & Reder, 1979). Moreover, a deep strategy to learning is linked to greater levels of learning outcomes (Biggs & Telfer, 1987), and it has been found that deep methods of learning are positively related to academic engagement (Willis, 1993). Therefore, a deep strategy involves questioning the reality of information and attempting to combine different information with previous knowledge, whereas surface techniques entail rote memorization and repetitive rehearsal of information (Entwistle & Ramsden, 1983).

Reliance

Reliance refers to the students' degree to which they believe and trust in their teachers' and parents' directions in relation to their learning process and studies. As for reliance, parents are responsible for providing a comfortable setting in which their children can manage their homework and studies (Xu & Corno, 2003). Xu and Corno (1998) established that by reducing distractions, parents can facilitate their children's schoolwork conditions., engaging their children on their assignments, and making assignments easier for them. Such parents are more successful in engaging their children in homework. As a result, with parental engagement, schoolwork may be a social and interesting activity. Involvement of parents varies depending on the age of the student (Batool & Riaz, 2019). Therefore, parental attitudes regarding their children's homework have a beneficial impact on their achievement (Else-Quest et al., 2008; Leone & Richards, 1989).

Skinner et al. (1990) outlined students' aspects as environments made up of schoolmates, teachers, family members, and others with whom children interact and engage in social activities. The interactions of students with teachers, classmates, and materials determine the level of student engagement in mathematics, in particular of reliance. Positive teacher affect (e.g., a high level of belief and trust in the teacher by students) is attributed with engagement, while negative teacher affect is aligned with a disengaged attitude (Roorda et al., 2011). Middle school teachers who were observed demonstrating specific learning goals work, managing student performance and giving structures, and stimulating student thinking resulted in students exhibiting a higher degree of belief and trust in their teacher, as well as in higher levels of student engagement (Raphael et al., 2008).

Previous Research on Motivation for Learning Mathematics

Lepper and Hodell (1989) conducted a study on American third- through fifth-grade students, in which the participants were asked to spend time working on a computer-based activity designed to teach students about the use of Cartesian coordinates. It was found that younger students were more significantly more intrinsically motivated to explore and understand the world around them, but their intrinsic motivation faded throughout their progression in the academic environment which regulated the content students are required to learn. Moreover, students spent more time on a task and engaged in deeper learning when the activities were presented with motivational appeal (e.g., hunting for hidden treasures buried on an island) than with a control condition appeal (e.g., finding hidden dots on a grid).

Harter (1981) conducted a study focused on examining the developmental trends in intrinsic and extrinsic motivation across samples of American students from Grades 3 to 9 from New York, California, and Colorado. She found a decline in intrinsic motivation through Grades 3 to 9, and an increase in extrinsic motivation. She concluded that children may be either adapting to the demands of the school culture, which reinforces a more extrinsic orientation, or perhaps the school system is gradually stifling children's intrinsic motivation, and hence children's intrinsic motivation is shifting to extrinsic motivation with age. Also, it was found that there was a dramatic shift from reliance on teacher's judgment to independent judgment in children across Grades 3-9. Harter concluded that this might be because at higher grades, children should become more knowledgeable and should be more capable of making their own judgments as to whether or not they are successful.

Sengodan and Iksan (2012) conducted a study on students' learning styles and intrinsic motivation in learning mathematics. This study took place in Malaysia between 78 students in the Youth Skill Training Institute of Sepang (IKTBNS). The researchers analyzed the data by performing a correlational analysis (using Pearson product-moment correlation coefficient), in order to determine the relationship between learning style and achievement. The findings revealed a significantly strong correlation between students' willingness, intrinsic motivation, and hardworking learning preferences.

Kiwanuka et al. (2016) investigated the reasons why students' and classroom aspects influenced motivation toward mathematics (in terms of self-belief, worth, and interest) in a survey administered to 4819 first-year secondary students from Central Uganda. Students' enjoyment of learning mathematics was found to be strongly and positively connected with performance expectancy and self-confidence, according to the initial report. This suggests that students' motivation for learning mathematics is related to their cognition (i.e., self-belief and worth). The same study found a decrease in students' cognitive assessments and satisfaction with learning mathematics as earlier than usual as the first year of secondary school.

Previous Research on Cognitive Engagement in Mathematics Class

Shahrill and Wahid (2014) conducted a study to investigate the elements that lead to students' engagement in mathematics achievement, as well as how students engaged in or out classroom instruction. This study used mainly a survey research design, class observations, and a student engagement scale. This research took place on 30 pre-university students ranged from 16-18 years old in a school in Brunei Darussalam. As a result of the research, they determined that the majority of students learned through the surface strategy, but that certain students may also engage in using the deep strategy, in which they showed preference to grasp mathematical concepts and apply what they have learned in real-life situations. When students got happiness and satisfaction from a greater understanding, they were intrinsically motivated. Furthermore, students participating in this study were found to rely on their teacher and parents for encouragement in order to retain their grades, which can be understood as an evidence of reliance. In this research, the data was analyzed using Pearson correlation to identify any relation between dimensions. The result showed that deep strategy and interest were significantly correlated. However, it showed that interest correlated negatively with surface strategy.

Akhtar and Batool (2020) conducted a study to analyze the level of cognitive engagement in Mathematics classroom and mathematics achievement. This study took place in District Lahore (Punjab, Pakistan). A quantitative research approach was used, and a test group consisting of 300 high school students were selected as the sample group. The data was analyzed by the researchers using primary and secondary data sources with the statistical software package SPSS. The findings revealed a significant correlation between mathematics performance, cognitive engagement, surface strategy, deep strategy, and teacher reliance. They interpreted the low level of surface and deep strategies among male and female students. A moderate level of reliance for both male and female students was found.

Mentari and Syarifuddin (2020) conducted a study to determine how to increase students' engagement in mathematics understanding through contextual teaching and learning (CTL). The study used a sample of 25 eighth-grade students from Padang, Indonesia. In order to make a comparison in student engagement, the researchers used a pretest-posttest analysis of the data. The average level of cognitive engagement of students in pre-test and post-test indicated as the same level of cognitive engagement. The level of surface strategy and deep strategy in before and after the test indicated as moderate levels, while the level of reliance in pre -test and post- test indicated as high level of cognitive engagement. Also, according to the findings and comparing means of the study, there was a decrease in surface strategy domain after CTL-based instruction. This is because in CTL-based learning, students are more facilitated and constructed by their understanding the concepts. Besides, deep strategy increased after CTL-based instruction.

The Demonstration School of Ramkhamhaeng University (DSRU)

The Demonstration School of Ramkhamhaeng University (DSRU) is a well-reputed school located in Bangkok, Thailand. This refers to a government multilingual school founded in 1994.There are already 1,797 students in the second semester of the academic year 2021-2022, including junior and senior high school students enrolled in both English and Thai programs. Junior high school begins with Matthayom 1 (Grade 7) and ends with Matthayom 3 (Grade 9). Most junior high school students are between the ages of 13 and 15. Students in senior high school, which consists of Matthayom 4-6 (Grades 10-12), are within an age range of 16-18 years, need to choose an academic learning program, according to their interest. Senior high school students have four options at the school: Science-Mathematics, Arts-Mathematics, Arts-Language, and National Courses.

Most of the students in this school come from middle-class families, and have parents who have completed a college degree, have good jobs, and support their children's teaching and learning process (Academic Department, 2016). Some of these parents select the learning program and plan everything for their children. Some of them allow their children to see what they want to do or gain knowledge for their future. As a result, these findings will be focused on motivation from students themselves, others, and dimension of cognitive engagement such as surface and deep strategies, as well as reliance on teachers and parents. Teachers will also gain a deeper understanding of their students' challenges and create appropriate instructional resources, as well as assist parents on how to promote the learning of mathematics in their children in a reasonable way.

The school has two programs, according to the medium of instruction: the Thai

Program and the English Program (EP). In the EP, the following subjects are taught in English: Math Counts, Applied Mathematics, Science, Health, Social Study, Physics, Biology, Chemistry, and STEM. In the EP, from Grades 7-9, students will study Mathematics Counts (basic subject) and Applied Math (additional subject). This research focused on the group of students taking Mathematics Counts, enrolled in Grades 7, 8, and 9 at the English Program in the target school, in which mathematics is held three hours per week as a basic subject. In the following paragraphs, the researcher introduced the course description and the content of the mathematics book in each grade. The chapters in the Mathematics Counts series are coded according to three strands in the secondary syllabus as: numbers and algebra, geometry and measurement, and statistics and probability. In Grades 7 (Matthayom 1), 8 (Matthayom 2), and 9 (Matthayom 3), students have Mathematics Counts as a basic 3-credit subject, 3 periods per week. Each period is 50 minutes long.

In Grade 7 course, students develop a unified understanding of numbers and algebra in the first five chapters of the eight ones covered in this course. Chapter 1 deals with numbers, factors and multiples; Chapter 2 with rational numbers and estimations; Chapter 3 with percentages; Chapter 4 with algebraic expressions and manipulations; and Chapter 5 with ratio, rate and speed. The students gain familiarity with geometry and measurement in Chapter 6 (Basic geometry); and Chapter 7 (Mensuration of planes and solids). Students learn statistics in the Chapter 8 (Statistical representations).

In Grade 8 course, students acquire an understanding of numbers and algebra in the first five chapters. Chapter 1 deals with algebraic expansions and factorizations; Chapter 2 with algebraic fractions, equations and inequalities; Chapter 3 with Cartesian coordinates and linear graphs; Chapter 4 with proportions and map scales; and Chapter 5 with simultaneous linear equations. Geometry and measurement are included in Chapter 6 (Triangles, polygons and congruence); and Chapter 7 (Mensuration). This course enables students to focus on statistics and probability in Chapter 8.

In Grade 9 course, students concentrate on understanding of numbers and algebra in the first two chapters: Chapter 1 deals with mathematics in practical situations; while Chapter 2 deals with indices and standard form. This course is designed to provide students with knowledge on geometry and measurement in Chapter 3 (Pythagoras' theorem and trigonometry); Chapter 4 (Coordinate geometry); Chapter 5 (Quadratic equations); Chapter 6 (Graphs of non-linear functions); Chapter 7 (Congruence and similarity); and Chapter 8 (Symmetry and angle properties of circles). The last chapter, Chapter 9, covers statistics and probability content: cumulative frequency and box-and-whisker plots.

