# การพัฒนารูปแบบการสอนเพื่อเสริมสร้างแรงจูงใจและผลสัมฤทธิ์ทางการเรียนรู้ ตาม แนวทฤษฎีความสามารถของตนเองและทฤษฎีพัฒนาการด้านการรู้คิดทางสังคม สำหรับนักเรียนประถมศึกษาตอนต้นในโรงเรียน นานาชาติในกรุงเทพมหานคร

นาง ลิสตาติ สุกีมิน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาครุศาสตรดุษฎีบัณฑิต
สาขาวิชาหลักสูตรและการสอน ภาควิชาหลักสูตรและการสอน
คณะครุศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2554

# DEVELOPMENT OF AN INSTRUCTIONAL MODEL TO FOSTER LEARNING MOTIVATION AND LEARNING ACHIEVEMENT BASED ON SELF-EFFICACY AND SOCIAL COGNITIVE DEVELOPMENT THEORIES FOR LOWER PRIMARY STUDENTS IN INTERNATIONAL SCHOOLS IN BANGKOK

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A Dissertation Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy in Curriculum and Instruction
Department of Curriculum and Instruction
Faculty of Education
Chulalongkorn University
Academic Year 2011

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|---|---|
| Thesis Title | DEVELOPMENT OF AN INSTRUCTIONAL MODEL TO FOSTER LEARNING MOTIVATION AND LEARNING ACHIEVEMENT BASED ON SELF-EFFICACY AND SOCIAL COGNITIVE DEVELOPMENT THEORIES FOR LOWER PRIMARY STUDENTS IN INTERNATIONAL SCHOOLS IN BANGKOK |
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ลิสตาติ สุกีมิน: การพัฒนารูปแบบการสอนเพื่อเสริมสร้างแรงจูงใจและผลสัมฤทธิ์ทางการเรียนรู้ตามแนวทฤษฎีความสามารถของตนเองและทฤษฎีพัฒนาการด้านการรู้คิดทางสังคมสำหรับนักเรียนประถมศึกษาตอนต้นในโรงเรียน นานาชาติในกรุงเทพมหานคร (DEVELOPMENT OF AN INSTRUCTIONAL MODEL TO FOSTER LEARNING MOTIVATION AND LEARNING ACHIEVEMENT BASED ON SELF-EFFICACY AND SOCIAL COGNITIVE DEVELOPMENT THEORIES FOR LOWER PRIMARY STUDENTS IN INTERNATIONAL SCHOOLS IN BANGKOK) อ.ที่ปรึกษาวิทยานิพนธ์หลัก : รศ.ดร.สำลี ทองธิว, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม : ผศ.ดร.สร้อยสน สกลรักษ์, 158 หน้า

การวิจัยครั้งนี้เป็นการวิจัยและพัฒนามีวัตถุประสงค์เพื่อ(1)พัฒนารูปแบบการสอนคณิตศาสตร์เพื่อเสริมสร้างแรงจูงใจและผลสัมฤทธิ์ทางการเรียนรู้ตามแนวทฤษฎีความสามารถของตนเองและทฤษฎีพัฒนาการด้านการรู้คิดทางสังคมสำหรับนักเรียนชั้นประถมศึกษาและ(2)ประเมินประสิทธิภาพของรูปแบบการเรียนการสอนที่พัฒนาขึ้น

การนำกระบวนการการเรียนการสอนดังกล่าวไปทดลองสอนเบื้องต้นเป็นการนำร่องและทดสอบความเป็นไปได้ แล้วปรับปรุงก่อนนำไปใช้กับกลุ่มตัวอย่างนักเรียนชั้นประถมปีที่2 จำนวน 11 คน

การศึกษานี้ใช้รูปแบบการทดลอง 1กลุ่มแบบอนุกรมเวลามีการสังเกตและประเมินผลการเรียนรู้คณิตศาสตร์หลายๆ ครั้ง ก่อนและหลังการทดลองโดย นักเรียนได้รับการเรียนการสอนตามขั้นตอนที่พัฒนาขึ้นตลอด 20 บทเรียน

นักเรียนได้รับแรงจูงใจในการเรียนคณิตศาสตร์และวัดผลแบบวัดแรงจูงใจภายในต่อการเรียนของเด็กที่ปรับปรุงและได้รับอนุญาตจากผู้พัฒนาและโฆษณามีการสังเกตในห้องเรียนและสัมภาษณ์แบบมีโครงสร้างเพื่อศึกษาพฤติกรรมการเรียนของนักเรียนการวัดผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ใช้คะแนนได้จากการทดสอบให้นักเรียนหลังจากจบการเรียนการสอนแต่ละบทเรียน

ผลการวิจัยครั้งนี้สรุปได้ ดังต่อไปนี้

๑) รูปแบบการเรียนการสอนมีหลักการ 7ประการคือ (1)ด้วยความรักใคร่ความอบอุ่น ความเอาใจใส่ การยอมรับในทัศนคติของแต่ละคน (2)การรวมกลุ่มครูใช้อุปกรณ์เครื่องมือที่หลากหลายแสดงวิธีการต่างๆในการเริ่มต้นบทเรียน (3)ความชัดเจน ครูใช้การสาธิตขั้นตอนและวิธีการในการแก้ปัญหาคณิตศาสตร์ โดยการทำตัวอย่างให้ดู (4)การประสานร่วมกับครูเตรียมการให้นักเรียนโดยเริ่มจากงานเฉพาะที่เหมาะสมที่จะนำไปสู่ความสำเร็จและให้นักเรียนรู้จักการนำไปประยุกต์ใช้ (5)การท้าทายครูจัดทางเลือกของงานที่เหมาะสมและท้าทาย (6)รับรองผล การทดสอบประเมินผลความก้าวหน้าของนักเรียนแต่ละคนโดยไม่ต้องเปรียบเทียบกับผลสัมฤทธิ์ของนักเรียนอื่น (7) การสื่อสาร การบอกแจ้งความสามารถของนักเรียนด้วยความจริงใจ กระตุ้นให้กำลังใจให้นักเรียนทำให้ดีที่สุด

จากหลัก๗ประการดังกล่าวขั้นตอนการเรียนการสอนมี๔ขั้นหลักคือ ๑) ครูสร้างเสริมสิ่งแวดล้อมในทางบวกตลอดบทเรียนโดยรักษาสภาพบรรยากาศการกระตุ้นให้นักเรียนมีความกล้าที่จะแสดงออกไม่กลัวที่จะเรียน และได้รับการยอมรับจากครูและครูพูดให้กำลังใจนักเรียนพยายามใช้ความสามารถอย่างเต็มที่ ๒) กระตุ้นสิ่งที่ น่าสนใจ ๓)ทำความเข้าใจให้ชัดเจน ๔) ท้าทายความสามารถของแต่ละบุคคลและจบด้วย การตรวจสอบ ความก้าวหน้า

๒) ผลการศึกษานี้แสดงแรงจูงใจการมีส่วนร่วมในการเรียนการสอนคณิตศาสตร์ มีผลอย่างมีนัยสำคัญทางสถิติด้วยความเชื่อมั่นระดับ95เปอร์เซ็นต์หวังจากการทดลอง มีการพัฒนาผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ด้วยคะแนนสูงกว่า 80 เปอร์เซ็นต์ของเกณฑ์ขั้นต่ำที่ตั้งไว้

ภาควิชา หลักสูตร และการสอน ---------- ลายมือชื่อนิสิต .....

สาขาวิชา หลักสูตร และการสอน ---------- ลายมือชื่ออ.ที่ปรึกษาวิทยานิพนธ์หลัก.....

ปีการศึกษา 2554 ---------- ลายมือชื่ออ.ที่ปรึกษาวิทยานิพนธ์ร่วม.....

##4984795027: MAJOR CURRICULUM AND INSTRUCTION

KEYWORDS: MOTIVATION/ACHIEVEMENT/SELF-EFFICACY

LISTATI SUGIMIN: DEVELOPMENT OF AN INSTRUCTIONAL MODEL TO FOSTER LEARNING MOTIVATION AND LEARNING ACHIEVEMENT BASED ON SELF-EFFICACY AND SOCIAL COGNITIVE DEVELOPMENT THEORIES FOR LOWER PRIMARY STUDENTS IN INTERNATIONAL SCHOOLS IN BANGKOK . ADVISOR: ASSOC. PROF. SUMLEE THONGTHEW, Ph.D. CO-ADVISOR: ASST. PROF. SOISON SAKOLRAK, Ph.D., 158 pp.

The objectives of this research were: 1) to develop an instructional model to foster learning motivation and learning achievement based on self-efficacy and social cognitive development theories for lower primary students, and 2) to evaluate the effectiveness of the developed model by implementing it in class.

A pilot study was conducted to test the feasibility of the developed model before implementing it to a purposively selected sample of 11 Primary 2 students. The study employed a single group time-series design involving one group of participants and several observations or assessments pertaining to the participants' mathematics learning before and after the treatment. The participants were taught using the developed procedures over 20 lessons. Their motivation to learn mathematics was measured using Young Children's Academic Intrinsic Motivation Inventory which had been modified with permission from the author and publisher. Classroom observations and structured interviews were conducted to provide more insights into the participants' learning behaviour. Their mathematics achievement was measured using the scores obtained on tests following the completion of each lesson unit.

The findings of this study were as follow:

a) The developed model had seven components as follow: 1) Cordiality: Teacher models warmth, respect, and caring attitude. 2) Collection: Teacher uses a variety of material/tool or opening presentation method to start the lesson. 3) Clarity: Teacher demonstrates to students the steps and procedure involved in solving the task by doing worked examples. 4) Coordination: Teacher provides students with initial tasks that are certain to bring success to the students and provide them practice in applying the procedure. 5) Challenge: Provide options of tasks for students to choose that gives them optimal challenge. 6) Confirmation: Record students' results in individual file for evaluation of progress, and not compared with other students' results. 7) Communication: Communicate faith in the students' ability. Praise them for their effort. Challenge them to do their best. Based on those 7 components, the instructional procedure for use in the classroom is as follow: Teacher creates a positive environment throughout the lesson by i) maintaining a positive ambience where students feel encouraged, accepted and unafraid to try, and ii) communicating faith in the students' ability and praising their effort and response. The lesson is taught in steps: 1) interest stimulation, 2) clear coordination, 3) individualized challenge, and ends with progress check.

b) Results of this study show that the research participants' motivation in learning mathematics was significantly higher ($p \leq .05$) after the treatment. There was an improvement in their mathematics achievement where the participants achieved test scores higher than the set minimum criteria of 80 percent.

Department: Curriculum and Instruction Student's Signature: ……..……

Field of Study: Curriculum and Instruction Advisor's Signature: …….....

Academic Year: 2011 Co-advisor's Signature: ……

## ACKNOWLEDGEMENT

This dissertation would not have been possible without the guidance and assistance of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study.

Firstly, I owe my deepest gratitude to my thesis advisor, Associate Professor Dr. Sumlee Thongthew, and my thesis co-advisor, Assistant Professor Dr. Soison Sakolrak, for their patience, encouragement, guidance and support from the initial to the final stage of this dissertation. They have been my inspiration as I hurdle all the obstacles and challenges in the process of completing this research work.

I am heartily thankful to the Chairperson of the dissertation committee, Associate Professor Dr. Sumalee Chinokul, and members of the committee, Assistant Professor Dr. Somyot Chidmongkol and Associate Professor Dr. Parnarai Sapayaprapa, for their valuable time, insightful comments and suggestions in various areas of this research.

I would like to acknowledge Albert Bandura, Professor Emeritus at Stanford University, for validating the instructional principles of this study, and Professor Adele Eskeles Gottfried of California State University, for her kindness in sending me her motivation instrument for use in this study. Furthermore, I would like to thank all experts: Associate Professor Dr. Chalong Boonyananta, Assistant Professor Dr. Yeap Ban Har, Dr. Pattamasiri Teeranurak Jaruchainiwat, Dr. Yurawat Klaimongkol, Dr. Surapee Sorajjakool, and Dr. Tawatchai Teeranusoun, for validating the developed instructional model and research instruments.

I express my gratitude to the Principal and teachers at Jurong West Primary School (Singapore) for allowing me to do class observation, to the Director and teachers at Ekamai International School for assisting with the reliability study, to Karen Lucas for allowing me to use her mathematics class to conduct my research, and to the parents and students of St. Mark's International School for their willingness to participate in this study. Their cooperation is indeed very much appreciated.

Many thanks go to my colleagues and friends in Thailand and overseas for their encouragement; to my parents and siblings, for being such a strong pillar of support and encouragement in my life – thank you for all your prayers! To my husband, thank you for being my companion throughout this period. To my children, you are the reason I made a commitment to complete this journey and I dedicate this work to you. May you use your lives to be a motivation and blessing to others.

Thank You, Lord, for being the wind beneath my wings. All glory goes to You alone.

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# CHAPTER 1

## INTRODUCTION

### 1.1 RATIONALE

The education system in Thailand has been going through a reform over the past decade to place the learner at the core of the system and provide educators with suggestions to foster student motivation. It was stipulated that the teachers' roles be 'confined to motivation and providing support in all activities' to develop independent learners (ONEC, 2000:26). In addition, subsection 24(5) of the National Education Act (1999) warned the necessity for teachers to create the ambience, environment, instructional media and facilities that are conducive for learning. There was such an urgent need of teaching-learning reform because the learning process, where students' success is governed by examination results, brings about unhappiness, gloom and boredom to the students (ONEC, 2000:4).

Learning is at the heart of education and the crux of any instruction. Teaching is not considered accomplished unless the students learn. John Dewey compared teaching to selling commodities, and stated that no one can sell unless someone buys. [Yet] there are teachers who think they have done a good day's teaching irrespective of what pupils have learned (Dewey, 1933:35). For learning to occur, it is necessary that there be student motivation. Unfortunately, student motivation remains a problem for teachers all around the world and, as mentioned above, this concern is resonant in Thailand. While motivation is not the only factor necessary in order for learning to take place, it is also true that without sufficient motivation not much learning is likely to occur. Consequently, one of the greatest challenges of this era is for schools to focus more on assisting students to become motivated to learn so they can succeed in school.

Motivation is the willingness to do something. Some teachers believe that motivation is something that students simply have or don't have, but several motivation theories point out that learning motivation is inherent in all human beings (Bruner, 1966:114; Piaget, 1952:269; Stipek, 1993:59; Wlodkowski & Jaynes,

1990:10). Virtually all children are born with motivation to learn so for them, learning takes place naturally (Gardner, 1991; White, 1959:318). This intrinsic motivation is one that does not depend upon some external reward; reward comes in the successful termination of the activity or even in the activity itself (Bruner, 1966:114). Current theories stress that motivation to learn is a natural capacity that exists in all students when they are in positive states of mind and have a supportive learning environment. Even students who look as though they have lost their motivation to learn can regain this natural capacity and grow in positive ways. A feeling of security and satisfying connections with others are innate human needs, and social contexts which support these feelings contribute to positive motivation (Sagor, 2008:27; Stipek, 1993:113; McCombs & Pope, 1994:18). Research studies conducted by Mason and Stipek (1989, cited in Stipek 1993:182) show dramatic improvements in students' expectations and behaviour over a short period of time as a result of being in a new classroom with a new teacher, or as a result of changes initiated by the same teacher in the same classroom with the same set of peers. In another study of gifted African American achievers and underachievers (Ford, 1995), the underachievers reported (a) less positive teacher-student relations, (b) having too little time to understand the material, (c) a less supportive classroom climate, and (d) being unmotivated and disinterested in school.

The research findings have highlighted several important factors influencing motivation. They are learning environment, social interaction, and teacher's characteristics. William Glasser (1998:28) suggests that teachers should be lead-managers rather than boss-managers because the former manages by empowering instead of overpowering. This makes lead-management more effective in producing motivation to learn. Teachers should therefore avoid creating an environment which engenders in the students a feeling of incompetence, or where students are commonly criticized or ridiculed for their mistakes. Unfortunately many classroom environments often make students feel that way long before they could even get through high school. Hurting or discouraging comments from the teachers, constant comparison among students' grades, and learning things that seem irrelevant and decontextualised from real life, are some factors that diminish the student's self-efficacy and learning motivation (Olson, 2008:47). Many teachers know the important relationship between motivation and learning. Yet, it remains one of the greatest challenges for teachers to

find a way to motivate all students to learn. So, what gets in the way of teachers motivating students? Muir (2001) identified two factors that are acting as roadblocks for teachers to implement motivational teaching. One is the difference of perceptions between teachers and students, and the other factor is teachers not having models for motivational teaching.

There is a difference between the teachers' perspectives of what makes them unable to motivate, and the students' perspectives of what makes them unmotivated. Students become unmotivated and lost interest in learning mainly due to personal and environmental factors. On the personal side, they have been wounded by comments from school personnel about their perceived abilities (Olson, 2008:47). The environmental factors affecting their learning motivation include specific school practices such as comparing students, announcing failures publicly, and making school a test-dominated environment. Those who struggled to pass the tests did not feel like learning because they were unwilling to play a game they felt they could not win. From the teachers' perspectives, however, they attributed the causes of their failure to enhance students' learning motivation to other factors. Firstly, mandated curriculum and standardized testing put them under time pressure to teach content and "cover" the curriculum (Landsman, et.al., 2008:62; ONEC, 2000:4; Passe, 1996). Secondly, large class sizes are causing a lot of behaviour issues as teachers cope with high number of students with various learning and emotional needs. Thirdly, heavy accountability demands from administration give pressure to the teachers to meet performance standards (Deci et.al., 1982; Reeve, 1996:36). All these work pressure and accountability cause teachers to overlook the affective components of learning.

The other factor that Muir identified as a roadblock for motivating students' learning is the lack of motivational teaching models. Teacher practice has a significant impact on student learning attitude. The National Research Council and Institute of Medicine (2004:214), which set up a committee to research on promoting high school students' engagement and motivation to learn, reported evidence on teaching methods that motivate students and recommended that instructional methods be redesigned in ways that will increase engagement and learning. In a research by Malouff et.al (2008:3), 12 categories of teaching methods were identified as follow: (1) making content relevant to student values and goals, (2) helping students achieve their

goals through learning, (3) providing potent models of learning, (4) prompting and persuading students to learn, (5) establishing a positive relationship with students. (6) rewarding student achievement and learning efforts, (7) not de-motivating students, (8) enhancing student learning self-efficacy, (9) using engaging teaching methods, (10) using an appealing teaching style, (11) giving motivational feedback, and (12) monitoring student motivation levels and adjusting motivation methods as needed.

