# A COMPARATIVE STUDY OF STUDENT MOTIVATION FOR LEARNING SCIENCE AND SCIENCE ACHIEVEMENT IN THE ENGLISH AND THAI PROGRAMS AT MATHAYOMWATSING SCHOOL IN BANGKOK, THAILAND

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**Abstract:** The purpose of this study was to explore the relationship between student motivation for learning science and science achievement of 55 mathayom 3 students in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand. This study employed a quantitative methodology employing both a questionnaire as well as "O" Net scores to address the research objectives. The study had six objectives which were 1) To determine the level of student motivation for learning science in the English Program at Mathayomwatsing school, in Bangkok, Thailand. 2) To determine the level of student motivation for learning science in the Thai Program at Mathayomwatsing school, Bangkok, Thailand. 3) To find the correlation between student motivation for learning science and science achievement in the English Program at Mathayomwatsing school in Bangkok, Thailand. 4) To find the correlation between student motivation for learning science and science achievement in the Thai Program at Mathayomwatsing school in Bangkok, Thailand. 5) To compare student motivation for learning science between students in the English and Thai programs at Mathayomwatsing school in Bangkok, Thailand. 6) To compare science achievement between students in the English and Thai programs at Mathayomwatsing school in Bangkok, Thailand. The research findings were the level of student motivation for learning science in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand were "rarely to sometimes" motivated and there was a significant relationship between student motivation for learning and the student science achievement in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand. There was no significant difference of student motivation for learning science and science achievement between students in the English and Thai programs at Mathayomwatsing School in Bangkok, Thailand.

**Keywords:** Motivation for Learning Science, Science Achievement.

## Introduction

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The ultimate goal of this research is to successfully use a variety of instructional strategies and tools into the science classrooms to accommodate the different learning styles and abilities exhibited by our students. The diversity of students in our classrooms is increasing; the need to shape curriculum and instruction to maximize learning for all students more urgent than ever (Allan, 2012). Guild (2001) stated that the everyday experience in the classroom confirms that students learn in different ways. These learning differences have led to extensive research and the formation of well-accepted theories in the academics. Most educators can identify learning differences by name, cognitive style, psychological type, or a combination of intelligences (multiple intelligence). Because of the uniqueness of each student, they can hone their individual approach, talents, and interests to the classroom to make learning more interesting.

When science is taught out of context and seems irrelevant to their lives, many students lose interest. And if a student's own motivation is disregarded, even the most careful preparation on the part of the teacher will be wasted. It is crucial, therefore, to highlight the importance of science and its relevance to students' lives (Brodie, 2006). To be motivated means to be moved to do something. A person who feels no impetus or inspiration to act is thus characterized as unmotivated, whereas someone who is energized or activated toward an end is considered motivated (Ryan and Deci, 2000).

Staver (2007) stated that learning is a purposeful, internal, mental process. Teachers can monitor learning by observing and gathering data on changes in students' actual behaviour or potential performance. Motivation drives the process of starting and continuing learning. Relevance refers to activities that give students satisfaction and meet their needs, including the chance to achieve personal learning goals. Given that there are learning differences in the classrooms; teachers must also have a way to capture each student's curiosity. According to Staver (2007), teachers must make connections between their lesson and everyday life in order to capture students' attention and to activate their motivation to learn. In this way, academic subjects such as science can be related to personal interests or issues, societal issues, cultural backgrounds, and other everyday events or concerns.

**Research Objectives**

There are six objectives including:

1. To determine the level of student motivation for learning science in the English Program at Mathayomwatsing school in Bangkok, Thailand.
2. To determine the level of student motivation for learning science in the Thai Program at Mathayomwatsing school in Bangkok, Thailand.
3. To find the correlation between student motivation for learning science and science achievement in the English Program at Mathayomwatsing school in Bangkok, Thailand.
4. To find the correlation between student motivation for learning science and science achievement in the Thai Program at Mathayomwatsing school in Bangkok, Thailand.
5. To compare student motivation for learning science between students in the English and Thai programs at Mathayomwatsing school in Bangkok, Thailand.