CHAPTER III

RESEARCH METHODOLOGY

In this chapter, the researcher presents the methodology and procedures to measure the level of the participants' motivation in learning and cognitive engagement in Mathematics class. The research methodology, involving the research design, population and sample, research instruments, validity and reliability of the instruments, data collection, data analysis, and summary of the research process, are described in this chapter.

Research Design

The purpose of this study was to determine whether there was a significant difference in both motivation for learning and cognitive engagement in Mathematics class among Grade 7, Grade 8, and Grade 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. A quantitative comparative research design was employed, in order to reach the purpose of the current study.

The researcher used the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ), a questionnaire comprised of 14 items on a 7-point Likert-type scale ranging from 1 (*not at all true of me*) to 7 (*very true of me*), adapted from Pintrich et al. (1991), to measure the participants' motivation for learning in Mathematics class. For the purpose of measuring cognitive engagement in Mathematics class, the researcher applied the Student Engagement in Mathematics Classroom Scale (SEMCS), which included 21 items on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), adopted from Kong et al. (2003).

Descriptive statistics, in terms of means and standard deviations, were performed on the data collected for each research variable. A comparative analysis using a one-way analysis of variance (ANOVA) were performed, in order to examine the difference in both motivation for learning and cognitive engagement in Mathematics class among Grades 7, 8, and 9 students in the target school.

Population

The target population of this research study were all the Grades 7-9 students currently enrolled in Mathematics class, English Program, at the Demonstration School of Ramkhamhaeng University, Bangkok, during the academic year 2021-2022. The participants were the 66 students who registered in the English Program, and were distributed as follows: 31 students in Grade 7; 14 students in Grade 8; and 21 students in Grade 9.

Sample

In this study, a population sample comprised of all the 66 Grades 7-9 students currently enrolled in Mathematics class, English Program, during the academic year 2021-2022 at the Demonstration School of Ramkhamhaeng University were utilized. The 66 participants in this study were distributed as follows: 31 students from Grade 7, 14 students from Grade 8, and 21 students from Grade 9. This information is displayed in Table 1.

Table 1

Sample Sizes of Participants in Grades 7, 8, and 9 at the Demonstration School of Ramkhamhaeng University, Bangkok

Grade	Sample size
7	31
8	14
9	21

Research Instruments

The following research instruments were used in this study: the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ), which was adapted from Pintrich et al. (1991), and the Student Engagement in the Mathematics Classroom Scale (SEMCS), that was adopted from Kong et al. (2003).

Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ)

The researcher used the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ), which was adapted from Pintrich et al.'s (1991) Motivated Strategies for Learning Questionnaire (MSLQ), to quantify the motivation for learning in Mathematics class held by Grades 7, 8, and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

There are 15 subscales in the MSLQ: six in the motivation section and nine in the learning strategies section. The MSLQ consists of 81 items divided into two broad categories: (1) a motivation section and (2) a learning strategies section. According to the MSLQ manual, the motivation section consists of 31 items that assess (1) value components, (2) expectancy components, and (3) affective components. In this study, only the subscale of value components, comprised of 14 items and three subscales (i.e., intrinsic goal orientation, extrinsic goal orientation, and task value) were considered.

The MSLQ was originally designed to measure students' motivation for learning by Pintrich et al. (1991), but without a specific subject in mind. In order to reach the purpose of the current study and maintain the content validity to measure the motivation for learning in Mathematics class, the word "mathematics" was added to each of the chosen items. After this adaptation, the MMSLQ, which targets the Mathematics subject, was developed.

The MMSLQ is composed of two parts: background information and the 14 items that measure students' motivation for learning in Mathematics class through items organized into three factors: intrinsic goal orientation (Items 1-4), extrinsic goal orientation (Items 5-8), and task value (Items 9-14).

All the items use a 7-point Likert-type scale to measure students' level of motivation for learning in Mathematics class. Students can choose one out of seven anchors (1 = *not at all true of me*, 2 = *not true of me*, 3 = *somewhat not true of me*, 4 = *neither not true or true of me*, 5 = *somewhat true of me*, 6 = *true of me*, 7 = *very true of me*).

Table 2 depicts a summary of the interpretation of scores for the MMSLQ.

Table 2

Interpretation of the 7-Point Likert-Type Scale of the Subscales of Motivation for Learning in Mathematics Class

Level of truthfulness of the statement	Score	Mean score scale	Interpretation level for motivation for learning in Mathematics class
Very true of me	7	6.50-7.00	Very high
True of me	6	5.50-6.49	High
Somewhat true of me	5	4.50-5.49	Slightly high
Neither not true or true of me	4	3.50-4.49	Moderate
Somewhat not true of me	3	2.50-3.49	Slightly low
Not true of me	2	1.50-2.49	Low
Not at all true of me	1	1.00-1.49	Very low

Validity and Reliability of the MMSLQ

In this section, the validity and reliability of the MMSLQ are discussed in detail.

Validity of the MMSLQ. Regarding to the validity of this instrument, the Motivated Strategies for Learning Questionnaire (MSLQ) is an instrument which has been used widely validated as a standardized motivation test by many researchers in different forms to investigate the affective variables. The MSLQ was originally validated by a team of researchers from the National Center for Research to Improve Postsecondary Teaching and Learning (NCRIPTAL) at the University of Michigan (Pintrich et al., 1991).

Karadeniz et al. (2008) expressed that the MSLQ also has a strong content and construct validity, based on general view that the instrument has been validated in different studies conducted in different countries. Lin and Liu (2010) reported the validation of the MSLQ in a Taiwanese high school Mathematics class.

Since the questionnaire was administered to mathematics students, the researcher adapted the original version of MSLQ by Pintrich et al. (1991), for the specific purpose of contextualizing the instrument to the mathematics subject. Then, the word “mathematics” was included to the item wording of the original questionnaire, in order to adapt the Motivated Strategies for Learning Questionnaire (MSLQ) and develop the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ), and so ensure content validity for this study, because the researcher was going to determine the level of motivation for learning in Mathematics class of the participants from the target school.

Reliability of the MMSLQ. Regarding to the reliability of the Motivated Strategies for Learning Questionnaire (MSLQ), Pintrich et al. (1991) reported an acceptable internal consistency reliability of the scales addressed in this study. Table 3 represents the internal consistency reliabilities reported in different and the current research studies.

Table 3

Reliability Statistics of Previous and Current Studies Using the MMSLQ

Subscale	Cronbach’s alpha (internal consistency)			
	Pintrich et al. (1991)	Current study		
		Grade 7	Grade 8	Grade 9
Intrinsic goal orientation	.74	.73	.73	.69
Extrinsic goal orientation	.62	.72	.84	.76
Task value	.90	.80	.91	.83
Overall	Not reported	.75	.90	.71

Student Engagement in Mathematics Classroom Scale (SEMCS)

In this research, the researcher adopted the Student Engagement in Mathematics Classroom Scale (SEMCS), developed by Kong et al. (2003), to quantify the cognitive engagement for learning in Mathematics class, held by Grades 7, 8, and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

The Student Engagement in Mathematics Classroom Scale (SEMCS) was developed by Kong et al. (2003), based on the previous work by Marton and Säljö (1976) and Biggs (1978). In this study, the researcher utilized the latest version of SEMCS, which was implemented on the subject of mathematics (Kong et al., 2003). The SEMCS was designed to assess three constructs: surface strategy, deep strategy, and reliance.

The SEMCS contains 21 statements about student cognitive engagement in the mathematics class, organized into three dimensions: surface strategy (Items 1-7), deep strategy (Items 8-16), and reliance (Items 17-21).

All the items used a 5-point Likert scale to investigate the participants' level of cognitive engagement in Mathematics class. Students were asked to read the question carefully and pick one out of five anchors (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*).

In order to interpret the mean score for cognitive engagement in Mathematics class, the researcher used the score interpretation shown in Table 4.

Table 4

Interpretation of the 5-Point Likert Scale for the Cognitive Engagement in Mathematics Class

Agreement level	Score	Mean score scale	Interpretation level for cognitive engagement in Mathematics class
Strongly agree	5	4.50-5.00	Very high
Agree	4	3.50-4.49	High
Neutral	3	2.50-3.49	Moderate
Disagree	2	1.50-2.49	Low
Strongly disagree	1	1.00-1.49	Very low

Validity and Reliability of the SEMCS

In this section, the validity and reliability of the SEMCS are discussed in detail.

Validity of the SEMCS. Regarding the validity of this instrument, in the SEMCS, which was designed by Kong et al. (2003), items were built in accordance with items from well-known instruments on student engagement, including the Learning Process Questionnaire (LPQ; Biggs, 1987), the Affective Engagement Questionnaire (Miserandino, 1996) and the Student Engagement Questionnaire (Marks, 2000). Because cognitive engagement has been linked to learning processes in earlier research (e.g., Willis, 1993), the Learning Process Questionnaire (Biggs, 1987), an instrument aimed to test the measure to which secondary school students in Australia were engaged to different approaches to learning, was used as a guide when developing items on cognitive engagement. Moreover, the phrases and wording identified in the interview transcripts from Biggs (1987) study were used as much as possible in the instrument item design, in order to ensure content validity.

Reliability of the SEMCS. Regarding reliability, and according to Kong et al. (2003), the internal consistency reliability of the scales comprising the Student Engagement in Mathematics Classroom Scale (SEMCS) was acceptable. Table 5 shows details on the internal consistency reliabilities reported in different research studies using the SEMCS.

Table 5

Reliability Statistics of Previous and Current Studies Using the SEMCS

Subscale	Cronbach's alpha					
	Kong et al. (2003)	Floyd et al. (2009)	Shahril and Wahid (2014)	Current study		
				Grade 7	Grade 8	Grade 9
Surface strategy	.81	.75	.83	.72	.75	.76
Deep strategy	.87	.88	.71	.74	.79	.76
Reliance	.81	Not reported	.82	.76	.88	.85
Overall	Not reported	Not reported	Not reported	.74	.87	.84

Collection of Data

Permission to conduct this study was requested by the researcher to the principal of the Demonstration School of Ramkhamhaeng University. The permission was granted in August 2021.

After passing her proposal defense, the researcher contacted the homeroom teachers of the sample classes to schedule a date to administer the questionnaires. The data collection was conducted in May 2022.