Although teachers know that they should use interest, hands-on activities, relationship, choices, and context to motivate students, they lack models of what those practices might look like in action. Some beginning teachers may not have had any successful experiences of motivating students. Some teachers have not been trained to teach using motivating strategies, so they may not have mental models to work from. Muir (2001) suggested that educators and researchers find examples of motivating, engaging learning in the classroom. Telling the stories of motivating teachers will help other teachers develop the appropriate schema to start reflecting on their own practice and to help staff developers design in-service to train teachers. By exploring diverse ways of motivational teaching, teachers will have choices about how to re-engage unmotivated students.

In regards to mathematics, it is one of the fundamental subjects that all students around the world are required to learn throughout their school life. Regrettably, studies show that many students in Thailand and those in western countries including Australia do not perform well in mathematics when compared with their counterparts in other countries. Results from the 2007 Trends in Mathematics and Science Study (TIMSS) show that among eighth-grade students in 48 participating countries, children in the afore-mentioned countries performed at or below TIMSS scale average in the mathematics assessment (Mullis, et.al, 2008:35). Moreover, there is a decline in the 2007 achievement results compared to the 1999 TIMSS mathematics study. Thailand also ranked very low (second from last) among the participating countries in terms of students' self-confidence. This problem, however, is not isolated to Thailand alone. Mullis et al. (2008:50) reported that students' confidence in their ability to learn mathematics is based to some extent on their past experience in learning the subject.

From collective research findings, several groups of influences were identified as having crucial importance for learners of mathematics. These include the

relatedness of the mathematics learning to the learner's real-life experiences; the influences of teaching materials on learning of mathematics; and the role of the teacher as the oldest influence on mathematics learning (Bishop, et.al, 1993:22). Another UNESCO reports highlighted the importance of teacher's role in mathematics learning by specifying things that teachers can control and influence the students. It was stated that teachers can inspire the students with their own enthusiasm, motivation, and ideas; give students confidence in their ability and their future; and create vibrant classroom with high expectations of students and connection to the world (Landsman, 2008:66). So, the challenge for today's teachers is not in making students memorise facts, but in motivating them to learn the subject for practical application in personal life.

Although there is no straightforward answer to all our student motivation problems, it is clear that young people are more likely to invest their energy in pursuit of what they view to be an achievable dream than in what they sense is futility. And the simplest way to ensure that students expect success is to make sure that they achieve it consistently (Bandura, 1997:80; Brophy, 1998:54). That is why students need continuous encouragement and hope from schools – so they can believe in their futures and themselves. Teachers can nurture optimism in all the students by creating routine education experiences in which manifestation of effort to achieve the set and possible goal within their competence range leads to success. And the bonus is: motivated students provide far fewer behavioural challenges for the teacher.

Based on theories and results from previous research, we know that the affective domain of learning, which is as important as the cognitive and psychomotor domains, has often been neglected by teachers for various reasons. In this research, the researcher attempted to create a teaching model based on the assumption of those theories that affection is important in fostering motivation, and put the model into trial to test its effectiveness in fostering motivation to learn mathematics, as well as raising the students' achievement scores. The researcher believes that ultimately, anything we do to make school a better place for the unmotivated will make it even better for those who are willing to work.

## 1.2 RESEARCH OBJECTIVES

The objective of this study is twofold:

1) To develop an instructional model to foster learning motivation and learning achievement based on self-efficacy and social cognitive development theories for lower primary students.
2) To evaluate the effectiveness of the developed model by implementing it in class.

## 1.3 RESEARCH QUESTIONS

In testing the research objectives, this study addressed the following research questions:

1) What does the instructional model look like?
2) What is the effect of the instructional model on primary students' learning motivation in mathematics?
3) Is there an improvement in student's mathematics achievement as a result of the treatment?
4) Which component in the instructional model is effective for increasing primary students' learning motivation?

## 1.4 RESEARCH HYPOTHESES

Based on the research questions and research findings about positive effects of motivational teaching on academic achievement and student attitudes towards learning (Malouff et.al., 2008; Mason & Stipek, 1989; NRCIM, 2004; Stipek, 1993; McCombs & Pope, 1994), the following directional hypotheses are generated for research questions 2, 3 and 4. Stated generally, the main research hypothesis is that the primary students will experience some positive changes in their measurement of learning motivation and learning achievement.

1. After learning using the developed model, the students will show higher learning motivation at the $p \leq .05$ significant level as measured by the modified Young Children Academic Intrinsic Motivation Inventory scale than before using the model.

2. After learning using the developed model, the students will achieve test scores at the set minimum criteria of 80% or higher.
3. All components in the developed model will be effective for increasing primary students' learning motivation.

## 1.5 DEFINITION OF TERMS

Certain terminology used in this study may have various meanings to different individuals. In order to facilitate a common understanding among readers for the purpose of this study, the relevant terms are defined as follow:

**Self-efficacy Theory**: The main aspect of this theory by Albert Bandura is that one's beliefs about own effectiveness in performing specific tasks affects one's motivation and performance on the tasks. Self-efficacy theory suggests four major sources of information used by people to form self-efficacy judgments. They are: (1) enactive mastery experiences, (2) vicarious experiences, (3) verbal persuasion, and (4) physiological states.

**Social Cognitive Theory**: A learning theory by Bandura based on the ideas that people learn by observing others within the context of social interactions, experiences, and outside media influences. The person's environment, behaviour and cognition are three main factors that reciprocally linked to influence development.

**Social Cognitive Development Theory**: A theory of Lev Vygotsky that focus on social interaction as having a fundamental role in the development of cognition. A second aspect of this theory is the idea that cognitive development is limited to a certain range at any given age, also known as the zone of proximal development.

**Instructional model based on self-efficacy and social cognitive development theories**: A model to guide teaching that has its principles derived from the theory of self-efficacy, which concerns a person's beliefs about own competence or ability, and social cognitive development theory which posits that social interaction plays a fundamental role in the development of cognition. The

principles aim to promote positive social relations through connection and communication, make learning attractive and meaningful, challenge students at their appropriate level, and provide choices to give students a feeling of ownership and competence. There are seven components of the model and they are: 1) Cordiality 2) Collection 3) Clarity 4) Coordination 5) Challenge 6) Confirmation 7) Communication. Based on those seven components, the instructional procedure for use in the classroom is developed as follow: Teacher creates a positive environment throughout the lesson by i) maintaining a positive ambience where students feel encouraged, accepted and unafraid to try, and ii) communicating faith in the students' ability and praising their effort and response. The lesson is taught in steps: 1) interest stimulation, 2) clear coordination, 3) individualized challenge, and ends with progress check.

**Learning achievement**: This study used mathematics as the content for instruction. Learning achievement, therefore, refers to the marks that the students gained in the mathematics tests that the researcher prepared, based on Benjamin Bloom's Taxonomy of Educational Objectives of knowledge, comprehension, and application.

**Learning motivation**: The scores that the students gained in the modified Young Children's Academic Intrinsic Motivation Inventory – mathematics scale. Learning motivation was further determined by observing the students' behaviours such as the choice of interested tasks, effort, and persistence on selected task; their answers to interview questions structured by the researcher to measure confidence and self-efficacy; and their social interaction with the teacher and peers.

**Primary students**: Children between the age of 6 and 12 who study in primary school.

**International school**: A private school that provides education system based on countries other than Thailand, and where English is used as the main medium of instruction.

## 1.6 SIGNIFICANCE OF STUDY

Applying the results of this study to a broad population will be of interest as learning motivation is a great concern for many parents and teachers. To assume that all teachers have the ability to motivate students in the classroom is quite unrealistic. More fresh graduates in fields other than Education are joining the teaching profession in Thailand's international schools arena, and many of them plunge into actual teaching without much experience and mentoring. In light of this, an instructional model will be an effective way to provide these teachers with an example they can readily replicate in class to motivate their students. Therefore, findings from this study will have various implications on the budding teachers.

The results from this study will be useful for educators to understand the effectiveness of the motivational techniques on the students' learning behaviour, especially towards an important subject like mathematics which often cause high anxiety and phobia among students. Findings from the present study will help educators to understand the importance of holistic development in cognitive, psychomotor and, the frequently-overlooked affective domains, in fostering students' motivation to learn the subject.

## 1.7 BOUNDARIES OF STUDY

The research design of this study is research and development divided into two phases. The first phase focuses on developing a model of instruction starting with Research 1 to analyse and synthesize related theories and research. This was followed by Development 1 where the first draft of the instructional model was developed. Research 2 involved evaluation by experts and tryout of the model, followed by Development 2 in which some details of the instructional model was changed based on results of Research 2 and a second draft of the model was developed. Thereafter, the second phase followed which focus on evaluating the effectiveness of the model using quasi-experimental research involving both quantitative and qualitative methods. The population of this study is the lower primary students in international schools in Bangkok. The subject selected to test the effectiveness of the model is Mathematics and the duration of teaching implementation to evaluate the model is 20 fifty-minute periods over 6 weeks to override the threat of maturation of the research

participants. However, such length of teaching period may be a limitation of this study if an answer to the longitudinal effect of the developed model is sought. Furthermore, the result of this study may not be representative of all Primary 2 students studying in all international schools or local schools in Thailand.

# CHAPTER 2

## REVIEW OF THE LITERATURE

This chapter reviews the literature that focuses on the following main areas:

2.1. Learning Motivation
2.2. Approaches to Motivation
2.3. Self-Efficacy Theory
2.4. Theory of Social Cognitive Development
2.5. Instructional Model Development
2.6. Context of Mathematics Learning in International Schools in Thailand
2.7. Mathematics Textbook Used in Australian International Schools in Thailand
2.8. Research Review about Motivation and Self-Efficacy
2.9. Conceptual Framework

## 2.1 LEARNING MOTIVATION

In defining learning motivation for this research, the researcher will first study the definitions of learning and motivation separately.

### 2.1.1 Learning

The definition of learning is many and varied. Some define learning as “a process through which experience causes permanent change in knowledge or behaviour” (Woolfolk, 1998, p.204). Others define it as “changes in behaviour due to experience” (Lefrancois, 1999, p.40). From those definitions, the common factors of learning are ‘change’ and ‘experience’. While the cognitive view of learning focus on a change in knowledge (which is not directly observable), the behaviourists focus on a change in behaviour (which can be seen). Furthermore, the change must be brought about by experience, i.e. by the interaction of a person with the environment.

A more elaborate definition of learning is found in the American Psychological Association description as “a process of discovering and constructing meaning from information and experience, filtered through the learner’s unique

perceptions, thoughts, and beliefs" (Kauchak & Eggen, 1998, p.10). This definition tells us that the change is dependent on the learner's interpretation of the experience, implying that the change is based on cognition.

### 2.1.2 Motivation

The word motivation originated from the Latin 'movere', which means 'to move'. Thus, to motivate means to get someone moving into action. People are motivated by different reasons. What motivates one person may not always motivate another. As such, definitions of motivation are also many and varied, and there is no consensus on the precise concept of motivation. Some define motivation as "a force that energizes and directs behavior toward a goal" (Eggen & Kauchak, 1994, p.427). Another defines motivation as "an internal state that arouses, directs, and maintains behaviour" (Woolfolk, 1998, p.372). Cognitive researchers and practitioners define motivation as "the process whereby goal-directed activity is instigated and sustained" (Pintrich & Schunk, 1996). Overall, most people agree that motivation and cognition are intertwined (Mayer, 2003, p.459).

In examining the last definition above, we see that as a process, motivation is intangible and not directly visible. So, when we say a person is motivated, we infer it from the person's behaviours such as choice of tasks, effort, persistence, attention, and the things they say. Other observable behaviours include active participation in class, completing work, and seeking assistance when having difficulty. Motivation involves goals. People have something in mind that they wish to achieve or avoid, which becomes their goal. Motivation also requires activity – something that people do physically, e.g. exerting effort, or mentally, e.g. planning and organizing – toward reaching their goals. Finally, "instigated and sustained" in the definition means that motivated people do not only start an activity, but will stay on it despite problems and setbacks, until they attain their goal.

### 2.1.3 The Nature of Motivation

Motivation explains why behavior occurs. People move into action due to a force known by various names such as need, drive or desire, and motive. A need refers to a lack or deficit in the human organism. A need can be physiological, such as

the need for food and water, or psychological, such as the need for affection, achievement and social recognition. A drive is the tendency towards a certain behavior brought about by an unsatisfied need. For instance, a need for food gives rise to a hunger drive. Finally, a motive is a cause of behavior. Our motives explain why we engage in some behaviours but not in others. For instance, Sam did not scream in class like he did at home because he wanted his teacher to think he was a good student.

Motivation can be general or specific. General motivation to learn is a disposition to master a variety of learning situations. This kind of motivation is stable over time because it resides in the learner, not the teacher or class. On the other hand, specific motivation to learn energises the student in a particular learning situation. It is unstable, changing from class to class and even from topic to topic within a given class. This kind of motivation resides in the teacher and the particular content learned (Eggen and Kauchak, 1994, p.427).

Motivation can be further classified as intrinsic, extrinsic, or a combination of both. Intrinsic motivation is associated with activities that are their own reward (Woolfolk, 1998, p.374). A student who is intrinsically motivated completes his task because he enjoys doing it and the satisfaction comes from seeing it accomplished. Extrinsic motivation, on the other hand, is created by external factors like rewards and punishment. A student who is extrinsically motivated completes his task either because there is a reward waiting or he does not want to get punished by the teacher. In other cases, a student completes his task because of both internal and external sources of motivation - he enjoys doing it (intrinsically motivated) and he wants to get the reward promised upon completion (extrinsically motivated). With this last case, research has shown that under certain circumstances, external rewards can actually undermine intrinsic motivation in a task (Lepper & Hodell, 1989, p.77).

### 2.1.4 Learning motivation

Based on the above descriptions, learning motivation is operationally defined as the desire to acquire knowledge or skill based on the learner’s perceptions of their ability as provided by the environment. Learning motivation will be measured using a modified version of Young Children’s Academic Intrinsic Motivation Inventory (Y-

CAIMI) which has been developed by Adele Gottfried. ‘Desire to acquire knowledge’ will be determined by observing the learner’s behaviours such as the choice of interested tasks, effort, and persistence on selected task. ‘Perceptions of ability’ will be determined by the learner’s answers to interview questions structured by the researcher to measure confidence and self-efficacy. ‘Environment’ refers to social interaction with the teacher and peers.

## 2.2. APPROACHES TO MOTIVATION

People motivate others in one of two general ways – by using external motivational resources such as rewards and incentives, or by nurturing internal motivational resources such as needs and cognitions. There are four main approaches to motivation that view the source of motivation as intrinsic, extrinsic, or a combination of both.

### 2.2.1. Behavioural Approach

In the late nineteenth century, Edward Thorndike derived the law of effect as principle of operant conditioning theory to explain how behaviour is determined by its consequences. According to Thorndike, the effect of a response leads to the behaviour being learned or not learned. About three quarters of a century later, B.F. Skinner elaborated on the law of effect and came up with the much-acclaimed reinforcement theory. The main essence of Professor Skinner’s theory is that he considered only past events to be relevant to prediction of behaviour. Accordingly he stated that we do what we do because of what has happened in the past, and not what will happen in the future (Bigge & Shermis, 2004, p.100). His reinforcement theory attempts to identify stimuli that have the effect of increasing the probability of a behaviour, based on past consequences. These stimuli are termed reinforcers, and can be used in various ways to bring the desired behaviour (through positive reinforcement) or eliminate undesired behaviour (through negative reinforcement). In any case, the behaviourists view the source of motivation as an extrinsic one. With regards to education, the behaviourist’s idea is that cognitive factors are not necessary in the explanation of learning.

Reinforcement techniques are used in virtually all classrooms. When teachers praise students, give grades or gold stickers, puts students’ work on public display, or

tell students to stay after school for detention for being disruptive, they are applying principles of reinforcement theory. In many ways, reinforcement theory is simple to apply – the teacher makes positive reinforcers conditional on desired behaviour and punishments conditional on undesired behaviour. Its simplicity explains the widespread application of it in the classrooms, even among the most cognitively-oriented and humanistic teachers. This strategy was most popular in the 1960's. However, research show that a student's learning motivation is not simply driven by external rewards like stickers or high marks, and a teacher who relies too much on rewards and punishment to control behaviour may cause long-term negative effects on student motivation (Stipek, 1993, p.37). Firstly, direct reinforcement decreased intrinsic motivation in students. If a student is interested in a particular subject, providing rewards in that subject actually decreases interest (Lepper & Hodell, 1989, p.77). Such effects are most likely to occur when the student's initial interest on the task is high, when the reward is unnecessary and excessive, and when the reward is viewed as a 'bribe'. Such negative effects, however, are less likely to occur when the reward is seen as a 'bonus'. Also, when the reward is based on task performance rather than task engagement, and convey to the child clear positive information about their high competence and ability at an activity, the reward will be less likely to undermine later intrinsic interest. Other disadvantages of direct reinforcement include the fact that it overlooks important aspects of learning such as the perceptions and beliefs of students (Yount, 2010, p.428).

Direct reinforcement is, however, effective in motivating behavior in disadvantaged learners and those who are not intrinsically interested in the subject at hand. Praising student achievements appropriately increases their level of effort (Eggen & Kauchak, 1994, p.272). Encouraging student efforts for completing assigned tasks increases their expectation of success. By providing habitual successful class experiences, not only will the students master the required skills, but they will also develop a positive feeling about the teacher, the subject and themselves.

Teacher Praise

Research has shown that the most effective reinforcer is teacher praise. Praise provides the student with information about their personal worth, and this is a

powerful motivator. However, to be effective, praise should be given with the following points in mind (LeFrancois, 2000; Woolfolk, 1998):

- Praise should be made on specific task because random praise is ineffective.
- Praise should be given in moderation because too little is ineffective and too much is meaningless.
- Praise should be perceived as credible, believable, and sincere.
- Praise should focus on student performances, and not teacher perceptions.
- Use prior performance as a benchmark for a student's improvement rather than the performance of peers.