6. To compare science achievement between students in the English and Thai programs at Mathayomwatsing school in Bangkok, Thailand.

**Conceptual Framework**

This study provided information about the uses of motivation in Science teaching that affected student achievement in Science subjects. It was also to gather information about what motivated students to learn. The students were given a questionnaire to determine the level of motivation for learning science in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand. To find the correlation between student motivation for learning science and the students' science achievement and to compare the student motivation for learning science and science achievement between students in the English and Thai Program at Mathayomwatsing School in Bangkok, Thailand, the researcher used the students' "O" Net scores taken in 2014 March.

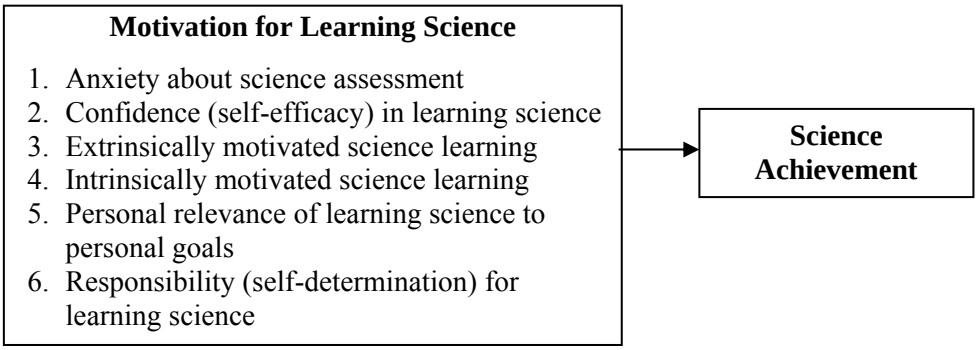


**Figure 1: Conceptual Framework of The Study**

**Review of Literature**

*Motivation in Science*

Today, children are exposed to a world full of technology brought about by scientific inquiry and engineering development. By the end of formal schooling, graduates will enter a world where there are new products born out of new technology and science (Staver, 2007). Hence, our students must be trained in scientific methods and information in order to make decisions regarding their personal lives, careers, and communities. According to Ryan (2009), all schools and schooling systems nowadays accept that part of their role is to prepare children for work, sometimes implicitly or explicitly (Ryan, 2009). However, science is not a discipline of unchanging truth but a field which equips us with knowledge, understanding, and methods which offer powerful ways to view our society (Ryan, 2009).

*Types of Motivation*

In addition, Ryan (2009) stated that there are two types of ways to motivate people: extrinsically or intrinsically. Extrinsic motivation is motivation that is stimulated by

things that are outside of your interests and self-esteem i.e. money, a nice car, an expensive house, high grades in school, gold stars, etc. In other words, extrinsic motivation requires something outside of yourself that you need to obtain. On the other hand, intrinsic motivation is the opposite because you are motivated for something that you are truly interested in and aligns with your passion i.e. interest in work, happiness in learning, or joy in doing something for yourself (Ryan, 2009).

*Variety of Strategies in Science*

Chunk (1991) found that instructional studies have substantiated the idea that teaching strategies have an effect with regards to self-efficacy and achievement. Effective strategies are important because they hone a student's problem-solving skills according to different situations. In addition, they can improve and facilitate faster learning. Lastly, teaching techniques may differ in various ways, such as accuracy, nature of execution, requirements, and the variability of application (Vosniadou, 2001).

Consequently, if you want to motivate students in learning and in understanding fundamental science, you will need to engage them in activities that develop a scientific method of inquiry as discussed earlier through establishing relationships between patterns and explanations in experiences; engaging in scientific application or inquiry; and developing scientific habits that are brought on by curiosity and model-based reasoning (Anderson, 2003).

Through science learning, students will be able to learn how to define, refine, and resolve problems and ideas through practical data gathering, varied information collection, data transformation and data generalization, and justification of outcomes and opinions based on the evidence gathered. Through this method, students will be able to analyze the limitations of their data and to further develop their arguments (Ryan, 2009).