Prior to the administration of the questionnaires, the researcher asked for assistance from homeroom teachers to distribute the questionnaires during break time and explained to the students that they could read the questionnaire before checking each item, that the completion of the questionnaire would not affect their academic performance, and that their responses would be treated privately and analyzed confidentially. Furthermore, all of them received clear instructions on how to complete the questionnaire, as well as completing the questionnaire without teacher force, so that they could think independently and respond confidently. The research timeline is shown in Table 6.

Table 6

Research Timeline for This Study

Date	Task
August 2021	Get the permission from the principal of the Demonstration School of Ramkhamhaeng University
August 2021-May 2022	Write the first three chapters of thesis proposal
May 2022	Do the thesis proposal defense
May 2022	Administer and collect the questionnaires to the target Grade 7-9 students
May-September 2022	Finish Chapters IV and V
October 2022	Do the final thesis defense

Data Analysis

Based on the research objectives, the data analysis was carried out according to the following statistical methods for this study.

1. To determine the levels of Grades 7-9 students' motivation for learning in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok.

   Method. Means and standard deviations were used to determine the levels of Grades 7-9 students' motivation for learning in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok.

2. To determine the levels of Grades 7-9 students' cognitive engagement in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok.

   Method. Means and standard deviations were used to determine the levels of Grades 7-9 students' cognitive engagement in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok.

3. To determine whether there is a significant difference in motivation for learning in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

   Method. A one-way analysis of variance (ANOVA) was used to determine whether there is a significant difference in motivation for learning in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

4. To determine whether there is a significant difference in cognitive engagement in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Method. A one-way analysis of variance (ANOVA) was used to determine whether there is a significant difference in cognitive engagement in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Summary of the Research Process

Table 7 presents the summary of the research process for this current study.

Table 7

Summary of the Research Process

Research objectives	Source of data or sample	Data collection method or research instrument	Method of data analysis
1. To determine the levels of Grades 7-9 students' motivation for learning in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok	All the Grades 7-9 students enrolled in the Demonstration School of Ramkhamhaeng, Bangkok: Grade 7 = 31 students Grade 8 = 14 students Grade 9 = 21 students	Mathematics Motivation Scale for Learning Questionnaire (MMSLQ)	Descriptive statistics (means and standard deviations)
2. To determine the levels of Grades 7-9 students' cognitive engagement in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok	All the Grades 7-9 students enrolled in the Demonstration School of Ramkhamhaeng, Bangkok: Grade 7 = 31 students Grade 8 = 14 students Grade 9 = 21 students	Student Engagement in Mathematics Classroom Scale (SEMCS)	Descriptive statistics (means and standard deviations)
3. To determine whether there is a significant difference in motivation for learning in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok	All the Grades 7-9 students enrolled in the Demonstration School of Ramkhamhaeng, Bangkok: Grade 7 = 31 students Grade 8 = 14 students Grade 9 = 21 students	Mathematics Motivation Scale for Learning Questionnaire (MMSLQ)	One-way analysis of variance (ANOVA)

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Research objectives	Source of data or sample	Data collection method or research instrument	Method of data analysis
4. To determine whether there is a significant difference in cognitive engagement in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok	All the Grades 7-9 students enrolled in the Demonstration School of Ramkhamhaeng, Bangkok: Grade 7 = 31 students Grade 8 = 14 students Grade 9 = 21 students	Student Engagement in Mathematics Classroom Scale (SEMCS)	One-way analysis of variance (ANOVA)

CHAPTER IV

RESEARCH FINDINGS

In this chapter, the research reports the research findings gathered from conducting the present study on 55 students from Grades 7, 8 and 9 at the Demonstration School of Ramkhamhaeng University, located in Bangkok. These findings were obtained to address the purpose of research, which was to carry out a comparative study of motivation for learning and cognitive engagement in Mathematics class held by Grades 7, 8 and 9 students at the target school.

Main Findings

In the following sections, the findings obtained from addressing the research objectives of the current research are presented in detail.

Findings From Research Objective 1

Research Objective 1 was to determine the levels of motivation for learning and cognitive engagement in Mathematics class held by Grades 7, 8 and 9 students at the Demonstration School of Ramkhamhaeng University located in Bangkok. In order to determine the level of motivation for learning in Mathematics class of the target students, the MMSLQ (see Appendix A) was used as an instrument. The MMSLQ is structured in three subscales, comprising the value components identified by Pintrich and DeGroot (1990): intrinsic goal orientation (4 items), extrinsic goal orientation (4 items), and task value (6 items). Thus, there are totally 14 items in this questionnaire, all using a 7-point Likert-type scale (1 = *not at all true of me,* 2 = *not true of me*, 3 = *somewhat not true of me*, 4 = *neither not true or true of me*, 5 = *somewhat true of me*, 6 = *true of me,* 7 = *very true of me*).

Table 8 displays the overall mean scores, standard deviations, and interpretations for motivation for learning in Mathematics class held by Grades 7, 8 and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. Details regarding this table are shown in Table 9 for Grade 7, Table 10 for Grade 8, and Table 11 for Grade 9.

Table 8

Mean Scores, Standard Deviations, and Interpretations for the Motivation for Learning in Mathematics Class Held by Grades 7, 8 and 9 Students at the Demonstration School of Ramkhamhaeng University, Bangkok

Variable	Grade 7			Grade 8			Grade 9		
	M	*SD*	*I*	*M*	*SD*	*I*	*M*	*SD*	*I*
Motivation for learning in Mathematics class	4.79	1.56	SH	4.31	1.53	M	4.60	1.23	SH
Intrinsic goal orientation	4.71	1.57	SH	4.13	1.49	M	4.21	1.35	M
Extrinsic goal orientation	5.09	1.65	SH	4.88	1.61	SH	5.46	1.34	SH
Task value	4.63	1.48	SH	4.06	1.49	M	4.30	1.07	M

Note. See Table 2 (p. 35) for the interpretation table. *I* stands for “Interpretation”; *SH* stands for “Slightly high”; *M* stands for “Moderate”.

For Grade 7, the results from Table 8 show that the level of students’ intrinsic goal orientation had a mean score of M = 4.71 (SD = 1.57), which was interpreted as slightly high. Moreover, the findings also revealed that the level of students’ extrinsic goal orientation for learning in Mathematics class had a mean score of M = 5.09 (SD = 1.65), that was interpreted as slightly high. Meanwhile, the results also show that Grade 7 students had a slightly high level of task value toward learning in Mathematics class with a mean score of M = 4.63 (SD = 1.48). Finally, Table 8 shows that the overall motivation for learning in Mathematics class of Grade 7 students at the target school was slightly high, because the overall mean score of the questionnaire was M = 4.79 (SD = 1.56).

For Grade 8, the results showed that the level of students’ intrinsic goal orientation had a mean score of *M* = 4.13 (*SD* = 1.49), which was interpreted as moderate. Moreover, the findings also showed that the level of students' extrinsic motivation for learning in Mathematics class had a mean score of *M* = 4.88 (*SD* = 1.61), which was interpreted as slightly high. The results also showed that students had a moderate level of task value for learning in Mathematics class with a mean score of *M* = 4.06 (*SD* = 1.49). Then, Table 8 indicates that the overall motivation for learning in Mathematics class of Grade 8 students at the target school was moderate, because the overall mean score of the questionnaire was *M* = 4.31 (*SD* = 1.53).

For Grade 9, the results showed that the level of students' intrinsic goal orientation had a mean score of *M* = 4.21 (*SD* = 1.35), which was interpreted as moderate. Moreover, the findings also showed that the level of students' extrinsic motivation for learning in Mathematics class had a mean score of *M* = 5.46 (*SD* = 1.34), which was interpreted as slightly high. The results also showed that students had moderate level of task value for learning with a mean score of *M* = 4.30 (*SD* = 1.07). The results summarized in Table 8 showed that the overall motivation for learning in Mathematics class of Grade 9 students at the target school was slightly high, because the overall mean score of the questionnaire was *M* = 4.60 (*SD* = 1.23).

For the purpose of presenting in detail the findings from Research Objective 1, this section was broken down into three sub-sections, according to the participants' grade. In the following subsections, participants' motivation for learning in Mathematics class is reported in detail, by focusing on its three subscales: intrinsic goal orientation, extrinsic goal orientation, and task value.

Grade 7

Table 9 depicts the mean scores, standard deviations, and interpretations for the motivation for learning in Mathematics class held by Grade 7 students at the Demonstration

School of Ramkhamhaeng University, Bangkok.

Table 9

Mean Scores, Standard Deviations, and Interpretations for the Motivation for Learning in Mathematics Class Held by Grade 7 Students at the Demonstration School of Ramkhamhaeng University, Bangkok

Item No.	Item statement	*M*	*SD*	Interpretation
	Intrinsic goal orientation			
1	In Mathematics class, I prefer course material that really challenges me so I can learn new things	4.86	1.70	Slightly high
2	In Mathematics class, I prefer course material that arouses my curiosity, even if it is difficult to learn	4.57	1.40	Slightly high
3	The most satisfying thing for me in this class is trying to understand the content as thoroughly as possible	5.00	1.61	Slightly high
4	When I have the opportunity in this class, I chose course assignments that I can learn from even if they don't guarantee a good grade	4.43	1.56	Moderate
	Overall (Intrinsic goal orientation)	4.71	1.57	Slightly high
	Extrinsic goal orientation			
5	Getting a good grade in this class is the most satisfying thing for me right now	5.57	1.45	High
6	The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade	5.00	1.80	Slightly high
7	If I can, I want to get better grades in this class than most of the other students	4.57	1.70	Slightly high
8	I want to do well in this class because it is important to show my ability to my family, friends, employer, or others	5.21	1.63	Slightly high
	Overall (Extrinsic goal orientation)	5.09	1.65	Slightly high
	Task value			
9	I think I will be able to use what I learn in this course in other courses	4.43	1.34	Moderate
10	It is important for me to learn the course material in this class	4.93	1.54	Slightly high

(continued)

(continued)

Item No.	Item statement	*M*	*SD*	Interpretation
11	I am very interested in the content area of this course	3.86	1.70	Moderate
12	I think the course material in this class is useful for me to learn	4.71	1.33	Slightly high
13	I like the subject matter of this course	4.43	1.60	Moderate
14	Understanding the subject matter of this course is very important to me	5.43	1.34	Slightly high
	Overall (Task value)	4.63	1.48	Slightly high
Overall (Motivation for learning in Mathematics class)		4.79	1.56	Slightly high

According to the mean scores of the items comprising the intrinsic goal orientation subscale of the Mathematics Motivated Strategies for Learning Questionnaire, Grade 7 students' insights on Item 1, Item 2, and Item 3 were interpreted as slightly high (e.g., "In Mathematics class, I prefer course material that really challenges me so I can learn new things" [Item 1], and "In Mathematics class, I prefer course material that arouses my curiosity, even if it is difficult to learn" [Item 2]"). On the other hand, students' perceptions on Item 4 ("When I have the opportunity in this class, I chose course assignments that I can learn from even if they don't guarantee a good grade") were interpreted as moderate.