In summary, behaviouristic approaches to motivation are extrinsic in nature and emphasize on the importance of positive and negative reinforcers. One very important reinforcer in the classroom is teacher praise, which should be used appropriately in order to be effective in yielding the desired outcome.

### 2.2.2. Humanistic Approach

The humanistic approach to motivation considers the intrinsic sources of motivation such as a person's needs for freedom, to make own choice, and to strive for personal growth. The humanists believe that people are continually motivated by the inborn need to fulfill their potential. So, from the humanistic perspective, to motivate students means to encourage their inner resources – their sense of competence, self-esteem, autonomy, and self-actualisation (Woolfolk, 1998, p.375). Two key humanistic theorists are Abraham Maslow with his theory of the Hierarchy of Needs, and Edward Deci with his self-determination theory.

Deficiency Needs

The Hierarchy of Needs consists of seven levels. Maslow called the first four levels deficiency needs, which are personal survival-oriented needs that must be satisfied before learners can develop the motivation to learn. The four levels are survival, safety, love, and self-esteem.

Survival needs refer to our immediate existence. Without food, shelter, and sleep, learners will not be motivated to seek other things. Safety needs refer to our

present environment. Learners need a sense of security and order in our environment before they are motivated to consider other higher needs. Love refers to our social environment. Learners need love and acceptance from family, teachers and classmates, before considering higher needs. Finally the need for self-esteem refers to the learner's acceptance of self, of being recognized and approved by others in the surroundings.

Growth Needs

Maslow called the higher levels growth needs which include knowing and understanding, aesthetic appreciation, self-actualisation, and transcendence (Yount, 2010, p.438). These higher needs are never satisfied, but they expand as people grow.

According to Maslow, human beings are constantly wanting and rarely reaching a state of satisfaction (Reeve, 1992, p.313). As one set of need is fulfilled, another set arises. For instance, once a child's basic needs of food and shelter are met, it will open the door to a need for a secure and safe environment. And if this is met, the child will desire for love from the people around him.

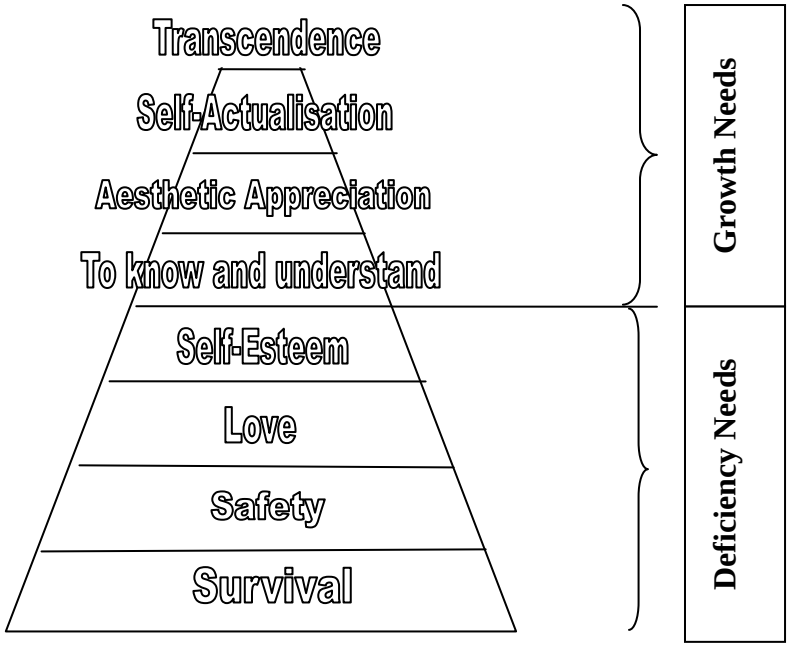



**Figure 2.1 Maslow's Hierarchy of Needs**

Source: Yount, 2010, p.439

One of the basic problems with Maslow's need hierarchy is that research found very little empirical evidence to support this theory. One study found that the rankings of the needs from least to most important do not conform to Maslow's predicted order. Another research that tested the validity of this hierarchy found that the importance ratings for the needs are not determined by age groups. The need for esteem was found highest for children and adolescents, instead of among the adults as Maslow had believed (Yount, 2010, p.441). Moreover, there is no definitive proof that once a need is satisfied, its strength diminishes.

Another approach to intrinsic motivation was developed by Edward Deci and Richard Ryan based on Robert White's humanistic thesis that people engage in intrinsically motivated behaviours when they view themselves as competent and self-determining in relation to the environment. Deci and Ryan (1985, p.32) named their motivation theory Self-Determination and define it as the capacity to choose and to have one's choices be the determinants of one's actions. They claimed that human beings have a natural need to feel self-determining and they want to believe they are engaging in activities by their own will rather than to achieve some external reward or avoid punishment (Raffini, 1993, p.65). In other words, people are intrinsically motivated when they perceive themselves as the cause of their own behaviour. Accordingly, an activity will be more motivating and enjoyable when people choose to do it themselves than when it is done because they were told to.

Intrinsic motivation is associated with better learning, performance, and well-being (Deci et.al., 1981). The conditions that were found to enhance intrinsic motivation include autonomy, positive feedback, and relatedness. While threats and surveillance undermine intrinsic motivation, providing choice increased autonomy, enhancing intrinsic motivation and boosting people's confidence in their performance. Positive feedback that foster perceived competence, and students' relation with warm and caring teachers were also found to enhance intrinsic motivation.

In summary, humanistic approaches emphasise intrinsic motives relating to autonomy, relatedness, and self-actualisation. Humanists' concern is on the students' personal development and self-esteem. Maslow's hierarchy of needs consider physiological needs as basic while psychological needs are considered at higher

levels. Deci and Ryan's believe that providing choices and positive feedback enhances motivation.

### 2.2.3. Cognitive Approach

Cognitive theorists believe that behaviour is determined by our thinking, not simply by whether we have been rewarded or punished for the behaviour in the past (Stipek, 1993, p.117). In other words, while reinforcement theorists focus on the person's environment, cognitive theorists focus on the person's interpretation of the environment. Like the humanists, however, cognitive theorists emphasize on intrinsic motivation. However, the difference between the two theories lies in their view of the important influences to motivation. Cognitive theorists consider that a person's beliefs, expectations, as well as attributions for success and failure, all influence a person's motivation. Bernard Weiner, a leading educational psychologist who relates attribution theory to school learning, proposed the causal dimensions of attributions.

According to Weiner, the causes of outcomes can be classified along three dimensions: locus of causality (internal vs. external), stability (stable vs. unstable), and controllability (controllable vs. uncontrollable) by the individual (Schunk & Zimmerman, 1994, p.81). The following table presents a 2 x 2 matrix of two of these dimensions and the typical attribution for each of the four cells in the matrix, with the third dimension of controllability in the brackets.

***Table 2.1 Matrix of Causal Dimensions of Attributions***

| | Locus of Causality Dimension | |
|---|---|---|
| Stability Dimension | Internal | External |
| Stable | Ability *(Uncontrollable)* | Task Difficulty *(Uncontrollable)* |
| Unstable | Effort *(Controllable)* | Luck *(Uncontrollable)* |

Source: Reeve, 1992, p.238

Causes that are both internal and stable give rise to an ability attribution which the individual has no control of, e.g. I fail because I am not smart. Causes that are internal but unstable are attributed to effort of which the individual can control, e.g. I

fail because I did not study for the test. Causes that are external and stable are attributed to task difficulty which the individual has no control of, e.g. I fail because the test is just too hard. Causes that are external and unstable are attributed to luck of which the individual has no control, e.g. I fail because I guessed wrongly on what to study.

**Table 2.2 Attribution of Outcomes**

| | | **Locus of Control** | |
|---|---|---|---|
| | | **Internal** | **External** |
| **Stability** | **Stable** | I'm not smart in maths! *(Ability)* | The test was just too hard! *(Task Difficulty)* |
| | **Unstable** | I did not study for this test! *(Effort)* | I guessed wrongly on what to study! *(Luck)* |

Attribution theory is not without criticism. Nisbett and Wilson (Reeve, 1992, p.251) argued that people usually do not make attributions to explain the outcomes in their lives. They pay much attention to their outcomes but little attention to the attributions of why the outcome occurred. They look at the consequences more than the causes of the outcome. Furthermore, they reported that there is little evidence that attributions have any direct effect on the person's behaviour.

Another key theorist with a cognitive approach to motivation is Martin Covington who developed self-worth theory. Self-worth concerns people's appraisal of their own value. Its basic assumption is that human beings naturally strive to protect their sense of self-worth when it is threatened, such as in the case of public failure (Stipek, 1993, p.148). In relation to learning, Covington believes that children feel most shameful and distressed when their failure appears to reflect low ability, rather than when the failure can be attributed to some other cause like low effort. As a result, to protect their self-worth, children try to maximize perceptions of their ability by putting little effort, so that if they fail, they can attribute the failure to low effort rather than low ability. This, however, is in conflict with the teacher's goal which is usually to maximize student effort, and thus it often creates tension between the teacher and student. Covington further points out that a competitive learning

atmosphere threatens the self-worth of some students who can never achieve success in comparison with their more able peers. And the result is that these children develop defensive strategies to protect their worth.

In a nutshell, the cognitive theorists believe that learning motivation is encouraged when the sources of motivation are intrinsic, the goals are personally challenging, and the individual student attributes successes and failures to controllable causes, and believes ability can be improved.

### 2.2.4. Social Learning Approach

Social learning theories of motivation are integrations of behavioural and cognitive approaches. Back in 1941, Neal Miller and John Dollard in their social learning theory hypothesized that if people were motivated to learn certain behaviour, then they would learn that behaviour through direct observations. By imitating the observed actions, the observer will internalize the learned action and will be rewarded with positive reinforcement. The social learning theory proposed by Bandura is rooted in many basic behavioural concepts, but the main difference with behavioural approach is that Bandura disputed B.F. Skinner's assertion that all behavior change results from reinforcement. He argued that direct reinforcement of the observer is not necessary for learning to occur. According to him, people can learn new behavior just by watching others, and he termed this type of learning as observational learning or modeling. The main concepts of Social Learning theory is that (1) people can learn through observation; (2) the person's mental states or cognition is essential in this learning process; and (3) learning through observation does not automatically produce a change in the observer's behavior. When an observer wants to be like the model, learning occurs simply by observing the model. Learning is strengthened in the observer when the model is reinforced, also known as social modeling.

Bandura's initial research in observational learning centred on the social modeling of aggression. In his experiment involving the now famous inflated plastic Bobo doll, children observed an adult model beat up the doll violently. The children who had observed the aggressive modeling subsequently adopted much of the displayed behaviour. The results from Bandura's research revealed that children did learn by observation, even when there is no reinforcement (e.g. reward) involved. He

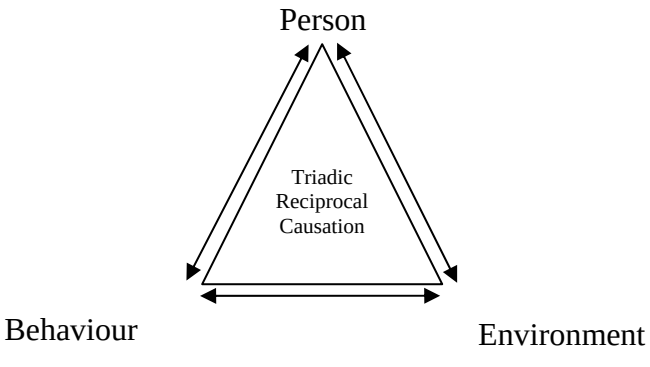
concluded that social modeling, which he termed vicarious reinforcement, was a powerful process that could explain for various forms of learning.

## SOCIAL COGNITIVE THEORY

In a later experiment to help people overcome phobic threats, Bandura discovered that powerful guided mastery experiences allowed people with snake phobias to overcome their long-time fear in just a few hours' treatment. He termed this treatment as participant modeling, and suggested that it is effective because it provides individuals with experiences that enhance their perceptions of self-efficacy, where the experiences come in the form of performance accomplishments. The major finding of this study was that people can regulate their behaviour through their belief in their own capabilities. This finding led Bandura to recognise the influential contribution of cognitive processes to human motivation and action. His further research on the influences that social and cognitive processes have on human thought and action eventually led him to develop his social cognitive theory.

Social cognitive theory is therefore rooted in the concept of human agency. This means that people are agents who develop themselves and make things happen by their own actions. His use of 'social' in this social cognitive theory implies that "behaviour, cognitive and other personal factors, and environmental influences all operate interactively as determinants of each other" (Bandura, 1986). His use of 'cognitive' implies that cognition is a central knowing process in learning procedures. His theory, therefore, centres upon how people gain understanding of themselves and their environments and how they act in relation to those understandings. This theory is thus based on a Triadic Reciprocal model where our cognition (person), behaviour, and environment work jointly to influence the way we behave.

**Figure 2.2 Triadic Reciprocal Model**



According to Bandura (1986), “people possess a self-system that controls their thoughts, feelings, motivation and actions”. The most significant personal factor that control thoughts, feelings, and actions is self-beliefs. This means that what people think, believe and feel affects how they behave. People also have the ability to symbolize, engage in forethought, learn by observing, self-regulate, and self-reflect. The ability to symbolize refers to our ability to use symbols as representation, including the ability to store the information required to guide future behaviors. The ability to engage in forethought is the ability to plan courses of action, anticipate the likely outcome of those actions, and set goals to guide them. It is this capability that enables human beings to anticipate the outcome of an action without actually doing it.

| **Table 2.3 Social Learning Stages** | |
|---|---|
| Attention | Observer attends to the behavior of a respected model |
| Retention | Observer encodes behavior, for recall and mental rehearsal |
| Production | Observer practices behavior on his own |
| Motivation | Observer may be reinforced directly or vicariously, or self-reinforced |

Learning by observing the behaviours of others is through the four-step processes of attention, retention, production, and motivation as shown in the table above. Attention refers to the ability to observe the actions of a model. Retention is made possible by human capability to symbolize, and it refers to the ability to retain what has been observed. Production refers to the ability to engage in the observed behavior, and motivation refers to the desire to repeat the behavior in the future because it produced valued outcome. Bandura’s view of the ability to self-regulate refers to people’s ability to make changes in their behavior through self-evaluation. Finally, self-reflect refers to the ability to make sense of our experiences and explore our own cognitions and self-beliefs.

Of all the human abilities, Bandura claimed that the ability to self-reflect is the most unique human characteristic because it enables us to evaluate our own experiences and thought process. Through reflection and self-evaluation, we can change our own thinking and behaviour. Bandura (1997, p.2) claimed that the beliefs we hold about our abilities and about the outcome of our efforts exert greater influence on our behaviour and are better predictors of our subsequent performances,

than our knowledge, skill, or past performance. In fact, perceptions of ability play an important role in all cognitive theories of learning motivation.

Almost all children possess “intrinsic” motives for learning (Bruner, 1966, p.114). An intrinsic motive is one that does not depend on external reward. The reward comes in the form of a good feeling that follows successful completion of the task. Bandura found one aspect that has important implications for intrinsic motivation and that relates to our personal judgment of our effectiveness and competency, which he termed self-efficacy. The intrinsic motivation to learn requires self-regulation and according to Bandura, self-regulation strongly depends on self-efficacy beliefs (Zimmerman, Bandura & Martinez-Pons, 1992, p.423). He regards the self-efficacy belief system as the foundation of human motivation and personal accomplishments. Unless people believe that their actions can produce the outcomes they desire, they have little incentive to act or to persevere in the face of difficulties (Pajares, 2005, p.339). Self-efficacy beliefs affect people in all aspects of life, including educational experiences. Beliefs about our own competence to perform a task successfully can affect motivation, interest, and achievement (Bandura, 1997, p.3). People will have the incentive to act or to persevere in the face of adversities if they believe they can bring about the desired outcomes by their actions. Based on this, self-efficacy theory was formulated.

In summary, social learning theory is a behavioural theory with cognitive elements, emphasizing observational learning and vicarious reinforcement. Social cognitive theory is an extension of social learning theory, and based on a triadic relationship among the learner’s personal characteristics, behavioural patterns, and the social environment.

## 2.3. SELF EFFICACY THEORY

Self-efficacy refers to the beliefs in one’s capabilities to organise and execute courses of action required to produce given attainments (Bandura, 1986, p.391). From his own research, Bandura found that people’s self-efficacy affects the sorts of choices they make in very significant ways. In particular, it affects their levels of motivation and perseverance in the face of obstacles. Numerous other studies have confirmed this finding, showing that students with a high sense of academic efficacy

display greater persistence, effort, and intrinsic interest in their academic learning and performance (Zimmerman, Bandura & Martinez-Pons, 1992, p.674).

Bandura (1997, p.2) contended that "people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true". Consequently, how people behave can often be predicted by the beliefs they have about their own capabilities than by what they are actually capable of achieving. In that sense, self-efficacy is a better predictor for people's achievements than their past achievements, knowledge or skills. Several critiques express doubt on the feasibility of this theory, to which Bandura explains that he does not mean people can achieve tasks beyond their capabilities just by simply believing that they can, because achievement requires a combination of self-beliefs and possessed skills and knowledge. What it means, however, is that self-efficacy beliefs help determine what people do with the knowledge and skills they have. People's beliefs about how likely they are to succeed in a given task (i.e. their self-efficacy beliefs for the task) strongly influence what they choose to do, how much effort they are willing to put into it, and how persistent they will be. In short, self-efficacy affects motivation, and self-efficacy beliefs can be strong predictors of performance when they are in harmony with other variables such as knowledge and skills, and perceived value of outcomes. This view is consistent with the findings from many researches (Bandura, 1997; Linnenbrink & Pintrich, 2002, p.313; Nilsen, 2009, p.545). The theory of self-efficacy is therefore giving educators new hope in enhancing the children's motivation to learn.