There are three types of varieties of strategies to improve students' motivation in science. They are 1) Teacher enthusiasm, 2) The learning environment, 3) Use of hands-on activities.

*1. Teacher Enthusiasm:* A teacher's enthusiasm affects student motivation. For example, if you become bored or apathetic, students will too. Typically, an instructor's enthusiasm comes from self-confidence, an innate excitement about the topic of the lessons, and a sincere pleasure in teaching (University of Arkansas, 1993). As Garbett (2011) illustrated, successful teachers of science need to be knowledgeable about 1) science content, 2) effective teaching and learning strategies in science, and 3) the combination and application of content knowledge and pedagogical knowledge in the classroom. Moreover, Anderson (2003) wrote that good science teachers motivate their students into learning and understanding science. Thus, another goal of science education is to create good science teachers to help students develop scientific understanding.

To facilitate better learning, teachers must also be aware that their expectations of the students' have an impact on classroom performance. Teachers should set high learning expectations while encouraging students to also set expectations for their learning as well. There are nonverbal and verbal behaviors that teachers use to express their expectations of students (Staver, 2007). Students are more likely to

respond positively to an enthusiastic teacher who has planned out a well-organized course because of his/her interest in the learning of the students. Therefore, all activities in the classroom must promote learning that will enhance student motivation (University of Arkansas, 1993).

Effective teachers believe that it is important to reach students through a variety of methods because they feel responsible for the success of their students. In essence, the effective teacher believes that all students can learn (Stronge, 2002). Aside from conveying passion and enthusiasm, as stated earlier, teachers must be willing to provide individual help. Also, the simple things such as body language and voice must convey your eagerness in the classroom. Lessons are engaging when teachers move around instead of sitting during a lecture (Palmer, n.d.). Among teachers, the most important qualities in the profession are "dedication," "passion," "zeal," "enthusiasm," and "love of teaching." Educational degrees and level of knowledge are secondary to passion for teaching (Urban, 2008).

*2. The Learning Environment:* Positive experiences in school create lifelong learning for citizens and provide them with situations to apply their learning. With active involvement and participation, students learn through observing, paying attention, memorizing, understanding, and assuming responsibility for their own learning (Ryan, 2009). With this in mind, teachers should also consider the type of classroom environment they wish to create in order to foster learning (Vosniadou, 2001). In addition, Lai (2011) wrote that teachers should empower students with autonomy or the ability to control the progress of their learning by allowing them to collaborate and cooperate with each other and to make individual choices. A supportive classroom environment in line with goals, objectives, and assessment are key in fostering this type of autonomy and collectivity in school learning. Research has also proved that social collaboration enhances student performance and achievement because of the contribution of social interactions to learning (Vosniadou, 2001).

The role of schools is to prepare students for the workforce wherein jobs have yet to be created, technologies have yet to be invented, and where new problems are expected to arise (Schleicher, 2010). The second philosophy I will identify with is progressivism according to Simpson (2008). Opposite with perennialists who holds onto fundamental and unchanging truths, progressivists see the world as constantly changing. Our ideas, interests, values, and visions are part of this process of change and therefore make each individual unique. In addition, this continuous change in society means that educators should allow children to bring interesting knowledge and experiences from the real world into the classroom (Simpson, 2008). In hindsight, if we take the interest of the students and incorporate them into the lessons we teach, our children and youth would effectively learn, retain, and acquire knowledge.

*3. Use of hands-on activities:* For the United Nations Educational, Scientific & Cultural Organization (2013), using teaching methods that appeal to inquisitiveness and ingenuity that describe all children is the best way to capture and increase students' interest in learning science related subjects. The teachers should use hands-on and inquiry-based activities to promote teamwork, critical thinking and problem-solving skills among students.

According to the study of the Third International Mathematics and Science study, classroom activities such as the teacher doing demonstrations and sample problems, science projects, group activities, and student investigations and experiments aided increase students' interest in science (House, 2002).