According to the mean scores of the items comprising the extrinsic goal orientation subscale of the Mathematics Motivated Strategies for Learning Questionnaire, Grade 7 students' insight on Item 5 ("Getting a good grade in this class is the most satisfying thing for me right now") was interpreted as high, while their insights on Item 6, Item 7, and Item 8 were interpreted as slightly high (e.g., "The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade" [Item 6], and "I want to do well in this class because it is important to show my ability to my family, friends, employer, or others" [Item 8]).

According to the mean scores of the items comprising the task value subscale of the Mathematics Motivated Strategies for Learning Questionnaire, Grade 7 students' insights on

Item 10, Item 12, and Item 14 were interpreted as slightly high (e.g., “It is important for me to learn the course material in this class” [Item 10], and “I think the course material in this class is useful for me to learn” [Item 12]). On the other hand, Item 9, Item 11, and Item 13 were interpreted as moderate (e.g., “I am very interested in the content area of this course” [Item 11], and “I like the subject matter of this course” [Item 13]).

Grade 8

Table 10 depicts the mean scores, standard deviations, and interpretations for the motivation for learning in Mathematics class held by Grade 8 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Table 10

Mean Scores, Standard Deviations, and Interpretations for the Motivation for Learning in Mathematics Class Held by Grade 8 Students at the Demonstration School of Ramkhamhaeng University, Bangkok

Item No.	Item statement	*M*	*SD*	Interpretation
	Intrinsic goal orientation			
1	In Mathematics class, I prefer course material that really challenges me so I can learn new things	4.23	1.55	Moderate
2	In Mathematics class, I prefer course material that arouses my curiosity, even if it is difficult to learn	3.73	1.41	Moderate
3	The most satisfying thing for me in this class is trying to understand the content as thoroughly as possible	4.57	1.63	Slightly high
4	When I have the opportunity in this class, I chose course assignments that I can learn from even if they don't guarantee a good grade	3.97	1.35	Moderate
	Overall (Intrinsic goal orientation)	4.13	1.49	Moderate
	Extrinsic goal orientation			
5	Getting a good grade in this class is the most satisfying thing for me right now	4.90	1.61	Slightly high

(continued)

(continued)

Item No.	Item statement	*M*	*SD*	Interpretation
6	The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade	5.03	1.59	Slightly high
7	If I can, I want to get better grades in this class than most of the other students	4.53	1.68	Slightly high
8	I want to do well in this class because it is important to show my ability to my family, friends, employer, or others	5.07	1.57	Slightly high
	Overall (Extrinsic goal orientation)	4.88	1.61	Slightly high
	Task value			
9	I think I will be able to use what I learn in this course in other courses	3.90	1.51	Moderate
10	It is important for me to learn the course material in this class	4.27	1.29	Moderate
11	I am very interested in the content area of this course	3.80	1.52	Moderate
12	I think the course material in this class is useful for me to learn	3.93	1.51	Moderate
13	I like the subject matter of this course	3.93	1.53	Moderate
14	Understanding the subject matter of this course is very important to me	4.53	1.57	Slightly high
	Overall (Task value)	4.06	1.49	Moderate
Overall (Motivation for learning in Mathematics class)		4.31	1.53	Moderate

According to the mean scores of the items comprising the intrinsic goal orientation subscale of the Mathematics Motivated Strategies for Learning Questionnaire, Grade 8 students' insight on Item 3 was interpreted as slightly high ("The most satisfying thing for me in this class is trying to understand the content as thoroughly as possible". On the other hand, students' perceptions on Item 1, Item 2, and Item 4 were interpreted as moderate (e.g., "In Mathematics class, I prefer course material that really challenges me so I can learn new things" [Item 1], and "In Mathematics class, I prefer course material that arouses my curiosity, even if it is difficult to learn" [Item 2]).

According to the mean scores of the items comprising the extrinsic goal orientation subscale of the Mathematics Motivated Strategies for Learning Questionnaire, Grade 8 students' insights on Item 5, Item 6, Item 7, and Item 8 were interpreted as slightly high (e.g., "Getting a good grade in this class is the most satisfying thing for me right now" [Item 5], and "The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade" [Item 6]).

According to the mean scores of the items comprising the task value subscale of the Mathematics Motivated Strategies for Learning Questionnaire, Grade 8 students' insight on Item 14 ("Understanding the subject matter of this course is very important to me") was interpreted as slightly high. On the other hand, Item 9, Item 10, Item 11, Item 12, and Item 13 were interpreted as moderate (e.g., "I am very interested in the content area of this course" [Item 11], and "I like the subject matter of this course" [Item 13]).

Grade 9

Table 11 depicts the mean scores, standard deviations, and interpretations for the motivation for learning in Mathematics class held by Grade 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Table 11

Mean Scores, Standard Deviations, and Interpretations for the Motivation for Learning in Mathematics Class Held by Grade 9 Students at the Demonstration School of Ramkhamhaeng University, Bangkok

Item No.	Item statement	*M*	*SD*	Interpretation
	Intrinsic goal orientation			
1	In Mathematics class, I prefer course material that really challenges me so I can learn new things	4.27	1.27	Moderate
2	In Mathematics class, I prefer course material that arouses my curiosity, even if it is difficult to learn	4.27	1.10	Moderate
3	The most satisfying thing for me in this class is trying to understand the content as thoroughly as possible	4.82	1.25	Slightly high

(continued)

(continued)

Item No.	Item statement	*M*	*SD*	Interpretation
4	When I have the opportunity in this class, I chose course assignments that I can learn from even if they don't guarantee a good grade	3.45	1.70	Slightly low
	Overall (Intrinsic goal orientation)	4.21	1.35	Moderate
	Extrinsic goal orientation			
5	Getting a good grade in this class is the most satisfying thing for me right now	5.27	1.56	High
6	The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade	6.27	.65	High
7	If I can, I want to get better grades in this class than most of the other students	5.36	.92	Slightly high
8	I want to do well in this class because it is important to show my ability to my family, friends, employer, or others	4.91	1.87	Slightly high
	Overall (Extrinsic goal orientation)	5.46	1.34	Slightly high
	Task value			
9	I think I will be able to use what I learn in this course in other courses	4.64	1.03	Slightly high
10	It is important for me to learn the course material in this class	4.91	1.14	Slightly high
11	I am very interested in the content area of this course	3.45	1.13	Slightly low
12	I think the course material in this class is useful for me to learn	4.18	.98	Moderate
13	I like the subject matter of this course	3.36	.92	Slightly low
14	Understanding the subject matter of this course is very important to me	5.27	1.19	Slightly high
	Overall (Task value)	4.30	1.07	Moderate
Overall (Motivation for learning in Mathematics class)		4.60	1.23	Slightly high

According to the mean scores of the items comprising the intrinsic goal orientation subscale of the Mathematics Motivated Strategies for Learning Questionnaire, Grade 9 students' insight on Item 3 (“The most satisfying thing for me in this class is trying to understand the content as thoroughly as possible”) was interpreted as slightly high. On the other hand, students' perceptions on Item 1, Item 2 were interpreted as moderate (e.g., “In

Mathematics class, I prefer course material that really challenges me so I can learn new things" [Item 1], and "In Mathematics class, I prefer course material that arouses my curiosity, even if it is difficult to learn" [Item 2]), while Item 4 ("When I have the opportunity in this class, I chose course assignments that I can learn from even if they don't guarantee a good grade") was interpreted as slightly low.

According to the mean scores of the items comprising the extrinsic goal orientation subscale of the Mathematics Motivated Strategies for Learning Questionnaire, Grade 9 students' insights on Item 5 and Item 6 were interpreted as high (e.g., "Getting a good grade in this class is the most satisfying thing for me right now" [Item 5], and "The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade" [Item 6]), while Item 7 and Item 8 were interpreted as slightly high (e.g., "If I can, I want to get better grades in this class than most of the other students" [Item 7], and "I want to do well in this class because it is important to show my ability to my family, friends, employer, or others" [Item 8]).

According to the mean scores of the items comprising the task value subscale of the Mathematics Motivated Strategies for Learning Questionnaire, Grade 9 students' insights on Item 9, Item 10, and Item 14 were interpreted as slightly high (e.g., "It is important for me to learn the course material in this class" [Item 10], and "Understanding the subject matter of this course is very important to me" [Item 14]). On the other hand, Item 12 ("I think the course material in this class is useful for me to learn") was interpreted as moderate, whereas Item 11 and Item 13 were interpreted as slightly low ("I am very interested in the content area of this course" [Item 11] and "I like the subject matter of this course" [Item 13]).

Findings From Research Objective 2

Research Objective 2 was to determine the levels of cognitive engagement in

Mathematics class held by Grades 7, 8 and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. In order to determine the level of cognitive engagement in Mathematics of the target students, the SEMCS (see Appendix B) was used as an instrument. The SEMCS is structured in the three subscales identified by Kong et al. (2003): surface strategy (7 items), deep strategy (7 items), and reliance (7 items). Thus, there are totally 21 items in this questionnaire using a 5-point Likert scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*).

Table 12 displays the overall mean scores, standard deviations, and interpretations for the cognitive engagement in Mathematics class held by Grades 7, 8 and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. Details regarding the information shown in Table 12 are shown in Table 13 for Grade 7, Table 14 for Grade 8, and Table 15 for Grade 9.