### 2.3.1. Sources of Self-Efficacy Beliefs

People's beliefs about their efficacy are susceptible to change during the course of life. Accordingly, children's beliefs about their efficacy change during the schooling years. Very young elementary school children frequently have high self-efficacy beliefs about their competence. A majority of first graders rank themselves near the top of their classes with respect to things like reading ability (Wigfield, et al, 1998). However, as time goes by, their self-efficacy tends to decline and, in the end, sadly becomes more highly correlated with actual success as reflected in school grades. Before analysing the causes of the decline in the children's self-efficacy, let us look at the four main sources from which people form their self-efficacy beliefs.

### a. Enactive Mastery Experience

Enactive mastery experiences are the most influential source of efficacy information because they provide the most authentic evidence of whether one can muster whatever it takes to succeed (Bandura, 1997, p.80). Based on his earlier findings, Bandura affirmed that a small achievement that persuades individuals they have what it takes to succeed often enables them to go well beyond their immediate attainment to higher accomplishment and even to succeed at new activities or in new settings. Put simply, successes build higher self-efficacy, while consistent failures undermine it. This relationship, however, is not so straightforward because self-efficacy judgments involve other factors such as the task's difficulty level, the amount of effort exerted and the amount of help received.

Task

Tasks that are perceived as easy will not give the students who complete them a feeling of efficacy. Likewise, school tasks that are too difficult and do not lead the student to mastery despite repeated efforts, will lower the student's self-efficacy. To raise feelings of efficacy and maximize intrinsic motivation, children must be given challenging but achievable tasks. It should be of intermediate difficulty so as to allow students to observe their skills improving and to experience some success. Bandura (1997, p.80) claimed that development of the cognitive basis of human competencies is facilitated by breaking down complex skills into easily mastered subskills and organizing them hierarchically. Stipek (1993, p.86) suggests that the school tasks be ordered by difficulty level to provide students with a sense of increasing mastery, and thereby enhance their self-efficacy. All in all, the importance of matching tasks to each child's skill level cannot be overlooked. Although it may be difficult to implement, it is deeply necessary for developing the child's motivation to learn.

There are a variety of ways to individualise tasks to meet the children's varying ability and skill levels. One of them is mastery learning, in which the teacher breaks a course into small units of learning to give students specific skills to work towards and to allow individualised evaluation of increments in mastery. These evaluations provide the teacher and student with feedback about the student's progress toward achieving the educational objectives (Stipek, 1993, p.200). The

student is given additional assignments based on his level of mastery. However, this method has its limitation. Although this method show positive effects on children's achievement, they are not entirely effective in achieving motivation-related goals, such as focusing students' attention on improving their own skills as opposed to competing against classmates. Despite this limitation, mastery learning provides teachers with models that can be adapted to their teaching style and individual student needs.

Even whole class instruction can involve some individualisation. Research show that Asian teachers accommodate to individual differences in skill levels by continuously changing their mode of presentation. They often stop in the middle of a whole-class instructional periods and give students one or a few problems to do at their seats, individually or in small groups. Teachers engage all students by encouraging different solution strategies, which are discussed by the class when students have all completed the problems. Incorrect solutions become topics for discussion from which all children can learn (Stipek, 1993, p.89). Another study of the whole-class format found that teacher-student interactions during instruction play a significant role in motivating children. Highly motivating teachers are those who create mini-dialogues with individual students to adapt to different levels of understanding and provide other students an opportunity to learn by listening.

Chinese teachers, on the other hand, have developed a way to make sure that all students in a class are challenged by written tasks without individualising assignments. In China, assignments and tests always include some very easy problems that every student in the class can solve and some very difficult problems that no student in the class can solve (Stipek, 1993, p.90). This is a clever method of challenging the fast learners and encouraging them to strive for a higher level of understanding without discouraging the slow learners from trying. This is certainly a more efficient way of dealing with individual differences in ability than preparing many different assignments and tests. In any case, all the studies mentioned above show how teachers can develop students' feelings of efficacy through their intervention of providing challenging and achievable tasks.

Effort

Performance attainments are partly determined by the effort one exerts in the task. Children and adults view differently the relationship between effort and ability. For young children, high effort means more ability, whereas for adults, the need to exert high effort implies low ability.

Studies conducted by attribution theorists have examined how causal judgments of effort and task difficulty affect performance. Bandura (1997, p.84) criticised the classification, saying that the elements of effort, ability, task difficulty, and luck are not objective but relational. For instance, task difficulty is not a stable external cause because the same task that is trivially simple for a mathematician is extremely difficult for a child lacking basic mathematics skills. Furthermore, Bandura pointed out that particular factors picked by attribution theorists will influence performance largely through their intervening effects on self-efficacy beliefs. For example, attributing failure to insufficient effort will increase motivation only if the child believes he has the capability to succeed. If he has a low self-efficacy, he will see it as useless to exert additional effort. Hence, Bandura claimed that perceived self-efficacy has a greater predictive power for understanding motivation.

Children's understanding of the relationship between effort and ability differs. Some research had cautioned teachers on the adverse effect of complimenting or praising students' achievement by attributing it to the students' effort. Such compliment may be effective for young children who perceive effort and ability as synonymous, but not for children about the age of 11 or 12 who can fully differentiate performance, effort and ability. Under some circumstances, this group of children perceives high effort as evidence for low ability (Stipek, 1993, p.144).

Help

Students should be given assistance when they need it, but unnecessary help can prevent children from taking credit for completing a task. Children who are given a lot of help will not attribute outcomes to their own effort and competencies. Consequently they will not get a feeling of efficacy that comes with the successful completion of task. Several research show the adverse effect of unnecessary help on

children's motivation. Children who are overhelped display low persistence level (Stipek, 1993, p.103). The point is not that children should not be helped, but rather that help needs to be given in a way that enables the children to complete the tasks on their own. Thus, to increase the self-efficacy and motivation of the students, teachers need to encourage independent problem-solving as much as possible.

In summary, mastery experience is the most important factor affecting a child's self-efficacy. The children need to see that they are truly capable of better results, before they can believe what others say about them.

**b. Vicarious Experience**

In addition to interpreting results based on actual experiences, students form their self-efficacy beliefs through the vicarious experience of observing others perform the task. Vicarious (or observational) learning occurs when people acquire new attitudes, skills and behaviours by watching and imitating the actions of others (Kauchak & Eggen, 1998, p.267). For example, children sometimes believe they can do a task after watching their peers complete the task successfully. Bandura points out that vicarious experiences are most influential in situations when the child has little personal experience with the task. Self-efficacious children will raise their efficacy even higher if the person modeling the task can teach them better ways of doing things. Furthermore, children are more likely to imitate the actions of others who seem competent, powerful, and prestigious – people who are significant in their lives. Having said that, Schunk and Hanson found that when exposed to skilled peer or adult models showing the same cognitive skills, children derive a stronger sense of personal efficacy from peer modeling (Bandura, 1997, p.98).

Teachers take advantage of observational learning when they model positive attitudes such as tolerance and respect for other people. They also use modeling when they demonstrate complex skills on the board such as solving algebraic equations. Research indicates that teacher modeling is one of the most powerful vehicles available for teaching these kinds of attitudes and skills (Bandura, 1993, p.124). In teaching rules and strategies, providing many modeled examples demonstrates how the rules can be applied to fit changing circumstances. Models exhibit efficacy by word as well as by action. While struggling with problems, they may voice hopeful

determination and the conviction that problems are surmountable and valued goals are achievable, or discouragement and the futility of continued effort. Models who express confidence in the face of difficulties instill a higher sense of efficacy and perseverance in others than do models who begin to doubt themselves as they encounter problems (Bandura, 1997, p.88).

Bandura notes that there are four important elements to be considered in observational learning – attention, retention, production, and motivation or reinforcement. At the Attention stage, to learn through observation, we must pay attention. At the retention stage, to imitate the behavior of a model, we must remember what the model did. At the Production stage, practice doing what the model did makes our performance better. At Motivation stage, the anticipation of some reinforcement gives us motivation or incentive to reproduce the behaviour. With regards to reinforcement, Bandura further identifies three forms of reinforcement that can encourage observational learning (Woolfolk, 1998, p.228):

(1) Direct reinforcement: the observer may reproduce the behaviours of the model and receive direct reinforcement, as when a gymnast successfully executes a front flip and the coach/model says “Excellent!”

(2) Vicarious reinforcement: the observer sees others, e.g. on TV, reinforced for a particular behaviour and then increase his production of that behaviour.

(3) Self-reinforcement: controlling own reinforcers, e.g. promising oneself a vacation for finishing some amount of work.

Self-modeling

Altering efficacy beliefs through vicarious influence is not simply a matter of exposing people to models. It was found that self-modeling, which involves observing oneself performing, can also affect one’s sense of efficacy. Bandura notes that the performance improvements accompanying successful self-modeling are mediated by increases in beliefs of personal efficacy. Self-modeling has remarkably wide applicability and often succeeds with self-doubters where other instructional, modeling, and incentive approaches fail (Bandura, 1997, p.94). Self-modeling can be

achieved by structuring performance tasks in ways that ensure progressive mastery or by arranging conditions that bring out the best of one's capabilities. Schunk and Hanson used this self-modeling strategy to develop cognitive skills in children. Those who had the benefit of observing themselves perform successfully in the initial phase of learning developed a stronger belief in their learning efficacy. As a result, they subsequently mastered the full range of cognitive skills faster, and had a higher sense of cognitive efficacy, and outperformed their counterparts in the control group (Bandura, 1997, p.94). Furthermore, those who voice self-efficacious beliefs when they struggle with difficult tasks are found to have less distress.

### c. Verbal Persuasion

Social persuasion is another means of strengthening people's beliefs in their capability. Bandura theorized that people need not only effective rules and strategies, but to be persuaded that they can exercise better control by applying them consistently and persistently. In his research on the benefits of strategy training, Schunk (1987, p.165) found that instruction on the strategy improved neither the children's sense of efficacy nor their academic attainments. But, reminding the children that they were exercising better control over academic tasks by using the strategies and giving success feedback as evidence that they were applying the strategies well, substantially enhanced the children's efficacy beliefs and intellectual attainments. This shows that skill transmission with social validation of personal efficacy produces large benefits. Bandura (1997) further suggests that to dislodge a low sense of personal efficacy, it requires explicit, compelling feedback that forcefully disputes the preexisiting disbelief in one's capabilities. Once a strong sense of efficacy is developed through repeated successes, occasional failures are unlikely to undermine belief in one's capabilities.

Children develop self-efficacy beliefs as a result of the verbal persuasions they receive from significant others. These persuasions can be in the form of verbal judgments or written messages. Bandura (1997, p.105) found that people who are persuaded verbally that they possess the capabilities to master given tasks are likely to exert greater effort and sustain it than if they have self-doubts. Persuaders, therefore, play an important part in the development of a child's self-beliefs. A teacher or parent can sometimes persuade children that they are able to achieve some goal. However,

these social persuasions should not be some insincere praise or aiming towards an unrealistic goal. As Erik Erikson (excerpt found in Wikipedia) put it, “Children cannot be fooled by empty praise and condescending encouragement. …… what I call their accruing ego identity gains real strength only from wholehearted and consistent recognition of real accomplishment, that is, achievement that has meaning in their culture.” Effective persuaders must cultivate people's beliefs in their capabilities while at the same time ensuring that their success is attainable. In some cases where the task is new, encouragement like “Try it, I know you can do it” can be effective in strengthening a child’s self-confidence when it is given by someone they trust. And, just as positive persuasions may work to encourage and empower, negative persuasions can work to defeat and weaken self-efficacy beliefs. In fact, it is usually easier to weaken self-efficacy beliefs through negative appraisals than to strengthen such beliefs through positive encouragement.

Feedback

The effects of evaluative feedback on efficacy beliefs have been examined extensively by Schunk. In his studies, children with mathematical deficits pursue a program of self-directed instruction during which they receive prearranged attributional feedback, regardless of their actual performance, that carries efficacy implications. They are told from time to time that their work shows they are capable, that they have been working hard, or that they need to work harder (Bandura, 1997, p.100). Evaluative feedback highlighting personal capabilities raises efficacy beliefs. Feedback that the children improve their capabilities through effort also enhances perceived efficacy, although not as much as being told that their progress shows they have the ability for the activity.

People do not always believe what they are told about their abilities. Simply telling them they are much more capable than they believe themselves to be will not necessarily make it so. In classroom teaching, to instill efficacy beliefs in the children, Bandura (1997, p.105) suggested that teachers present the pursuit as relying on acquirable skills, raise the children’s beliefs in their abilities to acquire the skills, and model the requisite skills. The teacher then structures activities in masterable steps that ensure a high level of initial success by the students, and provide explicit feedback of continued progress. Teachers, therefore, should do more than simply

convey positive feedback to the students. In addition to cultivating the children's beliefs in their capabilities, the teacher should structure activities in ways that bring success and avoid placing them prematurely in situations where they are likely to experience repeated failure. To do this effectively, the teacher must know how to tailor activities so that they can turn potentiality into actuality. Moreover, to ensure progress in personal development, the teacher should encourage the children to measure their successes in terms of self-improvement rather than in terms of triumphs over others.

### d. Physiological and Affective States

In judging their capabilities, people rely partly on information conveyed by their physiological and affective states such as anxiety, fear and stress. People measure their degree of confidence by the emotional states they experience. If a student taking a test has sweaty palms and fast heart beats, those with low self-efficacy may take this as a sign of their own incompetence, thus decreasing their self-efficacy further, while those with high self-efficacy are likely to interpret such physiological signs as normal and unrelated to their actual ability. Thus, it is the person's beliefs in the implications of their physiological response that changes their self-efficacy.

High arousal can lower performance. Hence, people usually expect success in a situation when they are not stressed. Stress reactions to lack of control of the situation generate further stress and lower self-efficacy. One way to raise self-efficacy beliefs is to improve physical and emotional well-being and reduce negative emotional states. Treatments that eliminate emotional reactions to subjective threats through mastery experiences increase beliefs in efficacy with corresponding improvements in performance (Bandura, 1997, p.106). This implies that a child's enactive experiences in achieving success on a task will in itself lower the child's negative emotional reactions to the task. Furthermore, there is evidence that the less absorbed people are in the task, the more they focus attention on themselves and notice their negative reactions to the taxing situation (Bandura, 1997, p.107). This suggests that teachers should arrange their classroom activities to be engaging so that the students will be absorbed in the task and not focus on their negative reactions.

Students who believe their value in the teacher's eyes depends on their success on academic tasks feel anxious about performance because they risk rejection and humiliation. Students who believe that the teacher respects and supports them, regardless of their performance, take risks and enjoy school tasks more (Stipek, 1993, p.113). Relationships among children also affect students' enjoyment and ability to concentrate on tasks. Based on these findings, in order to lower student anxiety and make them focus attention on task, teacher should arrange a positive learning environment where there is no comparison of grades, and provide the children some choice on the tasks. By providing the children some choice, the teacher is fostering autonomy and perception of control by the children, just as the humanists have proposed. Since people have the capability to alter their own thinking and feeling, enhanced self-efficacy beliefs can, in turn, powerfully influence the physiological states themselves.

In summary, the ideas of self-efficacy are useful in understanding learning behavior. Judgments of self-efficacy are affected by enactive mastery experiences (habitual success raise positive judgment), vicarious experiences (comparison with others), verbal persuasion (persuasion by others), and physiological and affective states (high arousal can increase or decrease judgments of self-efficacy).

## 2.4. THEORY OF SOCIAL COGNITIVE DEVELOPMENT

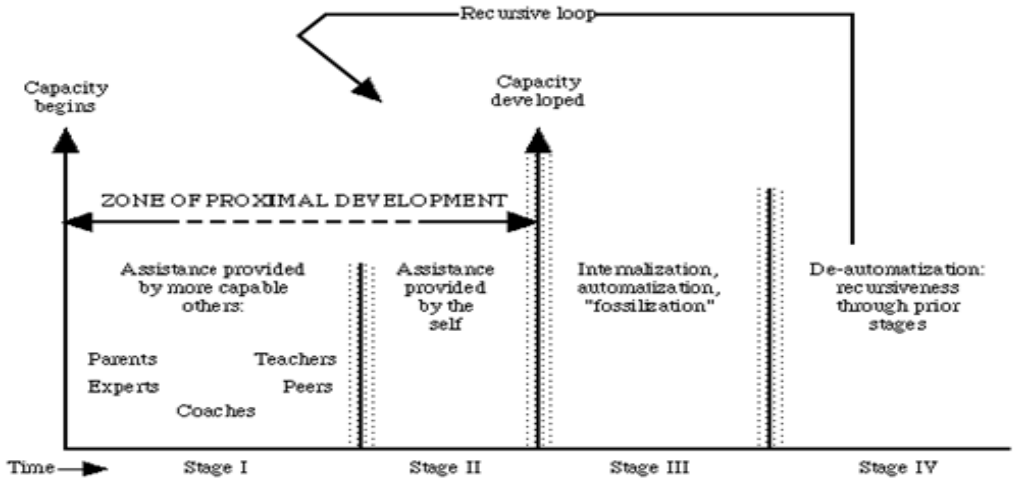
Russian psychologist Lev Vygotsky believes that learning occurs in a social context. In fact, Bandura's social learning theory, which believes that social interaction plays a fundamental role in the development of cognition, is complementary to Vygotsky's theory of social cognitive development. While Jean Piaget, a renowned Swiss psychologist, believes that development necessarily precedes learning in a child (i.e. the child must be developmentally 'ready' before they can learn), Vygotsky feels that social learning precedes development. Readiness to learn, in Vygotskian terms, involves not only the state of the child's existing knowledge but also his capacity to learn with help (Wood, 1988, p.25).

Vygotsky's theory emphasizes the role of social collaboration in learning through the child's interaction with people in their environment. According to

Vygotsky, a child's potential for learning is often realized in interactions with more knowledgeable others (MKO). The MKO refers to anyone who has a higher ability level than the learner in regards to a particular task, process, or concept. The MKO is usually a teacher, coach, or older adult, but the MKO may also be peers, a younger person, or even tools such as computers. The MKO provides 'scaffolding', a term used to describe the changing support over the course of a teaching session, with the more skilled person adjusting guidance to fit the child's current performance level (Santrock, 2007, p.229). For example, when a student is working on a task but is not yet able to successfully do each part without some kind of support, the teacher's scaffolding is needed. With the help of the MKO, the learner is able to assimilate more complex ideas and concepts than could be managed alone. This potential for cognitive development is what Vygotsky describes as the "zone of proximal development".