Hands-on activities in science classes can increase students' motivation in studying the subject. However, based on Stohr-Hunt's (1996) survey, it is not sufficient to just case any hands-on activity but rather, it should be "meaningful, relevant, and appropriately timed." Throughout the activity, teachers must provide students scaffolding and assist them comprehend the concepts being studied (Stohr-Hunt, 1996).

*Improving Teaching and Learning in Science*

There are multiple tasks that need to be done when teaching: carefully preparing and planning the objectives and activities for learning in a classroom setup on an hourly, daily and weekly basis. Planning on a long-term basis will ensure that the curriculum has covered the marking period, semester and year. Having high expectations for students and selecting strategies to prompt students' learning are some of the characteristics of an effective educator (Stronge, 2007).

There should be a significant shift on teachers, parents, and students' approach in using constructivism. Teachers should spend minimum time on lecturing, teaching student's basic concepts and mindless learning (Andrew, 2007).

Science teachers should involve scientific inquiry, thereby lessening their emphasis on teaching science as a chain of lectures and reading assignments. They must also decrease their time teaching non-fundamental scientific knowledge (Staver, 2007).

*The Six components of motivation for science learning used in the questionnaire*

1. Anxiety about science assessment

Olatoye (2009) described anxiety as "an emotional component of human beings that manifests itself in life endeavors in form of worry and restlessness." When this emotional component is present in a test or assessment condition, then it can be considered as an anxiety.

He also found that test anxiety is "an experience which expresses itself in candidate's mind and behaviour in form of fear or failure, negative self-valuation in relation to one's previously established standard, self-blame for perceived shortcomings, social evaluation in relation to one's estimate of how others are doing and negative prediction of what will be the outcome of a test" (Olatoye, 2009).

Mallow's (2010) research showed that there is a correlation between science anxiety reduction and role modeling. Science anxiety of both male and female students was reduced in Physics classes that were taught by an instructor of the same gender, on the condition that the instruction was interactive.

Based on the study conducted Olatoye (2009), two independent variables, students test anxiety and motivation for examinations, have significant influences on and are significant predicators of science achievement. There is a negative and significant relationship between test anxiety and students' science achievement.

Hence, the higher the test anxiety, the lower the science achievement. These two factors should always be considered if educators are to improve science achievement.

For Zhao (2013), standardized testing encourages the ability to find the "correct answer" but discourages creativity that promotes questioning and challenging the status quo. If a curriculum is narrow and uniform, it will deprive children of exploring their interest and passion, which is fundamental in entrepreneurship. If children are constantly being tested and being told that they are not good enough, their confidence depletes. Thus, their fuel for innovation decreases.

2. Confidence (Self-efficacy) in learning science and Education

Bandura (as cited in Webb-Williams, 2006) suggested that there are different ways to build up self-efficacy to help enhance a person's sense of accomplishment and well-being. The difference between individuals who have strong self-efficacy and those who doubt their capabilities are as follows: people with high self-efficacy see hard tasks as challenges rather than threats; they have challenging goals which they are committed to achieve; even when they failed, they sustain their effort and quickly recovers from it; they also attribute their failures to adaptable factors such as insufficient effort or skills; and they have intrinsic interest in doing their activities. He also found that people's belief about how abilities change over time also effect human functioning. There are people who believe that as their age increases, their abilities shrink. Thus, their faulty performances are quickly attributed to their declining capacities. In return, they do little to explore what they can do. On the other hand, those who regard abilities as a skill that should be developed and practiced over time have higher attainments (Bandura, 1993).

Self-efficacy is defined by social learning theorists as a "sense of confidence regarding the performance of specific tasks" (Lorsbach & Jinks, 1999). Lorsbach & Jinks (1999) assert that students' academic self-efficacy can change students' attitude towards their learning environment. They believe that student self-efficacy beliefs about academic performance can have significant implications for developing learning environments and student outcomes.

Schunk (1991) found that children with high self-efficacy were more likely to continue doing and were more successful finishing a certain difficult task compared to children with a low sense of self-efficacy.