Table 12

Mean Scores, Standard Deviations, and Interpretations for the Cognitive Engagement in Mathematics Class Held by Grades 7, 8 and 9 Students at the Demonstration School of Ramkhamhaeng University, Bangkok

Variable	Grade 7			Grade 8			Grade 9		
	M	*SD*	*I*	*M*	*SD*	*I*	*M*	*SD*	*I*
Cognitive engagement in Mathematics class	3.42	1.00	M	3.14	.94	M	3.26	.91	M
Surface strategy	3.34	.96	M	2.98	.90	M	3.44	.86	M
Deep strategy	3.51	1.04	H	3.13	.98	M	3.07	.89	M
Reliance	3.37	.98	M	3.36	1.01	M	3.36	1.01	M

Note. See Table 4 (p. 37) for the interpretation table. *I* stands for "Interpretation"; *M* stands for "Moderate"; *H* stands for "High".

For Grade 7, the results from Table 12 show that the level of students' cognitive engagement in Mathematics class by a surface strategy approach had a mean score of *M* =

3.34 (*SD* = .96), which was interpreted as moderate. Moreover, the findings also reviewed the level of students' cognitive engagement in Mathematics class by a deep strategy had a mean score of *M* = 3.51 (*SD* = 1.04), which was interpreted as high. Meanwhile, the results also show that students had a moderate level of cognitive engagement in Mathematics class by reliance, with a mean score of *M* = 3.37 (*SD* = .98). Finally, Table 12 shows that the overall cognitive engagement in Mathematics class of Grade 7 students at the target school was moderate, because the overall mean score of the questionnaire was *M* = 3.42 (*SD* = 1.00).

For Grade 8, the results from Table 12 show that the level of students' cognitive engagement in Mathematics class by surface strategy had a mean score of *M* = 2.98 (*SD* = 0.90), which was interpreted as moderate. Moreover, the findings also reviewed the level of students' cognitive engagement in Mathematics class by deep strategy had a mean score of *M* = 3.13 (*SD* = .98), that was interpreted as moderate. Meanwhile, the results also show that students had moderate level of cognitive engagement in Mathematics class by reliance, with a mean score of *M* = 3.36 (*SD* = 1.01). Therefore, Table 12 shows that the overall cognitive engagement in Mathematics class of Grade 8 students at the target school was moderate because the overall mean score of the questionnaire was *M* = 3.14 (*SD* = .94).

For Grade 9, the results from Table 12 show that the level of students' cognitive engagement in Mathematics class by surface strategy had a mean score of *M* = 3.44 (*SD* = .86), which was interpreted as moderate. Moreover, the findings also reviewed the level of students' cognitive engagement in Mathematics class by deep strategy had a mean score of *M* = 3.07 (*SD* = .89), which was interpreted as moderate. Meanwhile, the results also show that students had moderate level of cognitive engagement in Mathematics class by reliance, with a mean score of *M* = 3.36 (*SD* = 1.01). Therefore, Table 12 shows that the overall cognitive engagement in Mathematics class of Grade 9 students at the target school was moderate because the overall mean score of the questionnaire was *M* = 3.26 (*SD* = .91).

For the purpose of presenting in detail the findings from Research Objective 2, this section was broken down into three sub-sections, according to the participants' grade. In the following subsections, cognitive engagement in Mathematics class is reported in detail, by focusing on its three subscales: surface strategy, deep strategy, and reliance.

Grade 7

Table 13 depicts the mean scores, standard deviations, and interpretations for the cognitive engagement in Mathematics class held by Grade 7 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Table 13

Mean Scores, Standard Deviations, and Interpretations for the Cognitive Engagement in Mathematics Class Held by Grade 7 Students at the Demonstration School of Ramkhamhaeng University, Bangkok

Item No.	Item statement	*M*	*SD*	Interpretation
	Surface strategy			
1	I find memorizing formulas is the best way to learn mathematics	3.07	.62	Moderate
2	In learning mathematics, I prefer memorizing all the necessary formulas rather than understanding the principles behind them	3.00	1.04	Moderate
3	I think memorizing the facts and details of a topic is better than understanding it holistically	3.21	.89	Moderate
4	In mathematics learning, it is very useful to memorize the methods for solving word problems	3.79	.98	High
5	In mathematics learning, I prefer memorizing different methods of solution; this is a very effective way of learning	3.57	1.09	High
6	I think the best way of learning mathematics is to memorize facts by repeatedly working on mathematics problems	4.07	.73	High

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Item No.	Item statement	*M*	*SD*	Interpretation
7	I think memorizing mathematics is more effective than understanding it	2.64	1.22	Moderate
	Overall (Surface strategy)	3.34	.96	Moderate
	Deep strategy			
8	When I learn mathematics, I would wonder how much the things I have learnt can be applied to real life	4.07	.83	High
9	When I learn new things, I would think about what I have already learnt and try to get a new understanding of what I know	3.50	1.10	High
10	When I read mathematics textbook, I would try to pick out those things which should be thoroughly understood rather than just reading the text through	3.79	.80	High
11	I would try to connect what I learned in mathematics with what I encounter in real life or in other subjects	3.57	1.16	High
12	I would spend out-of-class time to deepen my understanding of the interesting aspects of mathematics	3.07	.92	Moderate
13	In learning mathematics, I always try to pose questions to myself and these questions would help me understand the core of mathematics	3.64	.75	High
14	I would use my spare time to study the topics we have discussed in class	2.93	1.07	Moderate
15	The best way to learn mathematics is to follow the teacher's instructions	3.71	1.33	High
16	The most effective way to learn mathematics is to follow the teacher's instructions	3.29	1.27	Moderate
	Overall (Deep strategy)	3.51	1.04	High
	Reliance			
17	I would learn what the teacher teaches	3.64	.93	High
18	I would learn in the way the teacher instructs me	3.57	.76	High
19	I would solve problems in the same way as the teacher does	3.00	1.11	Moderate
20	I solve problems according to what the teacher teaches	3.43	1.09	Moderate

(continued)

(continued)

Item No.	Item statement	*M*	*SD*	Interpretation
21	In learning mathematics, no matter what the teachers says, I will follow accordingly	3.21	.98	Moderate
	Overall (Reliance)	3.37	.98	Moderate
Overall (Cognitive engagement in Mathematics class)		3.42	1.00	Moderate

According to the mean scores of the items comprising the surface strategy subscale of the Student Engagement in Mathematics Classroom Scale, Grade 7 students' insights on Item 4, Item 5, and Item 6 were interpreted as high (e.g., "In mathematics learning, it is very useful to memorize the methods for solving word problems" [Item 4], and "In mathematics learning, I prefer memorizing different methods of solution; this is a very effective way of learning" [Item 5]). On the other hand, students' perceptions on Item 1, Item 2, Item 3, Item 7 were interpreted as moderate (e.g., "I think memorizing the facts and details of a topic is better than understanding it holistically" [Item 3], and "I think memorizing mathematics is more effective than understanding it" [Item 7]).

According to the mean scores of the items comprising the deep strategy subscale of the SEMCS, Grade 7 students' insights on Item 8, Item 9, Item 10, Item 11, and Item 13 were interpreted as high (e.g., "When I learn mathematics, I would wonder how much the things I have learnt can be applied to real life" [Item 8], and "When I read mathematics textbook, I would try to pick out those things which should be thoroughly understood rather than just reading the text through" [Item 10]), while Item 12, Item 14, and Item 16 were interpreted as moderate (e.g., "I would spend out-of-class time to deepen my understanding of the interesting aspects of mathematics" [Item 12], and "I would use my spare time to study the topics we have discussed in class" [Item 14]).

According to the mean scores of the items comprising the reliance subscale of the Student Engagement in Mathematics Classroom Scale Questionnaire, Grade 7 students' insights on Item 17 and Item 18 were interpreted as high (e.g., “I would learn what the teacher teaches” [Item 17], and “I would learn in the way the teacher instructs me” [Item 18]). On the other hand, Item 19, Item 20, and Item 21 were interpreted as moderate (e.g., “I would solve problems in the same way as the teacher does” [Item 19], and “In learning mathematics, no matter what the teachers says, I will follow accordingly” [Item 21]).

Grade 8

Table 14 depicts the mean scores, standard deviations, and interpretations for the cognitive engagement in Mathematics class held by Grade 8 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Table 14

Mean Scores, Standard Deviations, and Interpretations for the Cognitive Engagement in Mathematics Class Held by Grade 8 Students at the Demonstration School of Ramkhamhaeng University, Bangkok

Item No.	Item statement	*M*	*SD*	Interpretation
	Surface strategy			
1	I find memorizing formulas is the best way to learn mathematics	3.23	.82	Moderate
2	In learning mathematics, I prefer memorizing all the necessary formulas rather than understanding the principles behind them	2.63	.96	Moderate
3	I think memorizing the facts and details of a topic is better than understanding it holistically	2.63	1.00	Moderate
4	In mathematics learning, it is very useful to memorize the methods for solving word problems	3.13	.78	Moderate
5	In mathematics learning, I prefer memorizing different methods of solution; this is a very effective way of learning	3.17	.79	Moderate
6	I think the best way of learning mathematics is to memorize facts by repeatedly working on mathematics problems	3.63	1.00	High

(continued)

(continued)

Item No.	Item statement	*M*	*SD*	Interpretation
7	I think memorizing mathematics is more effective than understanding it	2.40	.93	Low
	Overall (Surface strategy)	2.98	.90	Moderate
	Deep strategy			
8	When I learn mathematics, I would wonder how much the things I have learnt can be applied to real life	3.37	1.13	Moderate
9	When I learn new things, I would think about what I have already learnt and try to get a new understanding of what I know	3.27	.91	Moderate
10	When I read mathematics textbook, I would try to pick out those things which should be thoroughly understood rather than just reading the text through	3.07	.87	Moderate
11	I would try to connect what I learned in mathematics with what I encounter in real life or in other subjects	3.13	.78	Moderate
12	I would spend out-of-class time to deepen my understanding of the interesting aspects of mathematics	2.73	.91	Moderate
13	In learning mathematics, I always try to pose questions to myself and these questions would help me understand the core of mathematics	3.13	1.01	Moderate
14	I would use my spare time to study the topics we have discussed in class	2.70	1.15	Moderate
15	The best way to learn mathematics is to follow the teacher's instructions	3.50	.94	High
16	The most effective way to learn mathematics is to follow the teacher's instructions	3.30	1.06	Moderate
	Overall (Deep strategy)	3.13	.98	Moderate
	Reliance			
17	I would learn what the teacher teaches	3.45	.82	Moderate
18	I would learn in the way the teacher instructs me	3.27	1.01	Moderate
19	I would solve problems in the same way as the teacher does	3.36	1.21	Moderate
20	I solve problems according to what the teacher teaches	3.64	.92	High

(continued)

(continued)

Item No.	Item statement	*M*	*SD*	Interpretation
21	In learning mathematics, no matter what the teachers says, I will follow accordingly	3.09	1.04	Moderate
	Overall (Reliance)	3.36	1.01	Moderate
Overall (Cognitive engagement in Mathematics class)		3.14	.94	Moderate

According to the mean scores of the items comprising the surface strategy subscale of the Student Engagement in Mathematics Classroom Scale, Grade 8 students' insight on Item 6 was interpreted as high (e.g., "I think the best way of learning mathematics is to memorize facts by repeatedly working on mathematics problems" [Item 6]. On the other hand, students' perceptions on Item 1, Item 2, Item 3, Item 4, and Item 5 were interpreted as moderate (e.g., "I think memorizing the facts and details of a topic is better than understanding it holistically" [Item 3], and "In mathematics learning, I prefer memorizing different methods of solution; this is a very effective way of learning" [Item 5]), while Item 7 ("I think memorizing mathematics is more effective than understanding it") was interpreted as low.

