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# A Comparative Study of Motivation for Learning and Cognitive Engagement in Mathematics Class Among Thai Lower Secondary Students

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## Abstract

**Purpose:** 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. **Research design, data and methodology:** A quantitative comparative research design was employed on 31 students from Grade 7, 14 students from Grade 8, and 21 students from Grade 9 enrolled in Mathematics class in the English Program during the academic year 2021-2022 at the target school. For the data collection, the Mathematics Motivated Strategies for Learning Questionnaire and the Student Engagement in Mathematics Classroom Scale were used. **Results:** The overall level of motivation for learning in Mathematics class held by Grades 7 and 9 students, was found to be slightly high, whereas it was found to be moderate for Grade 8 students at the target school. The overall level of cognitive engagement in Mathematics class held by Grades 7, 8, and 9 students, was moderate. Moreover, 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. **Conclusions:** The results indicate that being enrolled in either Grade 7, 8, or 9 at the target school appears to not have a statistical effect on the students' motivation for learning mathematics and cognitive engagement in Mathematics class.

Keywords: Cognitive Engagement, Motivation for Learning, Mathematics Education, Lower Secondary Students, Demonstration School

**JEL Classification Code**: C12, I20, I21, N35

## 1. Introduction[1112]

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).

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 the 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 extent of an individual's motivation (Kleinginna, 1981; Pintrich & De Groot, 1990).

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 et al., 2003). Furthermore, a student's degree of engagement is shaped by both the individual and the environment; hence, many elements in the school environment (e.g., interpersonal interactions, recognition) can help improve it (Fredricks et al., 2004).

From the first author's experience as a mathematics teacher at the Demonstration School of Ramkhamhaeng University, Bangkok, 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 are 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). According to the first author's observation, students enrolled in Grades 7, 8, and 9 in the target school 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 learning 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 to the level of standard skill, so they become uninterested to participate in, and anxious about, mathematics class (Siu et al., 1993).

With all this in mind, the goal of this investigation was twofold: firstly, to measure the levels of motivation for learning and cognitive engagement in Mathematics classes 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 motivations for learning in Mathematics class and cognitive engagement in Mathematics class between Grades 7-9 students at the Demonstration School of Ramkhamhaeng University, Bangkok.

## 2. Research Objectives

The following are the research objectives that guided this study.

4.1. To determine the levels of Grades 7-9 studen ts' motivation for learning in Mathematics class at t he Demonstration School of Ramkhamhaeng Univer sity, Bangkok.

4.2. To determine the levels of Grades 7-9 students' co gnitive engagement in Mathematics class at the Dem onstration School of Ramkhamhaeng University, Ba ngkok.

4.3. To determine whether there is a significant differe nce in motivation for learning in Mathematics class among Grades 7-9 students at the Demonstration Sc hool of Ramkhamhaeng University, Bangkok.

4.4. To determine whether there is a significant differe nce in cognitive engagement in Mathematics class a mong Grades 7-9 students at the Demonstration Sch ool of Ramkhamhaeng University, Bangkok.

## 3. Theoretical Framework

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

### 3.1 Student Motivation Model (Pintrich & DeGroot, 1990)

Student motivation is defined in this model as a motivating force generated from three sorts of sources or motivational components: a value component that includes students' aims and opinions about the task's relevance and interest; an expectancy component, which includes students' opinions about their ability to complete a task; and an affective component, which includes students' emotional responses to the task (Pintrich et al., 1991). The researchers focused on the value components for this study, because it examined 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 (e.g., challenges, curiosity, and mastery), extrinsic goal orientation (e.g., grades, rewards, and approval from others), and task value (e.g., how interesting, important, and useful an instructional task is; Pintrich et al., 1991).

### 3.2 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), 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 can be classified into three approaches to learning: surface strategy (i.e., using methods such as memorization and practicing), deep strategy (i.e., processing tests, comprehending questions, summarizing what might be studied, and relating new and old information), and reliance (i.e., trust in their teachers' and parents' directions in relation to their learning process and studies). This classification expanded upon previous constructs of cognitive engagement (i.e., Biggs, 1978; Marton & Säljö, 1976).