According to Bandura (1993), perceived self-efficacy utilizes its influence through cognitive, motivational, affective, and selection processes. Perceived self-efficacy acts as a significant contributor to academic progress at three different levels. Aspirations, level of motivation, and academic accomplishments are determined by students' self-efficacy beliefs to administer their own learning and master academic activities.

Bandura (1993) found that thoughts shaped most courses of action. Belief in one's efficacy can influence the kinds of anticipatory scenarios s/he will formulate and enact. People who have high sense of self-efficacy see success scenarios that give positive influences and assists for performance. On the other hand, people who fight with self-doubt see failure scenarios and focus on negative outcomes of events.

According to Schunk (1989), a person's success can raise self-efficacy and his/her failure can lower it, but an occasional failure may not have much effort on a person that has developed a strong sense of self-efficacy. People assess their self-efficacy from the information they acquire based on their actual performances, second-hand experiences, forms of persuasion, and physiological indexes.

Schunk (1989) also explained that peer modeling can help students with learning problems who doubt their capabilities for learning. Although it may seem that an adult teacher flawlessly demonstrating cognitive skills help children hone their skills, it does not help them develop learning efficacy. Students will only see teachers as someone who is competent which they may view as unachievable. However, if students see that their peers are performing successfully, it will raise their self-efficacy because they are apt to view themselves as someone who can attain those sills as well.

3. Extrinsically motivated science learning

Students who are extrinsically oriented are disposed to increase the minimum amount of effort needed to obtain the maximum reward. According to Ryan and Deci's (2000) research, in some situations, extrinsic rewards can decrease existing intrinsic motivation. Resentment, resistance, disinterest or, as an alternative, with an attitude of willingness that shows the inner acceptance of the worth or usefulness of a task, are some of the actions that students who are extrinsically motivated can perform.

Positive rewards such as praise, high grades, awards, money and food, that are used to increase the frequency of a target behaviour can result to extrinsic motivation.

Anderson (2003) stated that there are students who are extrinsically motivated that they have high expectancy of their learning capability in science and will do anything to get a good grade. Even though it might seem as a pure motive, teachers can still help extrinsically motivated students to learn with understanding. As a teacher, students will see you as accountable for making sure that the efforts they put to get their grades help them acquire valuable knowledge.

Intrinsic motivation is an individual's inherent inclination from which stems his or her tendency to learn about particular areas of life regardless of the presence of external enticements (Ryan and Deci, 2000). Intrinsic motivation is when learners actively participate in activities without having to be rewarded for it. The child who likes to put together puzzles for the fun of it intrinsically motivated. In recent years schools have increasingly come to recognize that intrinsic, or self-motivation is a much more powerful driver of learning and achievement (Vosniadou, 2001).

4. Intrinsically motivated science learning

Intrinsic motivation is an individual's inherent inclination from which stems his or her tendency to learn about particular areas of life regardless of the presence of external enticements (Ryan and Deci**,** 2000**)**. Intrinsic motivation is when learners actively participate in activities without having to be rewarded for it. The child who likes to put together puzzles for the fun of it is intrinsically motivated. In recent

years schools have increasingly come to recognize that intrinsic, or self-motivation is a much more powerful driver of learning and achievement (Vosniadou, 2001).

For Ryan and Deci (2000), "intrinsic motivation results in high-quality learning and creativity, it is especially important to detail the factors and forces that engender versus undermine it". "The presumption of intrinsic motivation is humans have the innate ability to learn which is perceived as "a natural and enjoyable activity" (Ryan and Deci, 2000).

Learners who actively participate in activities without the thought of having a reward are those who are intrinsically motivated. For example, a child who likes to solve puzzles just for fun is intrinsically motivated. It has been observed recently that intrinsic motivation, or self-motivation, can fuel a student more to study and achieve goals (Vosniadou, 2001).

Based on Anderson's (2003) observation, there are only few students who are intrinsically motivated to learn science. Science teachers will find students coming to class liking and believing that the subject is important (high value) and that they have the ability to learn it (high expectancy). These types of students are the easiest and most rewarding students to teach.