According to the mean scores of the items comprising the deep strategy subscale of the SEMCS, Grade 8 students' insight on Item 15 ("The best way to learn mathematics is to follow the teacher's instructions") was interpreted as high, while Item 8, Item 9, Item 10, Item 11, Item 12, Item 13, Item 14, and Item 16 were interpreted as moderate (e.g., "When I learn mathematics, I would wonder how much the things I have learnt can be applied to real life" [Item 8], and "When I read mathematics textbook, I would try to pick out those things which should be thoroughly understood rather than just reading the text through" [Item 10]).

According to the mean scores of the items comprising the reliance subscale of the Student Engagement in Mathematics Classroom Scale Questionnaire, Grade 8 students' insight on Item 20 ("I solve problems according to what the teacher teaches") was interpreted as high. On the other hand, Item 17, Item 18, Item 19, and Item 21 were interpreted as moderate (e.g., "I would solve problems in the same way as the teacher does" [Item 19], and "In learning mathematics, no matter what the teachers says, I will follow accordingly" [Item 21]).

Grade 9

Table 15 depicts the mean scores, standard deviations, and interpretations for the cognitive engagement in Mathematics class held by Grade 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Table 15

Mean Scores, Standard Deviations, and Interpretations for the Cognitive Engagement in Mathematics Class Held by Grade 9 Students at the Demonstration School of Ramkhamhaeng University, Bangkok

Item No.	Item statement	*M*	*SD*	Interpretation
	Surface strategy			
1	I find memorizing formulas is the best way to learn mathematics	3.73	.47	High
2	In learning mathematics, I prefer memorizing all the necessary formulas rather than understanding the principles behind them	3.36	.92	Moderate
3	I think memorizing the facts and details of a topic is better than understanding it holistically	3.55	.93	High
4	In mathematics learning, it is very useful to memorize the methods for solving word problems	4.27	.79	High
5	In mathematics learning, I prefer memorizing different methods of solution; this is a very effective way of learning	3.82	.75	High
6	I think the best way of learning mathematics is to memorize facts by repeatedly working on mathematics problems	3.00	1.10	Moderate
7	I think memorizing mathematics is more effective than understanding it	2.36	.92	Low
	Overall (Surface strategy)	3.44	.86	Moderate

(continued)

(continued)

Item No.	Item statement	*M*	*SD*	Interpretation
	Deep strategy			
8	When I learn mathematics, I would wonder how much the things I have learnt can be applied to real life	3.73	1.01	High
9	When I learn new things, I would think about what I have already learnt and try to get a new understanding of what I know	3.73	.65	High
10	When I read mathematics textbook, I would try to pick out those things which should be thoroughly understood rather than just reading the text through	3.82	.75	High
11	I would try to connect what I learned in mathematics with what I encounter in real life or in other subjects	3.09	1.04	Moderate
12	I would spend out-of-class time to deepen my understanding of the interesting aspects of mathematics	2.09	.94	Low
13	In learning mathematics, I always try to pose questions to myself and these questions would help me understand the core of mathematics	2.55	.82	Moderate
14	I would use my spare time to study the topics we have discussed in class	2.18	.87	Low
15	The best way to learn mathematics is to follow the teacher's instructions	3.36	.92	Moderate
16	The most effective way to learn mathematics is to follow the teacher's instructions	3.09	.94	Moderate
	Overall (Deep strategy)	3.07	.89	Moderate
	Reliance			
17	I would learn what the teacher teaches	3.45	.82	High
18	I would learn in the way the teacher instructs me	3.27	1.01	Slightly high
19	I would solve problems in the same way as the teacher does	3.36	1.21	High
20	I solve problems according to what the teacher teaches	3.64	.92	High
21	In learning mathematics, no matter what the teachers says, I will follow accordingly	3.09	1.04	High
	Overall (Reliance)	3.36	1.01	Moderate
Overall (Cognitive engagement in Mathematics class)		3.26	.91	Moderate

According to the mean scores of the items comprising the surface strategy subscale of the Student Engagement in Mathematics Classroom Scale, Grade 9 students' insights on Item 1, Item 3, Item 4, Item 5 were interpreted as high (e.g., “I think memorizing the facts and details of a topic is better than understanding it holistically” [Item 3], and “In mathematics learning, I prefer memorizing different methods of solution; this is a very effective way of learning” [Item 5]). On the other hand, students' perceptions on Item 2 and Item 6 were interpreted as moderate (e.g., “I think the best way of learning mathematics is to memorize facts by repeatedly working on mathematics problems” [Item 6]), while Item 7 (“I think memorizing mathematics is more effective than understanding it”) was interpreted as low.

According to the mean scores of the items comprising the deep strategy subscale of the SEMCS, Grade 9 students' insights on Item 8, Item 9, and Item 10 were interpreted as high (e.g., “When I learn new things, I would think about what I have already learnt and try to get a new understanding of what I know” [Item 9]), and “When I read mathematics textbook, I would try to pick out those things which should be thoroughly understood rather than just reading the text through” [Item 10]). On the other hand, Item 11, Item 13, Item 15, and Item 16 were interpreted as moderate (e.g., “In learning mathematics, I always try to pose questions to myself and these questions would help me understand the core of mathematics” [Item 13], and “The best way to learn mathematics is to follow the teacher’s instructions” [Item 15]). Moreover, Item 12 (“I would spend out-of-class time to deepen my understanding of the interesting aspects of mathematics”), and Item 14 (“I would use my spare time to study the topics we have discussed in class”) were interpreted as low.

According to the mean scores of the items comprising the reliance subscale of the Student Engagement in Mathematics Classroom Scale Questionnaire, Grade 9 students' insights on Item 17, Item 19, Item 20, and Item 21 were interpreted as high (e.g., “I would solve problems in the same way as the teacher does” [Item 19], and “In learning mathematics, no matter what the teachers says, I will follow accordingly" [Item 21]). On the other hand, Item 18 ("I would learn in the way the teacher instructs me") was interpreted as slightly high.

Findings From Research Objective 3

Research Objective 3 was to determine whether there was a significant difference in motivation for learning in Mathematics class, in terms of intrinsic goal orientation, extrinsic goal orientation, and task value of Grades 7, 8, and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. In order to address Research Objective 3 and compare the motivation for learning in Mathematics class among the three target grades, a one-way analysis of variance (ANOVA) was implemented. In a one-way ANOVA test, two or more groups or experimental conditions are compared simultaneously for their statistical equality on one dependent variable.

Table 16 presents the results obtained from performing the one-way ANOVA test on the collected data.

Table 16

Results of the One-Way ANOVA Test Comparing Grades 7, 8, and 9 Students' Motivation for Learning in Mathematics Class at the Demonstration School of Ramkhamhaeng University, Bangkok

Grade	*N*	*M*	*SD*	*dfs*		*F*	*p*
				Between groups	Within groups		
7	14	4.79	1.56	2	52	1.51	.230
8	30	4.31	1.53				
9	11	4.60	1.23				

Note. The significance level of the test was set at .05 (two-tailed).

According to Table 16, the data shows that the significance value was p = .230, which means that there was no statistically significant difference in motivation for learning

Mathematics among these three grades because the *p*-value was higher than the significance level of .05; $p = .230$. Therefore, it can be concluded that there was no statistically difference in motivation for learning Mathematics among Grades 7 ($M = 4.79$, $SD = 1.56$), Grade 8 ($M = 4.31$, $SD = 1.53$), and Grade 9 ($M = 4.60$, $SD = 1.23$) students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Findings From Research Objective 4

Research Objective 4 was to determine whether there was a significant difference in cognitive engagement in Mathematics class, in terms of surface strategy, deep strategy, and reliance of Grades 7, 8, and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. In order to address Research Objective 4 and compare the cognitive engagement in Mathematics class among the three target grades, a one-way analysis of variance (ANOVA) was implemented. In a one-way ANOVA test, two or more groups or experimental conditions are compared simultaneously for their statistical equality on one dependent variable.

Table 17 presents the results obtained from performing the one-way ANOVA test on the collected data.

Table 17

Results of the One-Way ANOVA Test Comparing Grades 7, 8, and 9 Students' Cognitive Engagement in Mathematics Class at the Demonstration School of Ramkhamhaeng University, Bangkok

Grade	*N*	*M*	*SD*	*dfs*		*F*	*p*
				Between groups	Within groups		
7	14	3.42	1.00	2	52	1.88	.163
8	30	3.14	.94				
9	11	3.26	.91				

Note. The significance level of the test was set at .05 (two-tailed).

According to Table 17, the data shows that the significance value was *p* = .163, which means that there was no statistically significant difference in cognitive engagement in Mathematics class among these three grades because the *p*-value was higher than the significance level of .05; *p* = .163. Therefore, it can be concluded that there was no statistically difference in motivation for learning Mathematics among Grades 7 (*M* = 3.42, *SD* = 1.00), Grade 8 (*M* = 3.14, *SD* = .94), and Grade 9 (*M* = 3.26, *SD* = .91) students at the Demonstration School of Ramkhamhaeng University, Bangkok.