The zone of proximal development refers to the difference between the child's current level of performance and the level of performance that the child could attain with expert guidance (Mayer, 2003, p.432). It bridges the gap between what is known and what can be known, and Vygotsky claimed that learning occurs in this zone. So, while Piaget would assume that the child does not yet have the mental ability to solve a problem, Vygotsky would offer encouragement or strategies, in the form of scaffolding, in order for the child to solve the problem. Vygotsky also defines the zone of proximal development as having four learning stages as follow (Tharp & Gallimore, 1988, p.35):

**Figure 2.3 Zone of Proximal Development**




Source: R.G. Tharp and R. Gallimore's (1988) Modified Zone of Proximal Development

| Table 2.4 Stages in Zone of Proximal Development | |
|---|---|
| Stage I | Assistance provided by more capable others<br>- The child relies on MKO such as teachers or more capable peers to help with their task performance, until they can progress to the next stage |
| Stage II | Assistance by self<br>- The responsibilities which were formerly shared between the MKO and the child, will now be taken over completely by the child. Therefore, at this stage, the child performs the task without help from others |
| Stage III | Automatisation<br>- The child's ability to perform the tasks smoothly and successfully time after time without any assistance indicates that he has reached the stage of internalization and automatisation. Performance here is already fully developed and Vygotsky described it as the fruits of development or fossilization |
| Stage IV | De-automatisation – recursiveness through prior stages<br>- This stage describes the child's return to Stage 1 in an entirely new process of learning a different task |

Vygotsky's definition of the zone of proximal development (ZPD) leaves open to us to identify how we should guide the children such that their development is enhanced and, in the process, we need to specify what the children learned in the course of interaction between the teacher and the student.

With regards to young children's learning abilities, research in the Vygotskian tradition showed that children's ability to learn and remember things arises as a natural and often incidental consequence of their activities. The children remember more spontaneously when they have the opportunity to actively involve or interact with the learning materials and their concentration on the task help them to become consciously aware of the objects. In other words, the processes involved in learning situations take place first in external, observable and social terms before being internalized by the child to become personal, mental activities (Wood, 1988, p.61). From this finding, it follows that if we want children to learn and remember things, we must often 'scaffold' the process for them by setting tasks, arranging materials, reminding and prompting them. By breaking complex tasks into smaller, manageable problems, we make the complex task more achievable to the child, thereby helping

them to become confident in managing their learning. When we, as experts, suggest, remind, praise, or prompt, we are revealing to them the thought processes that are in our head, so that they will become more familiar with it and develop themselves along similar lines of thought processes. Vygotsky believes that such external and social activities which we provide will gradually be internalized by the child and eventually form their processes of mental self-regulation, which Bandura believes the same. Vygotsky views such instruction and attempts to guide children as the 'raw material' of learning and development.

One instructional model that implements Vygotsky's theory of the important role of social interaction is reciprocal teaching. Reciprocal teaching takes place in a learning group consisting of a teacher and one or more students (Mayer, 2003, p.440). Teacher and students take turns to 'teach', with the teacher providing comments, feedback, and hints as needed. The interaction involves dialogues which occur between teacher and student or between students. The dialogue is structured by using four strategies which are predicting, questioning, clarifying, and summarizing. Results from most studies which implemented reciprocal teaching in reading showed positive gains made by the students in the area of reading comprehension. The most distinguishing aspect of reciprocal teaching is that the student assumes the role of a teacher and learns by teaching. In that sense, the student learns to take up an important role within a social situation. Here, we find one of Vygotsky's concepts which is congruent with Bandura's concept of vicarious learning, in which children learn through modeling.

Finally, a notable aspect of Vygotsky's theory in relation to learning is that "instruction is most efficient when students engage in activities within a supportive learning environment and when they receive appropriate guidance that is mediated by tools." (Vygotsky, 1978, p.25). These instructional tools can be defined as cognitive strategies, a mentor, peers, computers, printed materials, or any instrument that organizes and provides information for the learner.

So, in contrast to the traditional method of passive learning, Vygotsky's theory of social cognitive development promotes learning contexts in which students play an active role. Roles of the teacher and students are therefore shifted, as the teacher collaborates with the students in order to help facilitate meaning construction in

students. Learning therefore becomes a reciprocal experience for the students and teacher. Instructional strategies that apply Vygotsky's theory are not necessarily the same. The activities and format can vary considerably across classrooms, but Maddux, et.al. (1997) described four principles that are applied in any Vygotskian classroom:

1. Learning and development is a social, collaborative activity.
2. The zone of proximal development can serve as a guide for curricular and lesson planning.
3. School learning should occur in a meaningful context.
4. Relate out-of-school experiences to the child's school experience.

## 2.5. INSTRUCTIONAL MODEL DEVELOPMENT

Instructional models provide procedures or guidelines for teaching based on learning theories. Joyce and Weil (1996, p.385) maintained that an instructional model is not a fixed, inflexible formula for teaching because when implementing a teaching model, each learner's style of learning has to be taken into consideration. Robert Gagne analysed the important variables in learning and identified the following nine components of a lesson plan known as "nine events of instruction" (Ornstein, 2000, p.141): 1) Gain attention; 2) Inform learner of objective; 3) Recall prior knowledge; 4) Present the stimulus material; 5) Provide learning guidance; 6) Elicit performance; 7) Provide feedback; 8) Assess performance; and 9) Ensure retention and transfer. The components in Gagne's model are controlled by the teacher and there is no provision of choice for the students. Other literature has revealed that people have different learning motivation and learning styles which teachers must take into account when teaching. Joyce and Weil grouped various teaching models into four main families – behavioural, social, personal, and information-processing. The behavioural models consider the student's ability and prior achievement in adjusting the pace and complexity of tasks for the students. The social models consider the interaction of diverse minds and personalities of the students in planning instruction. The personal family considers the uniqueness of the student and tries to help the students take charge of their own growth. Meanwhile, the

information-processing family considers the students' cognitive development and style and adjusts instruction accordingly (Joyce & Weil, 1996, p.386).

The earlier part of this chapter has provided a background for understanding students' learning based on different theories of motivation. The information gathered would be synthesized to develop an instructional model that can be used to promote learning motivation and learning achievement in the students, taking into account their development in cognitive, psychomotor as well as affective domains. The main parts to consider for the instructional model development are teacher characteristics, classroom environment, and the student's self-efficacy.

*Teacher characteristics*

Teachers, being the oldest influence in learning, need to consider carefully how their words and actions can influence students. Their attitudes and beliefs about teaching and learning are communicated strongly through modeling (Eggen & Kauchak, 1994, p.453). Student motivation is very unlikely to happen if teachers show lack of interest and enthusiasm in what they teach. Teachers should care about what they teach and communicate to their students that what they are learning is important (Wlodkowski & Jaynes, 1990, p.19). Teaching is a human activity in which people relate to people (Eggen & Kauchak, 1994, p.454). Wlodlowski & Jaynes (1990, p.20) identified empathy as one of the characteristics of an effective teacher. Teachers who displayed the above-mentioned characters are most likely to create a motivating classroom.

*Classroom environment*

The students should be made to feel safe and secure, and at the same time feel they understand what is being taught and feel challenged learning in the classroom. Teachers create such a positive environment when they are genuinely committed to the students' learning. An encouraging teacher who allows the students to take risks without fear of being humiliated would create a positive classroom environment. Competition between students in the class should be avoided, and instead evaluate the students against their individual progress, so that the low-achieving students would have more courage and motivation to keep progressing.

*Students' self-efficacy*

Placed in a positive classroom environment with a supportive teacher, students who often experience success in their work, and hear confirmation and positive feedback about their achievement, will eventually increase their efficacy in learning the subject. Teachers who tailor their lessons to enable the students to experience the above-mentioned situations, would most likely achieve a classroom of motivated students.

## 2.6. CONTEXT OF MATHEMATICS LEARNING IN INTERNATIONAL PRIMARY SCHOOLS IN THAILAND

Thailand has the largest number of international primary schools in the world. There are different types of curriculum offered i.e. American, Australian, British, French, German, Indian, Japanese, Korean, Singaporean, and International Baccalaureate programs. The textbooks used for the different curricula naturally vary from school to school.

While many countries' mathematics curriculum use the spiral approach with each year's content revisited but growing in breadth and depth, American mathematics curriculum tend to concentrate on particular topics in one year and moving on to different topics in other years, with little reference to past topics. However, in recent years, the International Baccalaureate and American mathematics curricula have become more on par with many other countries' curriculum, where the spiral approach is adopted to ensure that each topic is covered at appropriate levels in increasing depth. This enables the students to consolidate the concepts and skills learnt and develop further concepts and skills.

Many countries around the world are turning to a more congruent mathematics curriculum because in recent years there had been increasing number of international mathematics assessments conducted around the world in which published results are used to discover the strengths and weaknesses of each country's mathematics teaching and learning. Among these assessments, two are conducted periodically around the world at a huge magnitude and they include the Trends in Mathematics and Science Study (TIMSS) and OECD Program for International Student Assessment (PISA). TIMSS 2007 involved 425,000 students from 59 countries around the world. The goal

is to provide comparative information about educational achievement across countries to improve teaching and learning in mathematics and science.

All TIMSS results revealed that Singapore has maintained its status as one of the top performing countries in mathematics achievement. A remarkable percentage (more than 40%) of Singapore students reached the Advanced International Benchmark for mathematics, representing fluency on items involving the most complex topics and reasoning skills, while the median percentage of students reaching this Benchmark was below 5 percent (Mullis et.al., 2008, p.6). Among the developed western countries, Australia was one of those that scored slightly below average in the eighth-grade mathematics achievement, obtaining an average scale score of 496 where the TIMSS scale average was 500. Meanwhile, Thailand achieved an average scale score of 441 in the same assessment.

In Thailand, the method of teaching mathematics in international schools mostly differs from that of the local schools. Firstly, the class size in international schools is smaller than that in a local Thai school. This factor enables the international school teacher to interact more closely with the students compared with teachers working in local schools. International school teacher also gets more opportunity to understand individual students' development and can guide them better towards better learning achievement.

## 2.7. MATHEMATICS TEXTBOOK USED IN AUSTRALIAN INTERNATIONAL SCHOOLS IN THAILAND

As at the time of this study, there were two international schools in Bangkok offering Australian curriculum. One of them offered only the early years program, while the other offered both early years and primary education. Since the main focus of this study was the primary students, only the latter school – St. Mark's International School – was selected to be sample in this research. At St. Mark's there were eight key learning areas in primary education namely, English, Mathematics, Science, Study of Society and Environment, Language Other Than English, Health and Physical Education, Arts, and Technology. Except for Mathematics, all key learning areas used textbooks from Australia. For mathematics, the school used

Singapore's mathematics textbook after results from TIMSS revealed repeated superior performance of Singapore students in this area.

As mentioned earlier, after international mathematics assessments were organized worldwide, the contents in the mathematics textbooks do not vary much between developed countries like Australia and Singapore. However, there was a difference in the teaching method, whereby in Singapore, the teachers were trained to use heuristics to teach the students how to solve a problem. The heuristics include acting it out, using a model/diagram, looking for pattern, as well as guess and check (Singapore Ministry of Education, 2000, p.11). Teachers who use the Singapore mathematics textbook have to introduce those heuristics from as early as Primary One, to help the students solve mathematical problems. In problem-solving, the students were shown that in some cases, there could be several ways of arriving at the right answer. This helped expand the students' thinking and problem-solving skills.

## 2.8. RESEARCH REVIEW ABOUT MOTIVATION AND SELF-EFFICACY

There is evidence that self-efficacy predicts outcomes in fields as diverse as education, medical, sales, and sports. According to Bandura (1997, p.2), people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true. In that regard, people's beliefs of their own efficacy affect their choice of activities, effort and persistence. Those who have a low sense of efficacy in accomplishing a task will not be motivated to do it and may even choose to avoid doing it.

In the education field, many evidences had been found to indicate that self-efficacy can be used to predict motivational outcomes. Schunk (1989, p.23) found that students' self-efficacy about their capabilities to cognitively process academic material can influence motivation and learning. Students who believe that they will experience much difficulty understanding the learning material tend to hold a low sense of self-efficacy for learning it, whereas those who feel they are capable would feel more efficacious. A higher sense of efficacy, in turn, leads them to perform those activities that they believe will result in learning. As students worked on tasks, they derive information about how well they are learning. The perception that they understand the learning material further increases their efficacy and motivation.

Other research findings provide further evidence that self-efficacy is positively related to motivation. Students use cues derived from their aptitude and prior experiences to evaluate their self-efficacy for learning (Schunk, 1989, p.23). Students' self-efficacy derived from enactive mastery experiences – of seeing themselves habitually successful in accomplishing their tasks – is the most effective among the four sources of influences and tends to increase the students' beliefs in their own capability. Once a strong sense of efficacy is developed, an occasional failure is not likely to have much effect (Schunk, 1989, p.15). Self-efficacy derived from vicarious experiences is also shown to be powerful. Children who observed a model emphasizing the importance of positive achievement beliefs had their motivation and skills in learning enhanced (Pintrich & De Groot, 1990, p.33; Zimmerman & Martinez-Pons, 1990, p.51). How the teacher opens the lesson may also affect the students' efficacy (Brophy, 1983, p.205). Teachers who give an introduction before moving into task, or state a positive expectation by emphasizing that students will enjoy the task and do well on it, are more likely to increase the students' self-efficacy for learning.

From what is gathered, there is little doubt that the students' efficacy in learning and, along with it, their motivation to learn, can be controlled and influenced by the teacher in various ways. Based on an extensive research, Wlodkowski and Jaynes (1990, p.19) compiled some qualities of effective and motivating teachers and found that they include teachers who (1) expect students to be successful learners; (2) present learning materials that are within the students' capacity to learn; (3) offer corrective feedback to students; (4) challenge and stimulate; (5) help students to realize their growing competence and mastery; (6) are empathic; and (7) value knowledge over grades.

It is clear that learning requires effort and one of the best predictors of students' effort and engagement in school is the relationships they have with their teachers (Osterman, 2000, p.323). Deborah Stipek, who has been conducting research on students' learning motivation for 30 years, confirmed that students function more effectively when they feel respected and valued, have a secure relationship with their teachers, and have a teacher who shows genuine concern for them (Stipek, 2006, p.46). Stipek further elaborated how young children know that their teachers care.

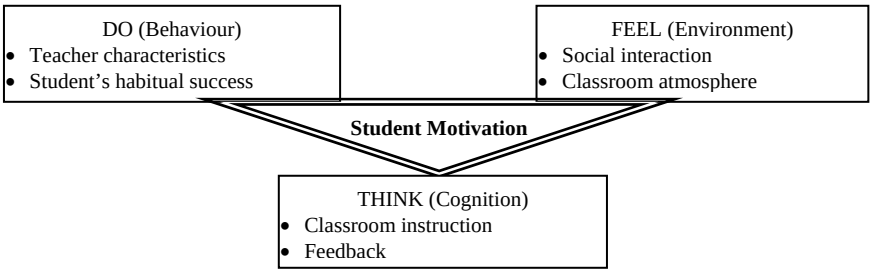
Those teachers usually (1) listen to their concerns; (2) are attentive; (3) address their non-academic needs; and (4) are fair. Such personal relationships become more valuable for students with poor social skills. Whereas for the older students, they feel that caring teachers are those who (1) treat them as individuals and express interest in their personal lives outside school; (2) grant them some autonomy such as giving them choices in assignments; and (3) are honest, fair and trusting.

There is sufficient research evidence to indicate that relationships support the students' learning motivation and achievement. Positive relationship between teachers and students can contribute significantly, not only to students' social-emotional health and well-being, but also to their academic performance (Stipek, 2006, p.49). Such evidence should therefore move teachers' attention to the students' nonacademic needs in order to bring the students to a higher level that meets the teachers' expectations of them.