## 4. Conceptual Framework

Figure 1 shows the relationship among the variables addressed in this study. The students' grade (Grades 7-9), served as the independent variable, while participants' motivation for learning and cognitive engagement in Mathematics class served as the dependent variables.

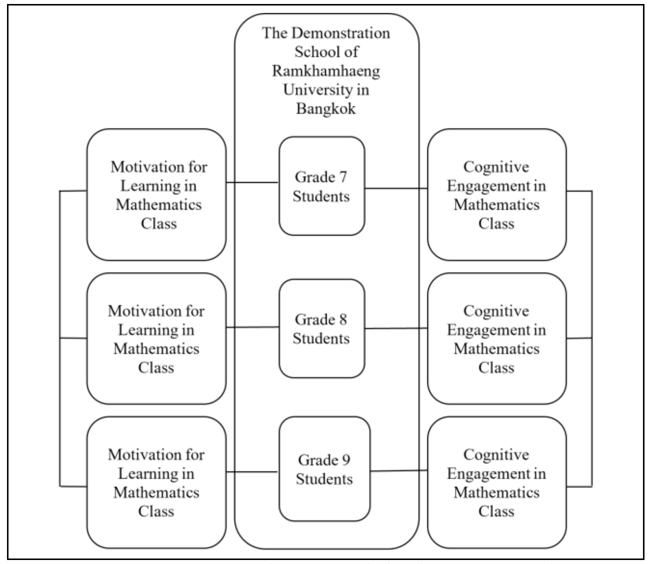


**Figure 1:** Conceptual Framework for the Current Study

## 5. Literature Review

In this section, some previous studies related to the research variables addressed in this study are reviewed and summarized.

Liu et al. (2015) performed a study to investigate the level of student motivation and self-regulated learning in mathematics. This study took place at secondary schools in Singapore. The sample population was comprised of 782 students from eight secondary schools, grouped into four distinct learning profiles. Cluster 1 ($n$ = 213), Cluster 2 ($n$ = 235), Cluster 3 ($n$ = 199), and Cluster 4 ($n$ = 135). The intrinsic motivation of Cluster 1 was found to be moderate, Clusters 2 and 3 were slightly high, and Cluster 4 was found to have a slightly low level for motivation for learning in Mathematics class. The extrinsic motivation of Clusters 1 and 3 was interpreted as moderate, while Clusters 2 and 4 were interpreted as having a slightly high level of motivation for learning in Mathematics class. The task value of Clusters 1 and 4 was interpreted as moderate, while Cluster 2 was found to be slightly high, and Cluster 3 was found to have a high level of motivation for learning in Mathematics class. Also, the researchers analyzed the data by multivariate analysis of variance (MANOVA). The result showed that the Cluster 3 and 4; good and poor motivated strategies for learning; differed significantly, whereas low and high motivated strategies for learning; Clusters 1 and 2; were homogeneous groups.

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 earlier than usual in the first year of secondary school.

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 of classroom instruction. This study used mainly a survey research design, class observations, and a student engagement scale. This research took place among students ranging 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 a 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 evidence of reliance. In this research, deep strategy and interest were found to be significantly and positively correlated. However, it showed that interest correlated negatively with surface strategy.

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 before and after the test indicated moderate levels, while the level of reliance in pre-test and post-test indicated a high level of cognitive engagement. Also, according to the findings and comparing means of the study, there was a decrease in the surface strategy domain after CTL-based instruction. This is because, in CTL-based learning, students are more facilitated and constructed by their understanding of the concepts. Besides, in-depth strategy increased after CTL-based instruction.

## 6. Methodology/Procedure

In this section, details on the study's population, sample and research instruments are provided.

### 6.1. Population and Sample

In this study, a population sample comprised of all the 55 Grades 7-9 students currently enrolled in Mathematics class, and English Program during the academic year 2021-2022 at the Demonstration School of Ramkhamhaeng University were utilized. The participants in this study were distributed as follows: 16 students from Grade 7, 27 students from Grade 8, and 12 students from Grade 9.

### 6.2. Research Instruments

The following research instruments were used in this study: the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ), and the Student Engagement in the Mathematics Classroom Scale (SEMCS).