CHAPTER V

CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

In the previous chapter, the researcher presented the research findings of this comparative study of Grades 7, 8, and 9 students' motivation for learning and cognitive engagement in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok. In this chapter, the researcher presents a summary of the study, a summary of the findings, conclusions, discussion, and recommendation for teachers, students, school administrators and future researchers.

Summary of the Study

The major purpose of this study was to determine whether there was a significant difference in both motivation for learning and cognitive engagement in Mathematics class among Grades 7, 8, and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. In order to achieve this purpose, a quantitative comparative research design was adapted for this study.

The sample of participants for this study was comprised of a population sample of 55 students (14 students from Grade 7, 30 students from Grade 8, and 11 students from Grade 9) enrolled in the Demonstration School of Ramkhamhaeng University, Bangkok, during the academic year 2022-2023.

The following were the research objectives of this study,

1. To determine the levels of Grades 7-9 students' motivation for learning in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok.

2. To determine the levels of Grades 7-9 students' cognitive engagement in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok.

3. To determine whether there is a significant difference in motivation for learning in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

4. To determine whether there is a significant difference in cognitive engagement in Mathematics class among Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

The following research instruments were used in this study in May 2022 to collect data from the participants: (a) the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ; Pintrich et al., 1991) was adapted and administered to measure the levels of students' motivation for learning in Mathematics class, and (b) the Student Engagement in Mathematics Classroom Scale (SEMCS; Kong et al., 2003) was adopted and administered to measure the levels of cognitive engagement in Mathematics class. With the support of a statistical software package, the researcher performed on the collected data descriptive statistics (means and standard deviations) in order to determine the levels of the research variables being addressed in this study, and comparative analysis (using a one-way ANOVA) in order to address this research's hypotheses.

Summary of the Findings

In this section the findings obtained from the qualitative analysis on the collected data. are summarized. The findings are organized and presented by research objective.

Findings From Research Objective 1

Regarding to this research objective, the following findings were obtained.

- The overall level of intrinsic goal orientation for learning in Mathematics class held by Grade 7 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was interpreted as slightly high, whereas it was interpreted as moderate for Grades 8 and 9 students at the target school.
- The overall level of extrinsic goal orientation for learning in Mathematics class held by Grades 7, 8 and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was interpreted as slightly high.
- The overall level of task value for learning in Mathematics class held by Grade 7 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was interpreted as slightly high, whereas it was interpreted as moderate for Grades 8 and 9 students at the target school.
- The overall level of motivation for learning in Mathematics class held by Grades 7 and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was interpreted as slightly high, whereas it was interpreted as moderate for Grade 8 students at the target school.

Findings From Research Objective 2

Regarding to this research objective, the following findings were obtained.

- The overall level of cognitive engagement in Mathematics class by surface strategy held by Grades 7, 8 and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was interpreted as moderate.
- The overall level of cognitive engagement in Mathematics class by deep strategy held by Grade 7, was interpreted as high, while it was interpreted moderate for Grades 8 and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.
- The overall level of cognitive engagement in Mathematics class by reliance held

by Grades 7, 8, and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was interpreted as moderate.

- The overall level of cognitive engagement in Mathematics class held by Grades 7, 8, and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was interpreted as moderate.

Findings From Research Objective 3

Regarding this research objective, the following finding was obtained.

- It was found that there was no significant difference in motivation for learning in Mathematics class among Grade 7, Grade 8 and Grade 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Findings From Research Objective 4

Regarding to this research objective, the following findings were obtained.

- It was found that there was no significant difference in cognitive engagement in Mathematics class among Grade 7, Grade 8 and Grade 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

Conclusions

In this section, the researcher presents the main conclusions drawn from the data analysis.

Conclusions From Research Objective 1

Regarding to this research objective, the following conclusions were obtained.

- The overall level of pursuing actions for learning in mathematics class held by Grade 7 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was slightly high, which might be because they are intrinsically enjoying or enjoyable. Whereas it was interpreted as moderate level of motivation that derives mostly from the inside for Grades 8 and 9.

- The overall level of concern regarding grades, rewards and ambition to exercise more in order to look good in front others in Mathematics class held by Grades 7, 8 and 9 students at the Demonstration School of Ramkhamhaeng University, was slightly high.
- The overall level of evaluation of how interesting, how important, and how useful an instructional task in Mathematics class held by Grade 7, was interpreted as slightly high, whereas it was interpreted as moderate for Grades 8 and 9 students at the target school.
- The overall level of efforts to achieve academic success in Mathematics class held by Grades 7and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was slightly high, whereas it was interpreted as moderate for Grade 8 students at the target school.

Conclusions From Research Objective 2

Regarding to this research objective, the following conclusions were obtained.

- The overall level of focus on lower-order cognitive skills in Mathematics class, such as memorizing facts, rather than understanding skills, such as analysis, synthesis, and evaluation, held by Grades 7, 8 and 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, was moderate.
- The overall level of cognitive participation in learning activities as well as mental energy invested in Mathematics class held by Grade 7 students was high. While it was moderate for Grades 8, 9 students at the target school.
- The overall level of belief in the teachers and parents' directions regarding Mathematics class held by Grades 7, 8 and 9 was moderate. In other words, students' degree to which they believed in trusting and following the instructions

of teachers and parents rather than understanding the core of mathematics, was moderate.

- The overall level of engagement of mental resources, psychological feature structures to the memorization, practicing, and preparing for tests, learning material, process the follows mathematics procedures, and exploitation of metacognitive methods to confirm learning in Mathematics class held by Grades 7, 8 and 9 was moderate at the Demonstration School of Ramkhamhaeng University, Bangkok.

Conclusions From Research Objective 3

Regarding to this research objective, the following conclusion was obtained.

- It was found that there was no significant difference in motivation for learning in Mathematics class among Grade 7, Grade 8 and Grade 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. Therefore, the grade in which these students were enrolled in appears to have no significant effect on their motivation for learning in Mathematics class.

Conclusions From Research Objective 4

Regarding to this research objective, the following conclusion was obtained.

- It was found that there was no significant difference in cognitive engagement in Mathematics class among Grade 7, Grade 8 and Grade 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. Therefore, the grade in which these students were enrolled in appears to have no significant effect on their cognitive engagement in Mathematics class.

Discussion

In the following sections, a discussion of the research findings of the current study is provided, by relating them to the findings reported in previous research studies.

Motivation for Learning in Mathematics Class

The results of the current study revealed that the overall level of motivation for learning in Mathematics class went from slightly high in Grade 7 students, to moderate in Grade 8, and back again to slightly high in Grade 9. This was the result of an overall level of intrinsic goal orientation for learning in Mathematics class that went from slightly high in Grade 7 students, to moderate in Grades 8 and 9, an overall level of extrinsic goal orientation for learning in Mathematics class that kept being slightly high across Grades 7 to 9, and an overall level of task value for learning in Mathematics class that went from slightly high in Grade 7 students, to moderate in Grades 8 and 9. As a mathematics teacher at the target school, the researcher believes that the reason for the moderate level of motivation for Grade 8 can apply to starting secondary school during the COVID-19 pandemic and having online mathematics classes, in which students demonstrated less involvement in mathematics classes. In this case, some students missed classes, and the consequences were moderate, as reported by the current study. These results are somehow similar to the ones reported by Lepper and Hodell (1989), who found that students' intrinsic motivation faded throughout their school progression on Grades 3 to 5 American students. These results are also similar to the ones obtained by Harter (1981), who found a decline in intrinsic motivation through Grades 3 to 9, and an increase in extrinsic motivation, across samples of American students from Grades 3 to 9 from New York, California, and Colorado.

In relation to the difference in motivation for learning in Mathematics class, the results obtained by Lepper and Hodell (1989) and Harter (1981) are not in line with the results obtained by the current study. This difference was not significant, and then the grade in which the participants of the current study were enrolled in appears to have no significant effect on their motivation for learning in Mathematics class. However, both Lepper and Hodell (1989) and Harter (1981) reported a significant decline in intrinsic motivation and increase in extrinsic motivation. No difference in motivation for learning in Mathematics class could indicate that students in Grades 7, 8, and 9 at the target school have similar perceptions of intrinsic and extrinsic goal orientations and task value in Mathematics class. As a result, regardless of their grade, they put in the same amount of effort to learn this subject (Pintrich et al., 1991). Another reason could be that, contrarily to the case of Harter (1981), the school culture at the target school does not reinforce a particular dimension of motivation for learning in Mathematics class more than other, and all are somehow consistently fostered throughout Grades 7 to 9. Finally, no difference in motivation for learning in Mathematics class may indicate that, besides the grade, there may be other important factors that affect motivation for learning in Mathematics class, and this demands a more specific investigation. Interviewing graduates using semi-structured or in-depth formats may provide us with greater insight on issues related this kind of motivation.

Cognitive Engagement in Mathematics Class

The results of the current study revealed that the overall level of cognitive engagement in Mathematics class held by the students participating in this study was consistently moderate across Grades 7, 8 and 9. The same occurred with the overall level of cognitive engagement in Mathematics class, by both surface strategy and reliance, held by the participants. However, the overall level of cognitive engagement in Mathematics class by deep strategy went from high in Grade 7 students, to moderate in Grades 8 and 9, and numerically decreased numerically across grades. This means that, in general, there is no preferred approach in the cognitive engagement in Mathematics class adopted by the participants, with the mean scores of the three dimensions of cognitive engagement in Mathematics class ranging from a lowest of 2.98 to a highest of 3.51, and a mean score of cognitive engagement in Mathematics class ranging from 3.14 to 3.42 across Grades 7, 8 and

9. These results are somehow similar to the ones reported by Mentari and Syarifuddin (2020), who found moderate levels of both surface strategy and deep strategy in the engagement in mathematics of 25 Grade 8 students from Padang, Indonesia, regardless of their learning method. This might be due to the provision of a similar instruction style at the target school across all grades, and then no particular changes in the engagement approach in Mathematics class is required from the students (Kong et al., 2003; Mentari & Syarifuddin, 2020).

The results of the current study are not in line with the ones reported by Shahrill and Wahid (2014), who found that the majority of pre-university students in Brunei Darussalam had a higher level of cognitive engagement in Mathematics class by surface strategy, in comparison with their levels of deep strategy and reliance. Also, the results from the current study are not in line with the ones reported by Akhtar and Batool (2020), who found that a moderate level of reliance and low levels of surface and deep strategies among 300 high school students from Punjab, Pakistan. Also, this study's findings are not in line with the ones reported by Mentari and Syarifuddin (2020), who found high levels of reliance in the engagement in mathematics of 25 Grade 8 students from Padang, Indonesia, regardless of their learning method.