## 2.9. CONCEPTUAL FRAMEWORK

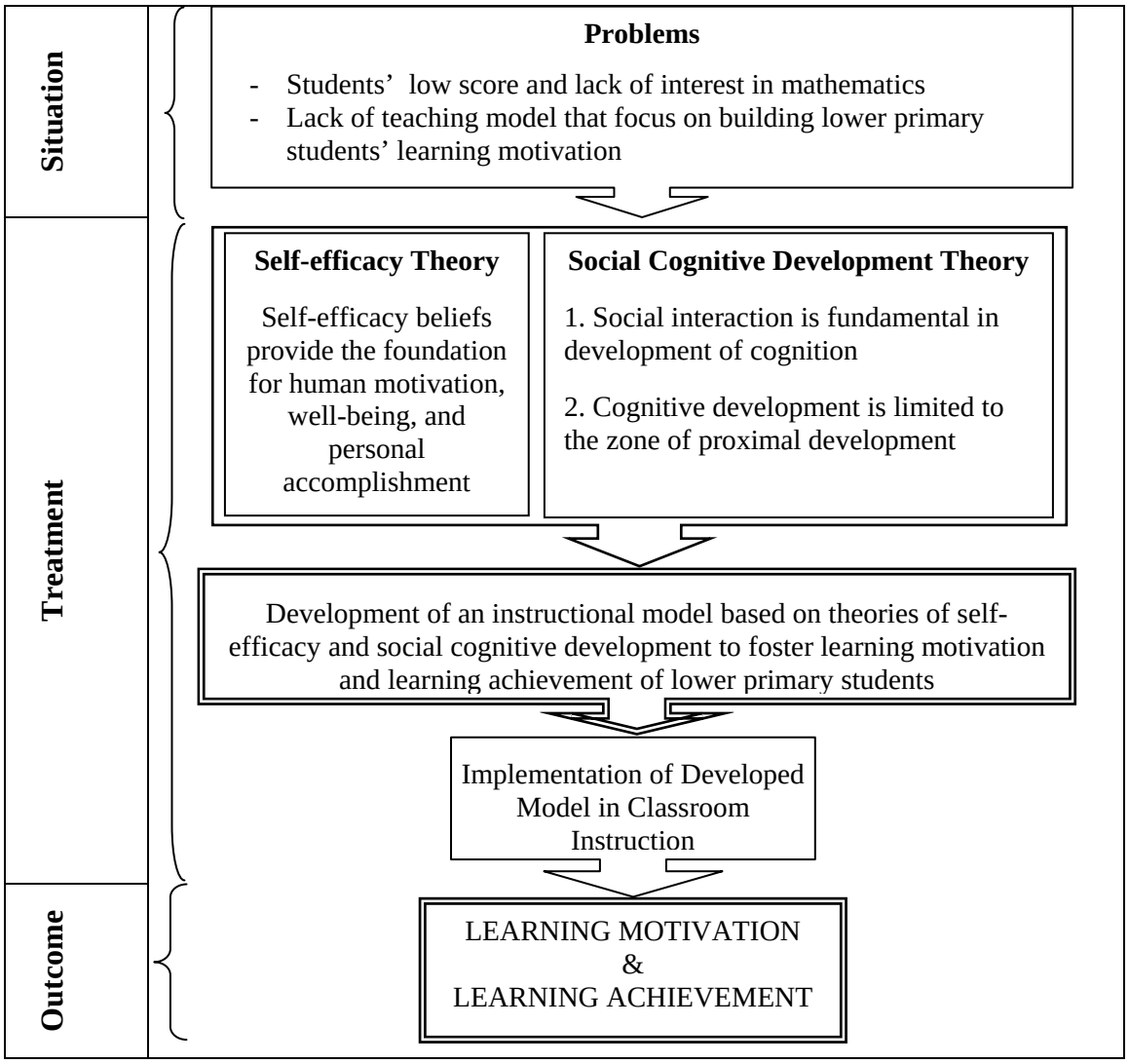
Having studied on the concept of motivation based on several different theories, it becomes clear to the researcher that the source of motivation can be both an intrinsic as well as extrinsic one. The fact that people are social beings makes social interaction an indispensable part of anyone's life. The link between a person's thoughts or beliefs (which is based on cognition), and what occurs in the environment, determines the person's behaviour or the motivation to behave or act accordingly. Consequently, to foster a child's motivation to learn, there has to be cohesiveness among what the child think, feel and do. In considering the mutual relationship among those three factors, the literature on social cognitive theories, specifically Bandura's Self-efficacy theory and Vygotsky's Social Cognitive Development theory, give a more noteworthy explanation for understanding children's learning motivation. The application of the two theories to foster student motivation under the headings of each of the three factors of think, feel and do is summarized in the illustration below.

**Figure 2.4 Factors affecting student motivation**




Based on the literature reviewed, the following conceptual framework is constructed. This framework depicts the levels involved in preparing the instructional model and testing its effectiveness by implementing it in the classroom, in order to foster the lower primary students' learning motivation and learning achievement, in this case, in mathematics.

**Figure 2.5 Conceptual Framework of the Research**



# CHAPTER 3

## DEVELOPMENT OF INSTRUCTIONAL MODEL

This chapter draws on the conceptual framework and principles for instruction derived from the literature reviewed in Chapter 2. The process of the model development to foster learning motivation and learning achievement based on self-efficacy and social cognitive development theories for lower primary students in international schools in Bangkok appears in five stages below as well as in Figure 3.1.

**Stage 1:** Studying and analyzing Bandura's self-efficacy theory and Vygotsky's social cognitive development theory, and then synthesizing the main principles of those theories.

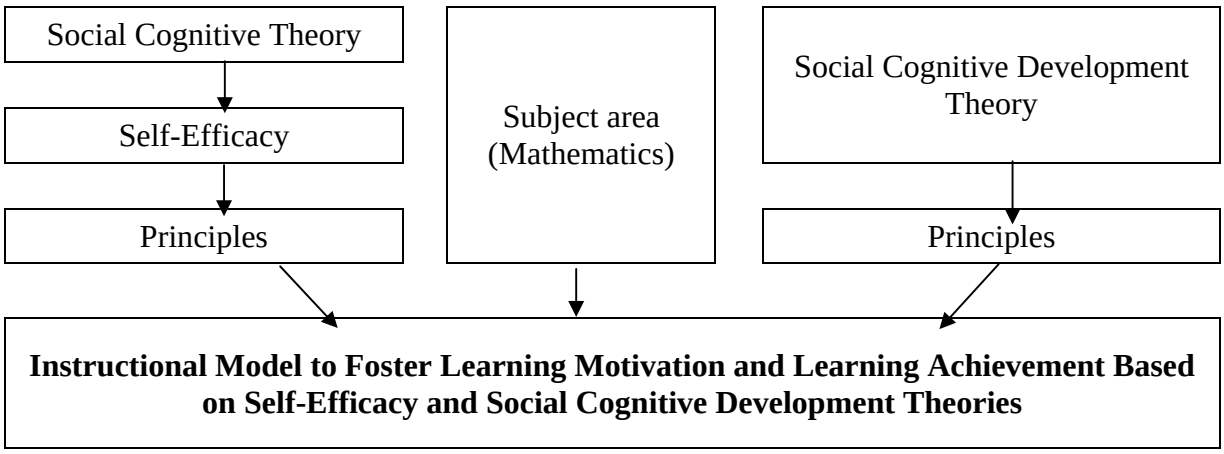
**Stage 2:** Developing the instructional principles based on the result in stage 1, and validating those principles by consulting with Albert Bandura, author of self-efficacy theory.

**Stage 3:** Developing the instructional model: specifying the instructional objectives and expected outcome of instruction, and criteria for evaluation.

**Stage 4:** Developing the instructional procedures.

**Stage 5:** Validating the instructional procedures.

**Figure 3.1 Development of the main principles and the model**



## 3.1 PROCESS OF DEVELOPMENT

**Stage 1:** Studying and analyzing Bandura's self-efficacy theory and Vygotsky's social cognitive development theory, and then synthesizing the main principles of those theories.

After reading various textbooks, journal articles, and past research related to the two theories above, an analysis was made from each theory about the important principles pertaining to motivation in learning and synthesized as shown in Figures 3.2 and 3.3 below.

**Figure 3.2 Result of studying Social Cognitive Development Theory**

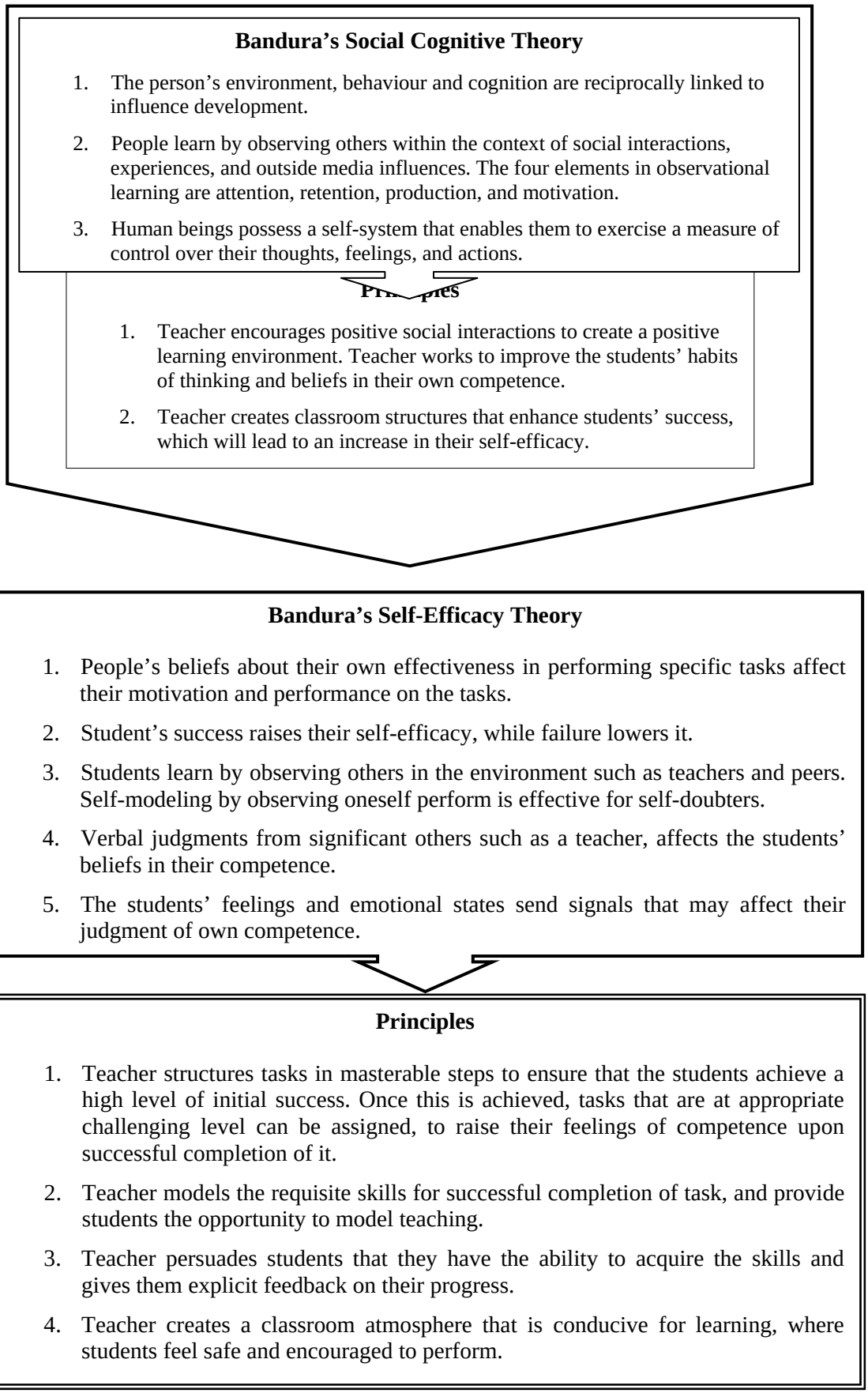
**Vygotsky's Theory of Social Cognitive Development**

1. Learning occurs in social context. Social learning precedes development. Social interaction plays fundamental role in the development of cognition. Learning is a reciprocal experience for teacher and students. It is best done in collaboration through modeling or scaffolding by the More Knowledgeable Others.
2. Cognitive development is limited to a certain range at any given age, and this range is termed the zone of proximal development. The potential for cognitive development depends on this zone, which bridges the gap between what is known and what is unknown.
3. Efficient instruction requires appropriate teacher guidance mediated by learning tools.

**Principles**

1. A positive teacher-student relationship makes learning a positive experience. Teacher models positive attitudes such as respect and hopeful determination. Teacher models by demonstrating to the children the skill to be learned. The children model the same skill while teacher facilitates their learning. More able children can be assigned to teach the less able.
2. Teacher assigns work that is at the appropriate challenging level for the child and assists only as and when is necessary.
3. Teacher uses a variety of teaching materials and presentation methods to engage students' interest. Teacher relates learning to students' real-life experiences so they find learning meaningful.

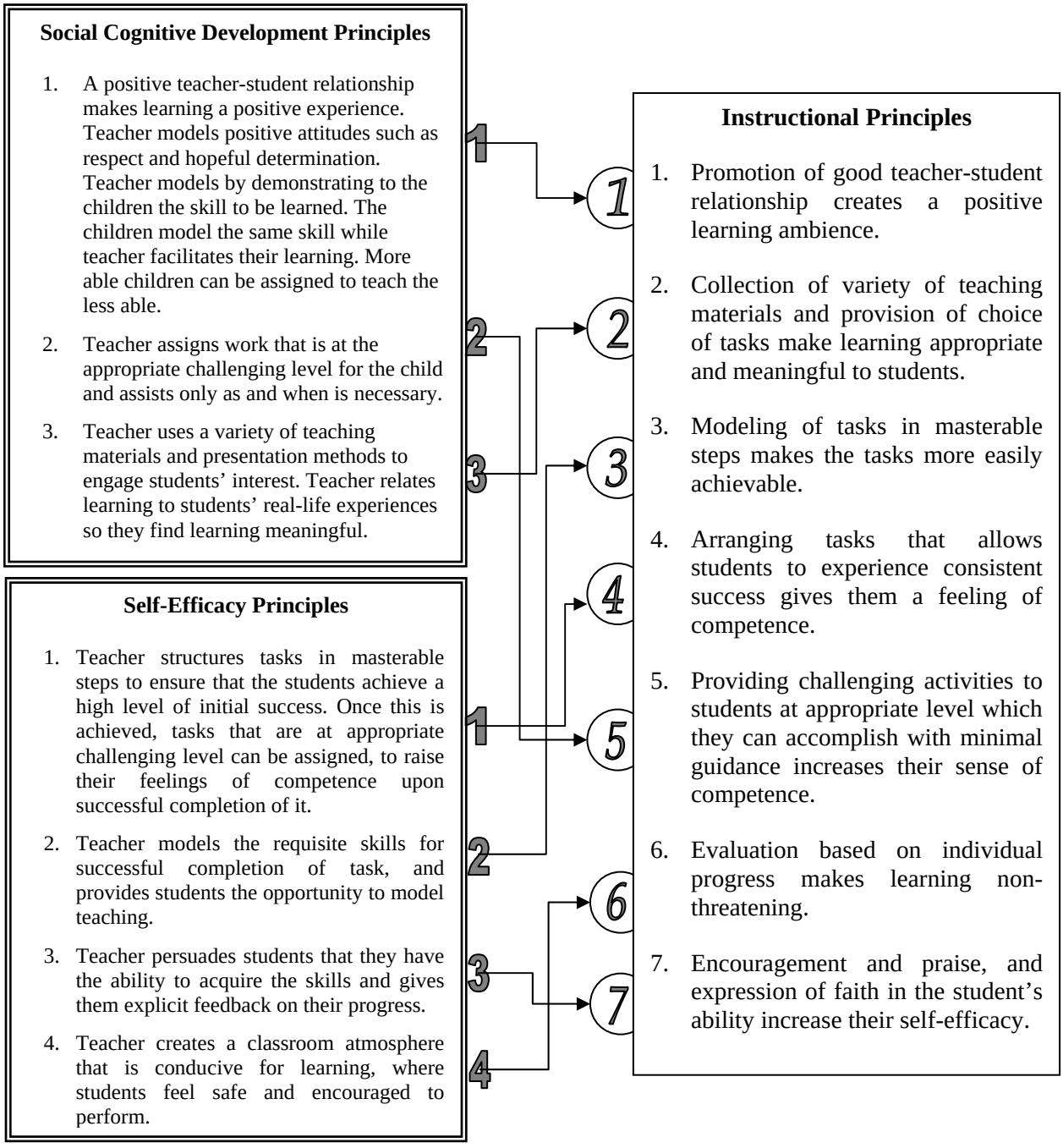
**Figure 3.3 Result of studying Self-Efficacy Theory**



**Stage 2:** Developing the instructional principles based on the results in Stage 1, and validating those principles by consulting with Albert Bandura, author of self-efficacy theory.

After synthesizing the essential principles of self-efficacy and social cognitive development theories, the researcher formulated the teaching principles of the instructional process for this study as follow:

**Figure 3.4 Development of Instructional Principles**



After formulating the seven instructional principles above, the researcher sent it to Albert Bandura, the author of self-efficacy theory, to verify its validity and accuracy for use to foster students' motivation in learning (see Appendix A). Each of the seven principles is elaborated below:

1. **Promotion of good teacher-student relationship creates a positive learning ambience.**

   Positive, caring relationships are vital for all students, especially the self-doubters. It has been shown that in an environment of trust and support, the student will have less anxiety in learning. Teachers create a warm and positive learning environment by modeling personal openness toward students and encouraging them to ask questions, explain, and share their ideas. Students are more motivated to obey instructions communicated by adults with whom they share an emotional relatedness. Students' sense of a trusting relationship with teacher is a key element in kindling their motivation. Teachers weaken trust when we create tension in the classroom, such as by putting the student on the spot, embarrassing them with sharp replies, or responding to their questions or comments with frustration. Teachers also weaken trust levels when we fail to protect members of the class from one another. Sharp disagreements and personal attacks among class members can hurt them to the point they refuse to share or, worse still, refuse to attend class at all. Instead, teachers should build trust by caring for the students, listening to them, and responding in kind ways. Teachers should engage the students with subjective questions in order to encourage them to share their personal experiences related to the topic (Yount, 2010:465). Subjective questions move learners into themselves to consider their own experiences: "If you were a teacher, how would you want the children to behave in class?" In contrast, objective questions move learners into the text. "Toy A costs $6.50 and Toy B costs $7.90. Which toy is cheaper?" To create an environment of mutual trust, teachers should lay a foundation for civil discourse and protect the students from each other, making peace when disagreements arise. Teachers should lead by example so that the students would be motivated to produce and repeat the desired behaviours. In this sense, teachers can cultivate in the students an enthusiasm to learn mathematics by actively modeling enthusiasm when teaching the subject. By their very presence, enthusiastic teachers tell students that they care about what they are teaching, and this value radiates through them with vitality (Wlodkowski and Jaynes, 1990:28). This part of the instructional process, of establishing good teacher-student relationship to create positive learning ambience, occurs throughout the time the teacher is in association with the students.

2. **Collection of variety of teaching materials and provision of choice of tasks make learning appropriate and meaningful to students.**

   Teachers should use a variety of materials and teaching methods to engage the students. Tell stories that capture the intellectual and emotional understanding of the child. Recent studies show that the brain cannot easily absorb information without an emotional connection, and listening to a story provides such a connection (Immordino-Yang and Damasio, 2007). Good instruction begins when interest and excitement are sparked. Build lessons around students' interests, talents, and personal goals to attract and sustain attention. Relate the subjects to the everyday experiences and backgrounds of the students, and ask them to imagine how the lesson could be transferred to situations associated with their own life expectations. Provide them the opportunities to choose the work from a selection of tasks so they feel that they are engaging in activities by their own choice.

3. **Modeling of tasks in masterable steps makes the tasks more easily achievable.**

   The importance of modeling in learning extends to the teaching of content. Teachers use modeling when we demonstrate the steps involved in solving problems. In teaching mathematics, teachers should directly model the skill for the students and at the same time asking the students questions to direct their attention to the important characteristics of the problems. It is important that teachers think aloud as we model the steps, to allow the students to hear our thought processes that goes on in solving problems as we verbalise the internal discussion. Say something like: "Hmm… do I need to know this point to solve the problem?.... Now, what is the next step?.... Okay, we have this part, now what do I need next?" Once the students retain the observed behavior in their mind, they would be ready to reproduce the modeled behavior on their own. The information placed in memory during the retention process would guide the students' performance in the reproduction stage.