#### 6.2.1. Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ)

The researchers used the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ; see Appendix 1), which was adapted from Pintrich et al.'s (1991) Motivated Strategies for Learning Questionnaire (MSLQ), to quantify the motivation for learning in Mathematics class. 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 items of the MSLQ.

The MMSLQ was 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 used a 7-point Likert-type scale to measure students' level of motivation for learning in Mathematics class. Students were asked to 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 nor true of me*, 5 = *somewhat true of me*, 6 = *true of me*, 7 = *very true of me*). The mean scores obtained from averaging the Likert scale ratings of all items were interpreted using a continuum from 1.00 (very low motivation) to 7.00 (very high motivation).

Regarding the validity of this instrument, the Motivated Strategies for Learning Questionnaire (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). Moreover, Karadeniz et al. (2008) expressed that the MSLQ also has strong content and construct validity, based on the 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.

Regarding the reliability of the Motivated Strategies for Learning Questionnaire (MSLQ), Pintrich et al. (1991) reported acceptable internal consistency reliability of the scales addressed in this study. Table 1 shows the internal consistency reliabilities reported in different and current research studies.

**Table 1:** Reliability Coefficients of the MMSLQ, Reported by Previous Studies and the Current Study

| Subscale | 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 |

### 6.2.2. Student Engagement in Mathematics Classroom Scale (SEMCS)

In this research, the researchers adopted the Student Engagement in Mathematics Classroom Scale (SEMCS; see Appendix 2), developed by Kong et al. (2003), to quantify the cognitive engagement for learning in Mathematics classes, held by Grades 7, 8, and 9 students in the Demonstration School of Ramkhamhaeng University, Bangkok. 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 (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*) to investigate the participants' level of cognitive engagement in Mathematics class. The mean scores obtained from averaging the Likert scale ratings of all items were interpreted using a continuum from 1.00 (very low cognitive engagement) to 5.00 (very high cognitive engagement).

Regarding the validity of this instrument, Kong et al. (2003) designed all the items in the SEMCS 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). 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.

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 good. Table 2 shows the details on the internal consistency reliabilities reported in different research studies using the SEMCS.

**Table 2:** Reliability Coefficients of the SEMCS, Reported by Previous Studies and the Current Study

| Subscale | Kong et al. (2003) | Current study | | |
|---|---|---|---|---|
| | | Grade 7 | Grade 8 | Grade 9 |
| Surface strategy | .81 | .72 | .75 | .76 |
| Deep strategy | .87 | .74 | .79 | .76 |
| Reliance | .81 | .76 | .88 | .85 |
| Overall | Not reported | .74 | .87 | .84 |

## 7. Research Findings

The research findings obtained from the data collection and analysis follows, presented by the research objective.

### 7.1. Findings From Research Objective 1

Regarding Research Objective 1, the following findings were obtained.

- The overall level of intrinsic goal orientation for lea rning in Mathematics class held by Grade 7 (*M* = 4.7 1, *SD* = 1.57) was slightly high, whereas it was inter preted as moderate for Grades 8 (*M* = 4.13, *SD* = 1.4 9), and 9 (*M* = 4.21, *SD* = 1.35) students.
- The overall level of extrinsic goal orientation for l earning in Mathematics class held by Grades 7 (*M* = 5.09, *SD* = 1.65), 8 (*M* = 4.88, *SD* = 1.61), and 9 (*M* = 5.46, *SD* = 1.34) was interpreted as slightly h igh.
- The overall level of task value for learning in Math ematics class held by Grade 7 (*M* = 4.63, *SD* = 1.4 8) were interpreted as slightly high, whereas it was interpreted as moderate for Grades 8 (*M* = 4.06, *S D* = 1.49) and 9 (*M* = 4.30, *SD* = 1.07) students.
- The overall level of motivation for learning in Mat hematics class held by Grades 7 (*M* = 4.79, *SD* = 1 .56) and 9 (*M* = 4.60, *SD* = 1.23) was slightly high , whereas it was moderate for Grade 8 (*M* = 4.31, *S D* = 1.53).