In relation to the difference in the cognitive engagement in Mathematics class, no significant difference was found in cognitive engagement in Mathematics class among Grade 7, Grade 8 and Grade 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok. Therefore, the grade in which participants were enrolled in appears to have no significant effect on their cognitive engagement in Mathematics class. This might be due to the use a common instructional approach across Grades 7, 8 and 9 at the target school. In the study conducted by Mentari and Syarifuddin (2020), the use of contextual teaching and learning (CTL) against a traditional teaching approach increases the use of deep strategy and decreases the engagement by surface strategy in Mathematics class. Therefore, no significant difference in cognitive engagement in Mathematics class among Grade 7, Grade 8 and Grade 9 students at the target school could be interpreted as an indicator of a traditional teaching approach across Grades 7, 8 and 9.

Recommendations

The researcher would like to provide the following recommendations for students, teachers, school administrators and future researchers according to the findings of current study of Grades 7, 8, and 9 students' motivation for learning in Mathematics class and cognitive engagement in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok.

Recommendations for Students

Some items were rated slightly low by some of the participants (e.g., "When I have the opportunity in this class, I chose course assignments that I can learn from even if they don't guarantee a good grade" [Item 4], "I am very interested in the content area of this course" [Item 11], "I like the subject matter of this course" [Item 13]). Therefore, the researcher suggests that it is important for students to set high-performance expectations for themselves to be interested in the content area, or make social comparative judgments such as: comparing their academic performances to others, asking questions, and being prepared for the Mathematics class. It means when students evaluate their sense of competency based on peer performance and also experience an increased sense of autonomy, they are more likely to exhibit interest behaviors, such as more effort to get a good grade and persistence in this course (Schunk, 2001).

In addition, the findings of this study also indicated that Grade 7, Grade 8, and Grade 9 students at the Demonstration School of Ramkhamhaeng University, Bangkok, had a moderate level of cognitive engagement in Mathematics class. Grade 7 and 8 students had a high level of learning mathematics to memorize facts by repetition on mathematics problems. Besides, the best way to learn mathematics is to follow the teacher's instructions. While Grade 8 and 9 students had a low level of cognitive engagement ("I think memorizing mathematics is more effective than understanding it" [Item 7]). Also, Grade 9 students had a low level of cognitive engagement (e.g., "I would spend out-of-class time to deepen my understanding of the interesting aspects of mathematics" [Item 12], "I would use my spare time to study the topics we have discussed in class" [Item 14]). In this regard, the researcher suggests that students could take additional mathematical classes and engage in extracurricular activities that help them develop their analytical thinking. An effective mathematics curriculum may include multiple math activities that fit the mathematics criteria. Students can compare their performances with other classmates to allow them to develop cognitive skills such as deep understanding, goal setting, and self-confidence. Students should keep engaged in supplemental math courses and get the instruction materials. It can increase extracurricular activities for students, encourage them to participate and provide appropriate competition. They may spend out-of-class time to deepen their understanding of mathematics or use their spare time to study the discussed topic (Rajkumar & Hema, 2016).

Recommendations for Teachers

Teachers need to consider additional mathematics activities that can improve each students' motivation for learning and cognitive engagement in Mathematics class, which will have a positive impact in their academic performance. Teachers need to provide more opportunities for students to increase sense of competition and prepare preserve a positive learning environment. Besides, they have to install supplemental activities during class time to increase student's understanding. Teachers should also frequently organize students to form study groups or design competition to compete, help, discuss and explore problem solving together. Through competition, teachers motivate and engage the students to develop their abilities to seek problem solving. Green and Miller (1996) found that prospective teachers involving high goals is relevant to students' academic achievement and cognitive engagement. Also, Clarke (2001) presented activities that are linked to past knowledge are indicators of cognitive engagement. Then, by providing more interesting and motivating activities, teachers will contribute with an increase in their students’ cognitive engagement (Shahrill & Wahid, 2014).

Recommendations for School Administrators

It is also important for school administrators to schedule additional mathematics courses and supplemental activities to enhance students’ interest and further engagement to strengthen their math skills. School administrators have to help teachers to run the competition among students to perform better in the subject. School administrators should provide space, equipment, and resources to support students' motivation and engagement in mathematics learning, both individually and in groups.

Recommendations for Future Researchers

The current research was a quantitative comparative research designed to investigate the comparative study of Grades 7-9 students’ motivation for learning and cognitive engagement in Mathematics class at the Demonstration School of Ramkhamhaeng University, Bangkok. Data for this study were collected from Grades 7-9 students in only one school in Bangkok. Therefore, it is suggested that future researchers could examine larger samples, and even multiple schools, which would be more conducive to obtain more generalizable results in students’ motivation for learning and cognitive engagement in Mathematics class.

In terms of the research content, there are many factors that can influence motivation and cognitive engagement. Yoon (2009) found that the social-contextual relations have significant impact on students’ motivation, in middle and high school. Kiwanuka et al. (2016)

believed students' belief, worth and interest are the aspects influence motivation toward mathematics. Also, Sengodan and Iksan (2012) reported that students' levels of willingness and hard work are factors that have a significant influence on motivation in learning mathematics. Singh et al. (2002) stated that cultural causes shape people's attitudes toward mathematics. For example, parents' and teachers' attitudes toward mathematics, and in particular, their attitudes regarding children as math learners, have an impact on the children's own perceptions of their talents and interests. Finally, attitudes toward learning mathematics are influenced by their own experiences and expectations of success in these areas. It is suggested that future researchers can study and explore these factors affecting motivation for learning and cognitive engagement in Mathematics class in depth.

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APPENDICES

APPENDIX A

Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ)

Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ)

Grade: **Student ID:**

Instructions: Read the following items carefully and try to focus on mathematics class and circle only one number, either 1, 2, 3, 4, 5, 6 or 7, that better expresses HOW TRUE OF YOU THE ITEM IS (the best answer that describes you).

There are not right or wrong answers.

1. Not at all true of me.
2. Not true of me.
3. Somewhat not true of me.
4. Neither not true or true of me.
5. Somewhat true of me.
6. True of me.
7. Very true of me.

Items	Not at all true of me	Not true of me	Somewhat not true of me	Neither not true or true of me	Somewhat true of me	True of me	Very true of me
1. In Mathematics class, I prefer course material that really challenges me so I can learn new things.	1	2	3	4	5	6	7
2. In Mathematics class, I prefer course material that arouses my curiosity, even if it is difficult to learn.	1	2	3	4	5	6	7
3. The most satisfying thing for me in this class is trying to understand the content as thoroughly as possible.	1	2	3	4	5	6	7
4. When I have the opportunity in this class, I chose course assignments that I can learn from even if they don't guarantee a good grade.	1	2	3	4	5	6	7
5. Getting a good grade in this class is the most satisfying thing for me right now.	1	2	3	4	5	6	7
6. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.	1	2	3	4	5	6	7
7. If I can, I want to get better grades in this class than most of the other students.	1	2	3	4	5	6	7

Items	Not at all true of me	Not true of me	Somewhat not true of me	Neither not true or true of me	Somewhat true of me	True of me	Very true of me
8. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.	1	2	3	4	5	6	7
9. I think I will be able to use what I learn in this course in other courses.	1	2	3	4	5	6	7
10. It is important for me to learn the course material in this class.	1	2	3	4	5	6	7
11. I am very interested in the content area of this course.	1	2	3	4	5	6	7
12. I think the course material in this class is useful for me to learn.	1	2	3	4	5	6	7
13. I like the subject matter of this course.	1	2	3	4	5	6	7
14. Understanding the subject matter of this course is very important to me.	1	2	3	4	5	6	7

APPENDIX B

Student Engagement in Mathematics Classroom Scale (SEMCS)

Student Engagement in Mathematics Classroom Scale (SEMCS)

Grade: **Student ID:**

Instructions: Read the following items carefully and try to focus on mathematics class and circle only one number, either 1, 2, 3, 4, or 5, that better expresses HOW MUCH YOU AGREE OR DISAGREE WITH THE ITEM (the best answer that describes your agreement or disagreement with the item statement).

There are not right or wrong answers.

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. I find memorizing formulas is the best way to learn mathematics.	1	2	3	4	5
2. In learning mathematics, I prefer memorizing all the necessary formulas rather than understanding the principles behind them.	1	2	3	4	5
3. I think memorizing the facts and details of a topic is better than understanding it holistically.	1	2	3	4	5
4. In mathematics learning, it is very useful to memorize the methods for solving word problems.	1	2	3	4	5
5. In mathematics learning, I prefer memorizing different methods of solution; this is a very effective way of learning.	1	2	3	4	5
6. I think the best way of learning mathematics is to memorize facts by repeatedly working on mathematics problems.	1	2	3	4	5
7. I think memorizing mathematics is more effective than understanding it.	1	2	3	4	5
8. When I learn mathematics, I would wonder how much the things I have learnt can be applied to real life.	1	2	3	4	5
9. When I learn new things, I would think about what I have already learnt and try to get a new understanding of what I know.	1	2	3	4	5
10. When I read mathematics textbook, I would try to pick out those things which should be thoroughly understood rather than just reading the text through.	1	2	3	4	5

Items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
11. I would try to connect what I learned in mathematics with what I encounter in real life or in other subjects.	1	2	3	4	5
12. I would spend out-of-class time to deepen my understanding of the interesting aspects of mathematics.	1	2	3	4	5
13. In learning mathematics, I always try to pose questions to myself and these questions would help me understand the core of mathematics.	1	2	3	4	5
14. I would use my spare time to study the topics we have discussed in class.	1	2	3	4	5
15. The best way to learn mathematics is to follow the teacher's instructions.	1	2	3	4	5
16. The most effective way to learn mathematics is to follow the teacher's instructions.	1	2	3	4	5
17. I would learn what the teacher teaches.	1	2	3	4	5
18. I would learn in the way the teacher instructs me.	1	2	3	4	5
19. I would solve problems in the same way as the teacher does.	1	2	3	4	5
20. I solve problems according to what the teacher teaches.	1	2	3	4	5
21. In learning mathematics, no matter what the teachers says, I will follow accordingly.	1	2	3	4	5

BIOGRAPHY

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