   In some cases where students have difficulty in reproducing the modeled behavior, e.g. due to lack of attention in class, teachers can accommodate this problem by intervening using a teacher-facilitated practice, sometimes known as controlled practice (Eggen and Kauchak, 1994:288) and guiding the students' initial reproductions as a group process. Using this procedure, teachers can provide immediate feedback in the case of incorrect answers, and cues if students are unable to answer. In this way, teachers will be able to see how much the children have understood the teaching, spot any learning difficulty and error pattern, and guide the children accordingly.

4. **Arranging tasks that allows students to experience consistent success gives them a feeling of competence.**

   Once the students are able to reproduce the modeled behavior, they would be prepared to practice it on their own under the guidance of the teacher. This is typically accomplished with seatwork, during which the teacher has a chance to circulate and monitor student performance. Teachers should coordinate the learning situation such that the students can develop a feeling of competence. This can be done by providing them tasks in which they are likely to achieve success habitually.

   During seatwork, while circulating around the class, teachers get the opportunity to give immediate feedback on the students' performance. Teachers can use this time to raise the students' feeling of competence by praising them for their competence, their effort and ability, their persistence in solving the problem, or other learning behaviours that we want to see in them.

5. **Providing challenging activities to students at an appropriate level which they can accomplish with minimal guidance increases their sense of competence.**

   Following the students' initial feeling of competence, teacher can sustain their positive feeling by providing choices of tasks related to the day's topic. The choices will give them a feeling of control over their own learning and the successful completion of the task will further increase their feeling of competence. Design instructional challenges to kindle success for the students. Challenge the children at their right level, thereby stretching their competence. Individuals are most motivated when they have an opportunity to engage in challenging but not impossible tasks – tasks that can give them feelings of competency and accomplishment. Tasks associated with a moderate probability of success provide maximum satisfaction and intrinsic motivation. Such success is associated with personal effort, well-chosen strategies, and ability; and these explanations give rise to feelings of pride, competence, determination, satisfaction, persistence, and personal control.

   The choices of task proposed for use in this present study were textbook problems, independent work cards, and problem posing. Textbook problems are, literally, problems that appear in the textbook used in the mathematics class. Of all the three choices, textbook problems were the most familiar to the children because the textbook was used at every lesson and the layout was similar from topic to topic. Independent Work Cards, on the other hand, were kept by the researcher in separate folders labeled by Units, and each Unit folder presented to the participants only when the particular

Unit was taught. Problem posing was the most unfamiliar, as each problem posed or authored by the child would have to be related to the new Unit taught.

6. **Evaluation based on individual progress makes learning non-threatening.**

   For the students' personal growth, there should be no comparison of grades so that the children have no basis to belittle one another. Students learn best when they focus on the work at hand and how to master it rather than on how they are performing relative to others. Results of research suggest that this focus can be fostered even among children who believe that their academic ability is low relative to their classmates. Teachers can record the children's scores individually and emphasise that their results are only available to them personally. With this, the less mathematically-talented students will be more encouraged and unafraid to try even if it means making mistakes, because the risk of embarrassment or feeling of inferiority has been removed.

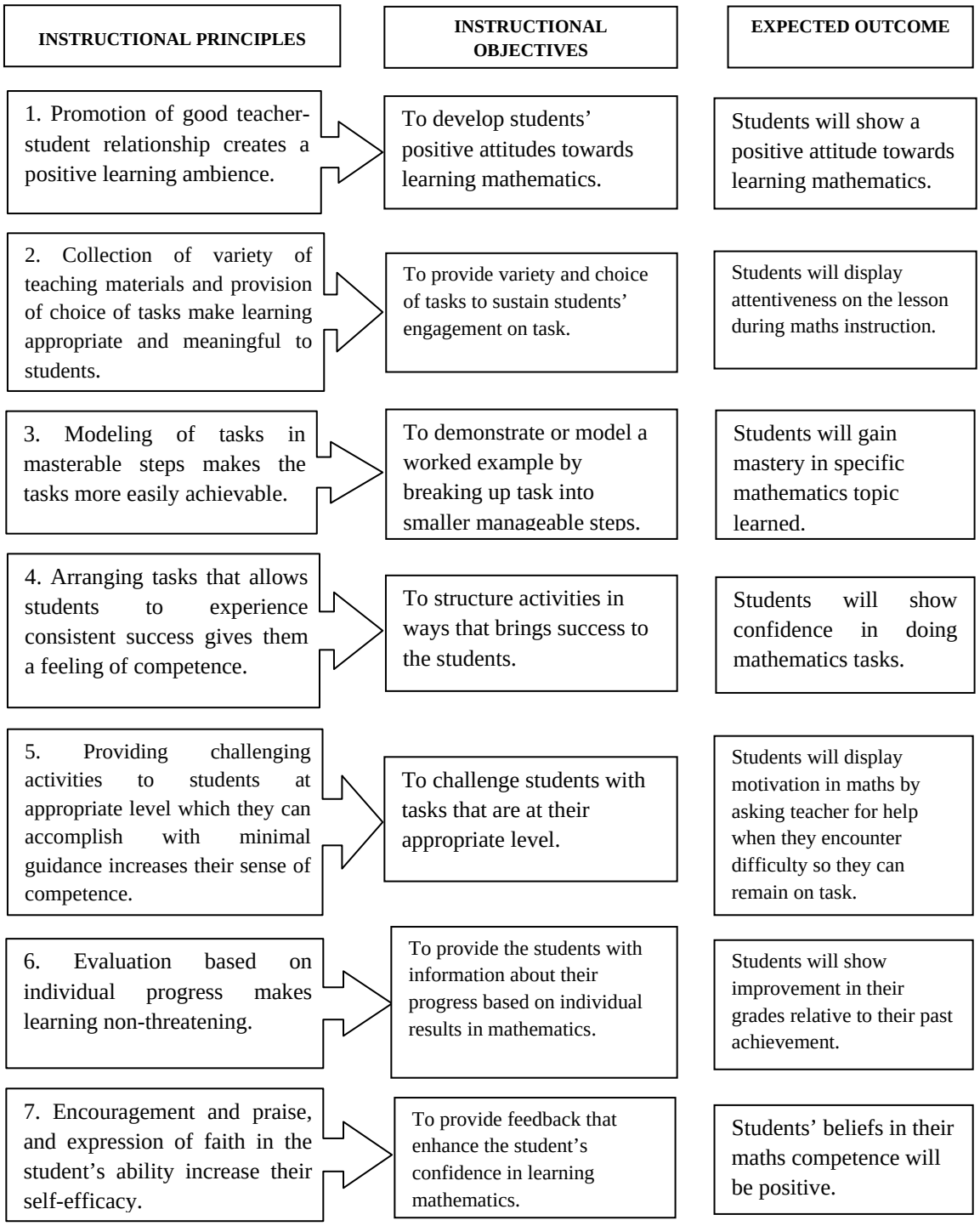
7. **Encouragement and praise, and expression of faith in the student's ability increase their self-efficacy.**

   A teacher's words can build or destroy the students' perception of their academic ability. Students can change their perceptions of competence and become more productive and optimistic if teachers convey faith in the students' capability, provide immediate constructive feedback, and encourage the students along the learning process. Teachers should communicate their admiration, appreciation, and faith in the students' learning – progress, attitude, and ability – and use words to edify, encourage and motivate the students. The praise should be sincere and focusing on the importance of exerting effort in learning.

**Stage 3:** Developing the instructional model: specifying the instructional objectives and expected outcome of instruction, and criteria for evaluation.

From the seven principles derived in Stage 2, the researcher developed the objectives and expected learning outcomes of the instruction for lower primary students as shown in Figure 3.5 below.

**Figure 3.5 Instructional Objectives and Expected Outcome of Instruction**




The criteria for evaluation was set at a minimum of 80 percent to show mastery. Any score below 80 percent indicated that the student needed more assistance or practice to achieve mastery.

**Stage 4:** Developing the instructional procedures.

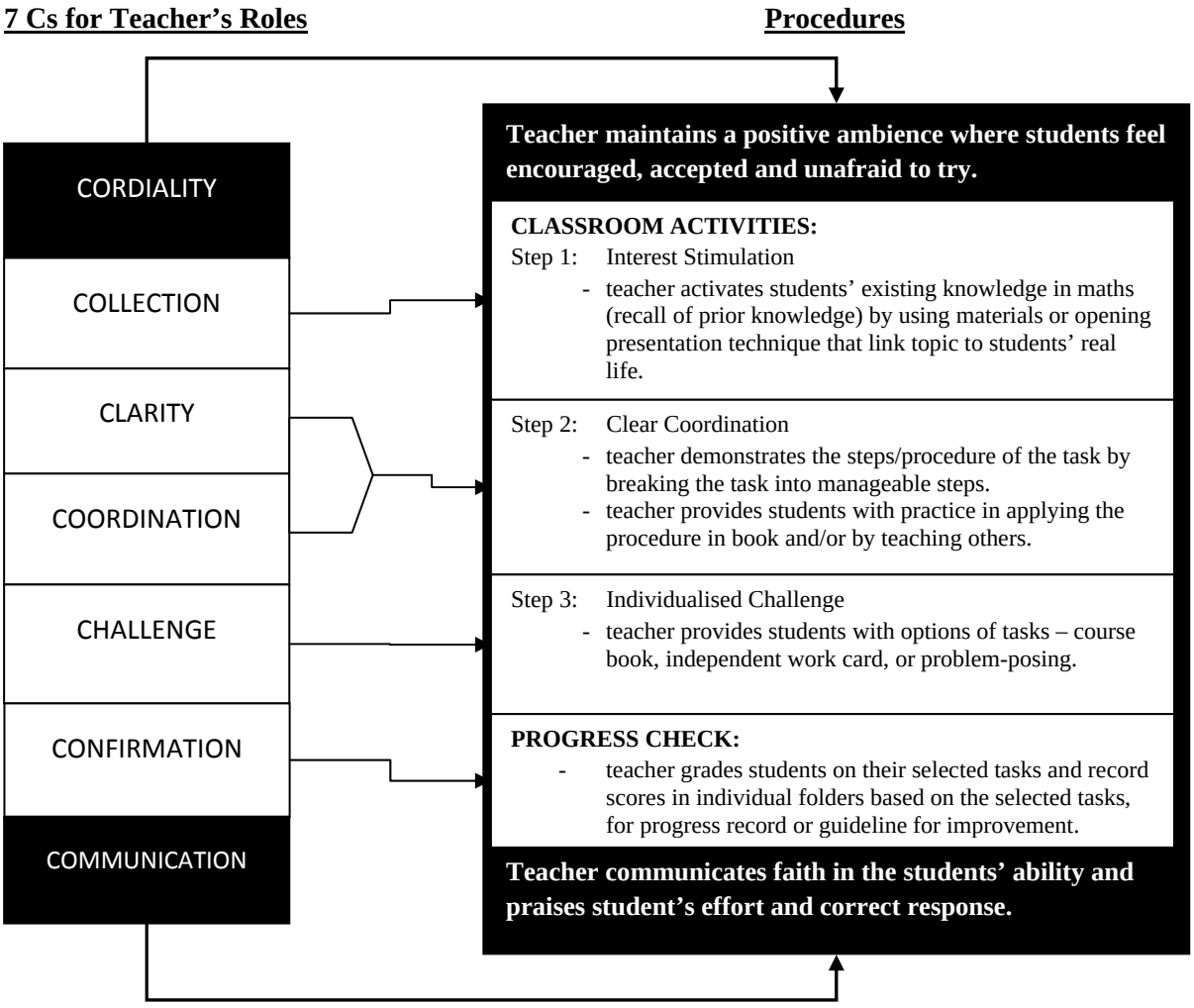
The researcher summarized all the results from the stages of development of the instructional model along with the seven C's for teacher's roles as shown in the table below. From there, the instructional procedure for use in the classroom is derived as shown in Figure 3.7.

**Figure 3.6 Development of Instructional Process**

| INSTRUCTIONAL PRINCIPLES | INSTRUCTIONAL OBJECTIVES | 7 Cs FOR TEACHER'S ROLES |
|---|---|---|
| 1. Promotion of good teacher-student relationship creates a positive learning ambience. | To develop students' positive attitudes towards learning mathematics. | **CORDIALITY**: Teacher models warmth, respect, and caring attitude. Before lesson starts, teacher greets students by name as they enter the classroom. |
| 2. Collection of variety of teaching materials and provision of choice of tasks make learning appropriate and meaningful to students. | To provide variety and choice of tasks to sustain students' engagement on task. | **COLLECTION**: Teacher uses a variety of material/tool or opening presentation method to start the lesson. |
| 3. Modeling of tasks in masterable steps makes the tasks more easily achievable. | To demonstrate or model a worked example by breaking up task into smaller manageable steps. | **CLARITY**: Teacher demonstrates to students the steps and procedure involved in solving the mathematics task by doing worked examples. |
| 4. Arranging tasks that allows students to experience consistent success gives them a feeling of competence. | To structure activities in ways that brings success to the students. | **COORDINATION**: Teacher provides students with initial tasks that are certain to bring success to the students, including asking students to paraphrase the modeled steps/procedure and providing them practice in applying the procedure. |
| 5. Providing challenging activities to students at appropriate level which they can accomplish with minimal guidance increases their sense of competence. | To challenge students with tasks that are at their appropriate level. | **CHALLENGE**: Provide options of tasks for students to choose – from coursebook, independent work card, or problem-posing – that gives them optimal challenge. |
| 6. Evaluation based on individual progress makes learning non-threatening. | To provide the students with information about their progress based on individual results in mathematics. | **CONFIRMATION**: Record students' results in individual file for evaluation of progress. The result should not be compared with other students' results. |
| 7. Encouragement and praise, and expression of faith in the student's ability increase their self-efficacy. | To enhance the student's confidence in learning mathematics. | **COMMUNICATION**: Communicate faith in the students' ability. Praise them for their effort. Challenge them to do their best. |

The term ‘seven seas’ means the oceans of the world and is sometimes used to refer to someone who has traveled widely and has a lot of experience. The “seven Cs” in this study, however, has no link to the seven seas. It is just a mnemonic device to help the users of the instructional model to remember the complete instructional procedures described in this study. The instructional procedures for learning which emphasized the teacher’s role in each step are illustrated in the diagram below:

**Figure 3.7 Instructional Procedures**




Further elaboration of the instructional procedures appears below:

## Essential mission

### *Cordiality*

Teachers must develop a classroom atmosphere that builds positive relationships and fosters mutual respect. They should show cordiality to make the students feel

welcomed. Teachers should greet students by name as they enter the class. Teachers should model caring attitude, enthusiasm, and motivation towards learning mathematics so that the students learn to pick these traits through their regular observations. Teachers should not allow words of ridicules or insults in the classroom so that no one will feel afraid to make mistakes. Teachers themselves should refrain from making comments that humiliate the students. This kind of positive classroom ambience should be maintained throughout the lesson.

***Communication***

At any step of the instructional process, teachers should communicate faith in the student's ability and high expectations for success for all students. With the situation arranged such that students achieve consistent success, teachers' praise on the students' ability should create a positive change in the personal efficacy even among the low-ability students. In fact, for students with a low sense of personal efficacy, teachers have more reason to verbally persuade them by expressing explicit, compelling feedback that forcefully disputes the students' pre-existing disbelief in their capabilities.

**Classroom Activities**

Step 1: Interest Stimulation Draw the students' attention by using materials, tools or opening presentation methods that link the lesson with the students' prior knowledge and real life experiences. For instance, in teaching Fractions, the teacher starts the lesson with storytelling one day, and the next day uses the interlocking cubes to attract attention, and on another day uses the fraction bars to start the lesson. When teaching the topic about Volume, teachers can start with a mind-boggling question such as "We need to drink 2 litres of water daily. Now, how much is 2 litres?" In that way, the teacher not only activates the students' existing knowledge structure, i.e. recall of prior knowledge, but also generates interest in the lesson, which makes accommodation of new information in their knowledge structure more readily.

Step 2: Clear Coordination This step of the instruction requires teacher demonstration, and student practice in applying the procedure. During initial whole-class instruction, the teacher demonstrates or models the procedure to accomplish a task by using worked examples. If the task is a multi-step problem, it can be broken

into smaller manageable steps that the students can learn more easily and increase their experience of mastery. The worked example shows each step of the problem-solving process. The student studies the problem by following through each step of the example. Then, similar example problems are presented for practice.

Initial tasks should ensure success so that the students gain confidence in the subject. Self-modeling and peer modeling can be implemented at this step to provide students with the challenge and opportunity to apply their learning, under the teacher's guidance. The students can implement the procedure by teaching or explaining to the class, and in so doing, the teacher is able to check their understanding. As the students become more skillful, teacher assigns more challenging tasks - those not too easy that the students do not need to exert much effort, nor too difficult that they feel despair.

Step 3: Individualised Challenge In assigning tasks to the students, teachers should consider the physiological states of the students by taking away the tension and anxiety from assigning single task to all students. Instead, teachers can provide the students with some alternative choice of activity with similar learning objectives. For instance, teachers can provide students with the options of doing the mathematics problems in the course book, problems on the independent work cards which contain similar problems to the course book, or the students can generate or pose their own problems similar to those in course book along with providing the answer keys in individual booklets. This last option is also known as problem posing. Problem-posing refers to both the generation of new problems and the reformulation of given problems (Silver, 1994).

**Progress Check**

To ensure progress in personal development, the teacher should encourage the students to measure their successes in terms of self-improvement rather than in terms of triumphs over others. The teacher can grade students on their selected tasks and record their scores in individual folders based on the tasks they have chosen, for progress record or guideline for improvement. The teacher should inform the class that their scores will all be different as they are based on individual chosen tasks, so they should not compare with one another. Social comparisons of achievement (which some research show has detrimental effect on the students' sense of efficacy) can

further be avoided by not making public announcement of the students' mathematics test scores, or announcing who gets the highest or lowest scores in class. The idea behind this kind of evaluation is that individual students should be made to feel safe in learning, in order to reduce unnecessary stress and anxiety. It also acts as a confirmation to the students that their own progress is valued more than their ability to outdo others. The focus is on improvement, not on comparisons among students.