### 7.2. Findings From Research Objective 2

Regarding this research objective, the following findings were obtained.

- The overall level of surface strategy in Mathematics class held by Grades 7 (*M*=3.34, *SD*=0.96), 8(*M*=2.98, *SD*=.96) and 9 (*M*=3.44, *SD*=.86) were moderate.
- The overall level of deep strategy in Mathematics class held by Grade 7 (*M*=3.51, *SD*=1.04), was high, while it was moderate for Grades 8 (*M*=3.13, *SD*=0.98) and 9 (*M*=3.07, *SD*=.89) students.
- The overall level of reliance in Mathematics class held by Grades 7 (*M*=3.37, *SD*=.98), 8 (*M*=3.36, *SD*=1.01), and 9 (*M*=3.36, *SD*=1.01) students were moderate.
- The overall level of cognitive engagement in Mathematics class held by Grades 7 (*M*=3.42, *SD*=1.00), 8 (*M*=3.14, *SD*=.94), and 9 (*M*=3.26, *SD*=0.91) students were moderate.

### 7.3. Findings From Research Objective 3

Regarding this research objective, 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. Therefore, the grade in which these students were enrolled appears to have no significant effect on their motivation for learning in Mathematics class.

### 7.4. Findings From Research Objective 4

Regarding this research objective, it was found that there was no significant difference in cognitive engagement in Mathematics class among Grade 7, Grade 8 and Grade 9 students. Therefore, the grade in which these students were enrolled in appears to have no significant effect on their cognitive engagement in Mathematics class.

## 8. Discussion

In this section, a discussion of the research findings from the current study is provided, by relating such findings with the ones reported by previous research studies.

### 8.1. 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. 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, no significant difference was found among the three grades, 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. The results obtained by Lepper and Hodell (1989) and Harter (1981) are not in line with the results obtained by the current study. Both Lepper and Hodell (1989) and Harter (1981) reported a significant decline in intrinsic motivation and increase in extrinsic motivation throughout the students' school progression.

No significant difference among the grades might be interepreted as the students putting 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 reinforces a particular dimension of motivation for learning in Mathematics class more than other, and all are somehow consistently fostered throughout Grades 7 to 9.

### 8.2. Cognitive Engagement in Mathematics Class

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).

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.

## 9. Recommendations

Based on the findings of this study, the following recommendations are provided for teachers, students, school administrators and future researchers.

### 9.1. Recommendations for Teachers

Teachers need to provide more opportunities for students to increase sense of competition and prepare preserve a positive learning environment. Besides, they have to employ supplemental activities during class time to increase students' understanding. Teachers should also frequently organize students to form study groups or design competitions 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 are relevant to students' academic achievement and cognitive engagement. Also, Clarke (2001) presented activities that are linked to past knowledge are indicators of cognitive engagement. Shahrill and Wahid (2014) investigated that interest is correlated to cognitive engagement.

### 9.2. Recommendations for Students

The researchers suggest 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 the best way to learn mathematics is to follow the teacher's instructions. Students could take additional mathematical classes and engage in extracurricular activities that help them develop their analytical thinking. Students can compare their performances with other classmates to allow them to develop cognitive skills such as deep understanding, goal setting, and self-confidence. 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).

### 9.3. Recommendations for School Administrators

It is also important for school administrators to provide and 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 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.

### 9.4. Recommendations for Future Researchers

Data for this study were collected from Grades 7-9 students in only one school in Bangkok. Based on the limitation of access, it is suggested that future researchers could devote more time to the study in order to examine a larger sample, which would be more conducive to obtaining more generalizable results in students' motivation for learning and cognitive engagement in Mathematics class.

In terms of research content, there are many factors that can influence motivation and cognitive engagement. Yoon (2009), showed that social-contextual relations significantly impact students' motivation, in middle and high school. Kiwanuka et al. (2016) believed students' beliefs, worth and interests are the aspects that influence motivation toward mathematics. Also, Iksan and Sengodan (2012) demonstrated that students' willingness and hard work affect motivation in learning mathematics. Singh et al. (2002) stated that cultural causes shape people's attitudes toward mathematics. 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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