5. Personal relevance of learning science to personal goals

In order to develop better school science, we need to change teaching and learning the subject in a way that it is better matched to science in the wider world. As Ryan (2009) stated, for cognitive learning theorists, it is important that teachers relate new information to things that are already familiar and meaningful to students for them to learn the subject better.

There are numerous techniques that were proposed to motivate the development of mastery goals. Students do not understand the purpose and usefulness of many school activities that's why they find it meaningless. To combat this, teachers should situate school activities in a real context (Vosniadou, 2001).

Contemporary research findings showed that the capability to relate newly acquired information to prior knowledge is crucial for learning. As Vosniadou (2001) said, "it is not possible for someone to understand, remember or learn something that is completely unfamiliar."

6. Self-determination for learning science

When self-determination theory is applied to education, its concern focuses on promoting an interest in learning for students, valuing education, and building students' self-efficacy (Deci & Ryan as cited in Deci, Vallerand, Pelletier, Ryan, 1991). These results are indications of students being intrinsically motivated and having the values and regulatory processes internalized.

*Student Achievement*

According to Yuenyong and Narjaikaew (2009), prestigious schools in Thailand strongly stresses science achievement in which they provide special science and technology programs. It is evident that scientific achievement is still the most important in science teaching in Thailand even though they promote scientific literacy and science, Technology and Society (STS) approach to teaching. Gifted

and talented science and mathematics students are selected to participate in special International Science Olympics (Yuenyong and Narjaikaew, 2009).

Based on Zhao's perspective, most education system began by determining the outcomes. They gamble which skills will be significant and assure that once those skills are mastered, students will succeed (Zhao, 2013). However, he sees this as a weakness because it homogenizes everyone into a single group, like making a sausage out of different kinds of meat. Determining outcomes permits the system to measure results, but it suppresses individuality (Zhao, 2013).

This is the kind of attitude towards science used to be – memorization of facts and high examination scores than knowing whether they actually liked science were more important to students (Zhao, 2013). It is fortunate that this view is already changing. Based on a research, even though much importance is given to the role of science in giving knowledge to students, appreciation and affinity to the subject in general is much more significant for students to learn while in school. However, it is until students reach college or high school that they realize what they want to have as a profession. With this, rote memorization is pointless and discourages scientific literacy and appreciation (Zhao, 2013).

**Research Methodology**

The research focused on motivation in science learning and students science achievement in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand. A total of 55 Mathayom 3 students from the English and Thai programs at Mathayomwatsing School were asked to complete a science motivational questionnaire.

This is a quantitative type of research. The researcher selected Mathayom 3 students in academic year 2013 from the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand as the subjects for data collection. Twenty-two students of Mathayom 3 from the English Program and 33 students from the Thai Program totaling 55 students who are studying science were asked to complete the questionnaire.

There were two research instruments. The first one was the science motivational questionnaire designed by Glynn and Koballa, 2006. The second one was the students "O" Net grades from the National Institute Educational Testing Service taken in March 2014. O-Net is the national standardized exam and it is given in Thai language and given to Mathayom 3 students.

**Findings/Results**

From the findings, the following conclusions are drawn:

1. In general, the level of student motivation for learning science in the English Program at Mathayomwatsing School in Bangkok, Thailand is "sometimes to often" motivated.

2. The level of student motivation for learning science in the Thai Program at Mathayomwatsing School in Bangkok, Thailand is "sometimes to often" motivated.

3. There is a significant relationship between student motivation for learning science and science achievement in the English Program at Mathayomwatsing School in Bangkok, Thailand.

4. There is a significant relationship between student motivation for learning science and science achievement in the Thai Program at Mathayomwatsing School in Bangkok, Thailand.

5. There is no statistically significant difference of science achievement between students in the English Program at Mathayomwatsing School in Bangkok, Thailand.

6. There is no statistically significant difference of science achievement between students in the Thai Program at Mathayomwatsing School in Bangkok, Thailand.

**Discussions**

This study examined the relationship between students' motivational level for learning science and student science achievement in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand by using the six components of motivation for science learning used in the questionnaire.

Results from this study showed that student motivation for learning science in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand are "sometimes to often" motivated. As the researcher mentioned in statement of the problem, the academic motivation in students' science learning declines gradually as the students enter Mathayom levels. In order to improve the academic motivation in students' science learning, science teachers need to effectively motivate their students in 1) questioning students to engage them in the lesson, 2) incorporating hands-on activities to help learn the lesson concepts, 3) exhibiting enthusiasm in lesson presentations, 4) using a variety of activities, 5) believing that students can achieve, 6) building caring relationships in the classroom. The researcher believes that teachers who incorporate such strategies into their classrooms will likely increase motivation and enhance learning for all students. Additionally, the effectiveness of teachers' strategies should be examined related to students liking science, developing an interest in science, and pursuing scientific careers.

Another finding from this study was there is a significant relationship between student motivation for learning and science achievement in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand. In their review of 20 studies dealing with student motivation, Kremer and Walberg (1981) concluded that there is a positive relationship between motivational variables and science learning. Findings from this study are agreement with the results of this review. There was a positive correlation (r=.494) between students' motivation for learning and student science achievement in the English Program at Mathayomwatsing school in Bangkok, Thailand. There was also a positive correlation (r=.853) between student motivation for learning science and student science achievement in the Thai Program at Mathayomwatsing school in Bangkok, Thailand. In their study of motivation and achievement, Uguroglu and Walberg (1979) concluded that the mean correlation between motivation and achievement from samples of studies in psychological and educational literature is .338. They also suggested that motivation and achievement were more highly correlated in later grades and motivation accounts for 11.4 percent of the variance in achievement.

Another finding in this study was there is a significant difference in student motivation for learning science and student achievement between students in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand. These different findings of the current study may derive from differences of learning environment. There are a lot of differences in the English and Thai Programs at Mathayomwatsing School in Bangkok, Thailand. English Program students, while being quite independent learners, also like to join group work, to discuss in class and engage in project work with others. Moreover, the learning environment might be the reason of the difference on these different findings and the environment of learning might have affected student motivation for learning science and science achievement.

**Recommendations for Mathayomwatsing School**

The school should support and provide the suitable teaching materials and multimedia facilities for teachers, as well as help teachers to improve their skill and knowledge to apply these resources. In order to improve all students' motivation to learn science and interest in science related careers, the school should employ women and men who are in science-related careers in the community to take part in school science activities and perform as science role models. By doing so, these women and men should contribute their educational histories, career responsibilities, and professional and personal challenges, focusing on science experiences that will improve students' intrinsic motivation, self-efficacy, and self-determination.

In addition, student's achievement in science will be highly enhanced if the government, school administrators and other stakeholders in education industry could improve on the learning environment of students and motivate teachers. Moreover, Bax (2010) recommended the improvement of the systematic development and training in teacher education so that teachers are knowledgeable about their roles in the classroom and can practice their skills in employing effective classroom techniques and approaches. This is the researcher's eighth year teaching in Thailand. It has been observed that teachers do not receive proper training from the Ministry of Education or their school. In order to encourage students to improve their motivation and raise their achievement, teachers need to take classes, attend conferences or enroll in courses to meet professional development goals. This study serves as a reminder for the Ministry of Education of the importance in conducting timely and effective seminars for foreign teachers periodically.

**Recommendations for Future Research**

Future research should be conducted in the different parts of Bangkok and provinces of Thailand. Also, the research should focus not only on students' motivation for learning science and but also for students' motivation for learning other subjects such as Mathematics and English.

The duration of this study was during December, 2013 to March, 2014. In order to avoid a restricted sample (e.g., majority secondary school students), future studies should collect data throughout the year. Impacts of other affective and

cognitive variables on students' science achievement can be investigated in future studies.

Although the students in the study expected to perform well in their science classes, they did not see the value in pursuing science after high school. Such a situation does not improve the current shortage of scientists in Thailand.

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