**Stage 5:** Validating the instructional procedures

After developing the instructional procedures, three experts – two in the field of Mathematics Education and one in the field of Curriculum and Instruction – were asked to comment on the applicability of the process for teaching primary school students. The initial diagram of the instructional procedures that was given to the experts was not the same as the diagram shown in Figure 3.7. All experts were positive that the steps could be undertaken in a primary mathematics classroom, but one suggested that the steps in the diagram be made more explicit for the teacher to execute it easily. Another expert also suggested that consideration should be made about the time duration of each lesson in order to fulfill all the steps. Following that, the researcher designed the lesson plans for actual study, taking into consideration the experts' comments and suggestions. Figure 3.7 shows the resulting diagram that had been modified following the suggestions provided.

## 3.2 THE DEVELOPED MODEL

The model of mathematics instruction is shown in the diagram below.

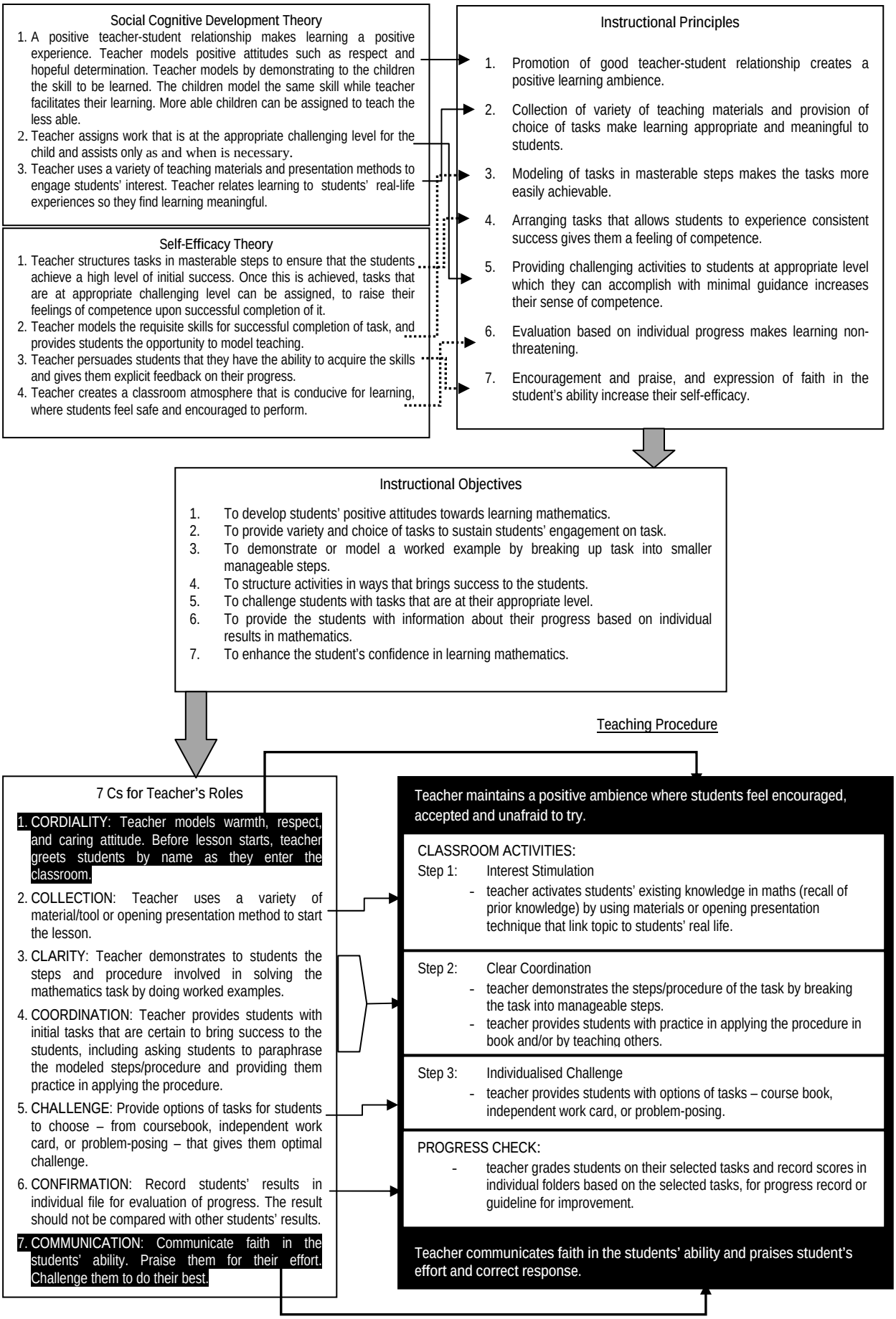
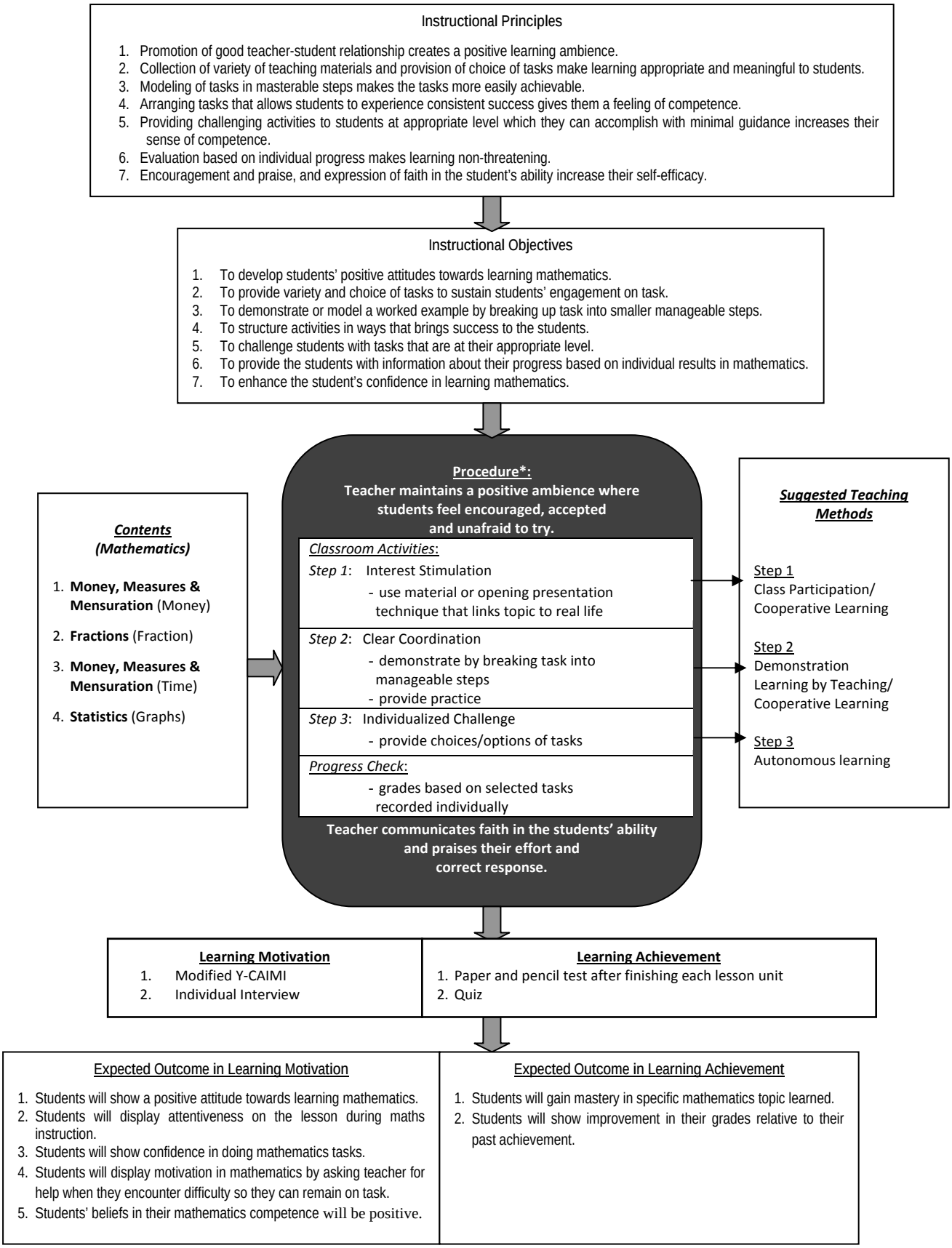

Social Cognitive Development Theory
1. A positive teacher-student relationship makes learning a positive experience. Teacher models positive attitudes such as respect and hopeful determination. Teacher models by demonstrating to the children the skill to be learned. The children model the same skill while teacher facilitates their learning. More able children can be assigned to teach the less able.
2. Teacher assigns work that is at the appropriate challenging level for the child and assists only as and when is necessary.
3. Teacher uses a variety of teaching materials and presentation methods to engage students' interest. Teacher relates learning to students' real-life experiences so they find learning meaningful.
Self-Efficacy Theory
1. Teacher structures tasks in masterable steps to ensure that the students achieve a high level of initial success. Once this is achieved, tasks that are at appropriate challenging level can be assigned, to raise their feelings of competence upon successful completion of it.
2. Teacher models the requisite skills for successful completion of task, and provides students the opportunity to model teaching.
3. Teacher persuades students that they have the ability to acquire the skills and gives them explicit feedback on their progress.
4. Teacher creates a classroom atmosphere that is conducive for learning, where students feel safe and encouraged to perform.
Instructional Principles
1. Promotion of good teacher-student relationship creates a positive learning ambience.
2. Collection of variety of teaching materials and provision of choice of tasks make learning appropriate and meaningful to students.
3. Modeling of tasks in masterable steps makes the tasks more easily achievable.
4. Arranging tasks that allows students to experience consistent success gives them a feeling of competence.
5. Providing challenging activities to students at appropriate level which they can accomplish with minimal guidance increases their sense of competence.
6. Evaluation based on individual progress makes learning non-threatening.
7. Encouragement and praise, and expression of faith in the student's ability increase their self-efficacy.
Instructional Objectives
1. To develop students' positive attitudes towards learning mathematics.
2. To provide variety and choice of tasks to sustain students' engagement on task.
3. To demonstrate or model a worked example by breaking up task into smaller manageable steps.
4. To structure activities in ways that brings success to the students.
5. To challenge students with tasks that are at their appropriate level.
6. To provide the students with information about their progress based on individual results in mathematics.
7. To enhance the student's confidence in learning mathematics.
Teaching Procedure
7 Cs for Teacher's Roles
1. CORDIALITY: Teacher models warmth, respect, and caring attitude. Before lesson starts, teacher greets students by name as they enter the classroom.
2. COLLECTION: Teacher uses a variety of material/tool or opening presentation method to start the lesson.
3. CLARITY: Teacher demonstrates to students the steps and procedure involved in solving the mathematics task by doing worked examples.
4. COORDINATION: Teacher provides students with initial tasks that are certain to bring success to the students, including asking students to paraphrase the modeled steps/procedure and providing them practice in applying the procedure.
5. CHALLENGE: Provide options of tasks for students to choose – from coursebook, independent work card, or problem-posing – that gives them optimal challenge.
6. CONFIRMATION: Record students' results in individual file for evaluation of progress. The result should not be compared with other students' results.
7. COMMUNICATION: Communicate faith in the students' ability. Praise them for their effort. Challenge them to do their best.
Teacher maintains a positive ambience where students feel encouraged, accepted and unafraid to try.
CLASSROOM ACTIVITIES:
Step 1: Interest Stimulation
- teacher activates students' existing knowledge in maths (recall of prior knowledge) by using materials or opening presentation technique that link topic to students' real life.
Step 2: Clear Coordination
- teacher demonstrates the steps/procedure of the task by breaking the task into manageable steps.
- teacher provides students with practice in applying the procedure in book and/or by teaching others.
Step 3: Individualised Challenge
- teacher provides students with options of tasks – course book, independent work card, or problem-posing.
PROGRESS CHECK:
- teacher grades students on their selected tasks and record scores in individual folders based on the selected tasks, for progress record or guideline for improvement.
Teacher communicates faith in the students' ability and praises student's effort and correct response.

**Figure 3.8 Developed Instructional Model**




* Note:
- One cycle of teaching procedure would take 1 period of about 1 hour.
- One mathematics unit would take an average of 8 periods.

# CHAPTER 4

## METHODOLOGY

The current study with the title “Development of an instructional model to foster learning motivation and learning achievement based on self-efficacy and social cognitive development theories for lower primary students in international schools in Bangkok” has the following objectives:

1) To develop an instructional model based on self-efficacy theory and theory of social cognitive development to foster primary students’ learning motivation and learning achievement.
2) To evaluate the effectiveness of the developed instructional model.

In testing those objectives, this study addressed the following research questions:

1) What does the instructional model look like?
2) What is the effect of the instructional model on primary students’ learning motivation in mathematics?
3) Is there an improvement in student’s mathematics achievement as a result of the treatment?
4) Which component in the instructional model is effective for increasing primary students’ learning motivation?

The research design is therefore research and development consisting of 2 phases: (1) phase of development and (2) phase of evaluation of the effectiveness of the model.

### 4.1 PHASES OF DEVELOPMENT

This study involved two phases of research procedures as consolidated below:

**Table 4.1 Phases of Research Development**

**PHASE 1**

**Development of an instructional model to foster learning motivation and learning achievement based on self-efficacy and social cognitive development theories for lower primary students in international schools in Bangkok**

**Research 1:** Analyzing and synthesizing various theories related to motivation for the development of the instructional process to foster motivation in learning mathematics

**Development 1**: (1) Developing the instructional principles based on self-efficacy and social cognitive development theories; (2) Validating instructional principles by the author of self-efficacy theory; (3) Specifying instructional objectives and expected outcome of instruction; and (4)Developing the instructional procedures

**Research 2:** Validating the instructional procedures by experts

**Development 2**: Developing and correcting the instructional model (second draft)

**Research 3**: Tryout of the model

**PHASE 2**

**Evaluation of the effectiveness of the instructional model**

**Development 3**: Developing third draft of the instructional model

**Development 4:** Preparing research instruments

(1) Specifying research design and research sample
(2) Organizing the research instruments for data collection
(3) Testing reliability of modified motivation instrument
(4) Preparing unit tests based on lesson objectives to measure mathematics achievement
(5) Writing lesson plans using the instructional procedures
(6) Preparing teaching materials

**Research 4**: Implementing the instructional model by

(1) Establishing a baseline of the children's behaviour and achievement in mathematics through interview and classroom observation, and collection of past mathematics test results respectively

(2) Conducting a pretest on the children's motivation in learning mathematics

(3) Conducting lessons using the developed instructional procedures, recording classroom observations, and collecting the children's results of each unit test

(4) Conducting a posttest on the children's motivation in learning mathematics, and interviewing them

Analyzing the results of implementation of the developed instructional model

(1) Determining the effect of the instructional model on primary students' learning motivation in mathematics by comparing their pretest and posttest scores on the learning motivation instrument
(2) Determining the change in the students' beliefs about their competence in mathematics by comparing their responses to interview questions before and after the treatment
(3) Determining the improvement in the students' mathematics achievement by analyzing the pattern of mathematics test scores before and after the treatment
(4) Verifying any changes in the students' learning motivation in another subject

**Research 5:** Drawing a conclusion on the effectiveness of the developed instructional model in fostering lower primary children's motivation in learning mathematics

## Phase 1: THE PROCESS OF DEVELOPING THE INSTRUCTIONAL MODEL

### Research 1: Analysis and Synthesis of Related Theories

The first step in the development of the instructional model involved studying the theories and models of instruction, reading books and educational articles related with student's motivation and mathematics, making classroom observations during a school visit (see Appendix C), searching websites, newspapers and journals for information on current issues pertaining to students' learning motivation, and interviewing adults and children about why (or not) they like mathematics in order to understand the common motivational problems faced by learners of mathematics. The researcher then made an analysis of those readings, theories and observations to synthesize and form the foundation of the instructional principles for the current teaching model. Summaries of the two theories appear below:

Self-efficacy theory purports that people's beliefs about their own effectiveness in performing specific tasks affects their motivation and performance on the tasks. This theory suggests four major sources of information used by people to form self-efficacy judgments. They are: (1) enactive mastery experiences, (2) vicarious experiences, (3) verbal persuasion, and (4) physiological states.

Social Cognitive Development Theory focuses on social interaction as having a fundamental role in the development of cognition. A second aspect of this theory is the idea that cognitive development is limited to a certain range at any given age, also known as the zone of proximal development.

### Development 1: Development and Validation of Instructional Principles

(1) The instructional principles for this research were developed based on the afore-mentioned two theories, which the researcher proposed would help instigate lower primary students' motivation to learn mathematics. There were seven principles altogether as listed below:

i) Promotion of good teacher-student relationship creates a positive learning ambience.

ii) The use of teaching materials or opening presentation technique that link topic to real life makes learning meaningful to students.

iii) Modeling of tasks in masterable steps makes the tasks more easily achievable.

iv) Arranging tasks that allows students to experience consistent success gives them a feeling of competence.

v) Providing challenging activities to students at appropriate level which they can accomplish with minimal guidance increases their sense of competence.

vi) Evaluation based on individual progress makes learning non-threatening.

vii) Encouragement and praise, and expression of faith in the student's ability increase their self-efficacy.

(2) One of the theories used in this study was self-efficacy theory authored by Albert Bandura, a professor at Stanford University. It is the core theory upon which the current instructional model was developed. After applying the theory to form the pedagogical principles, the researcher sought advice from Bandura to validate the accuracy of her teaching principles and received his recommendations to make them congruent with his self-efficacy theory as follow: principles (ii), (iv) and (v) above related to Enactive Experience, principles (i) and (iii) related to Vicarious Experience, principle (vii) related to Verbal persuasion, and principle (vi) related to Physiological States.

(3) Specify Instructional Objectives and Expected Outcome of Instruction

From the seven principles obtained in Stage 2, the researcher synthesized the objectives and expected learning outcomes of the instruction as tabulated below:

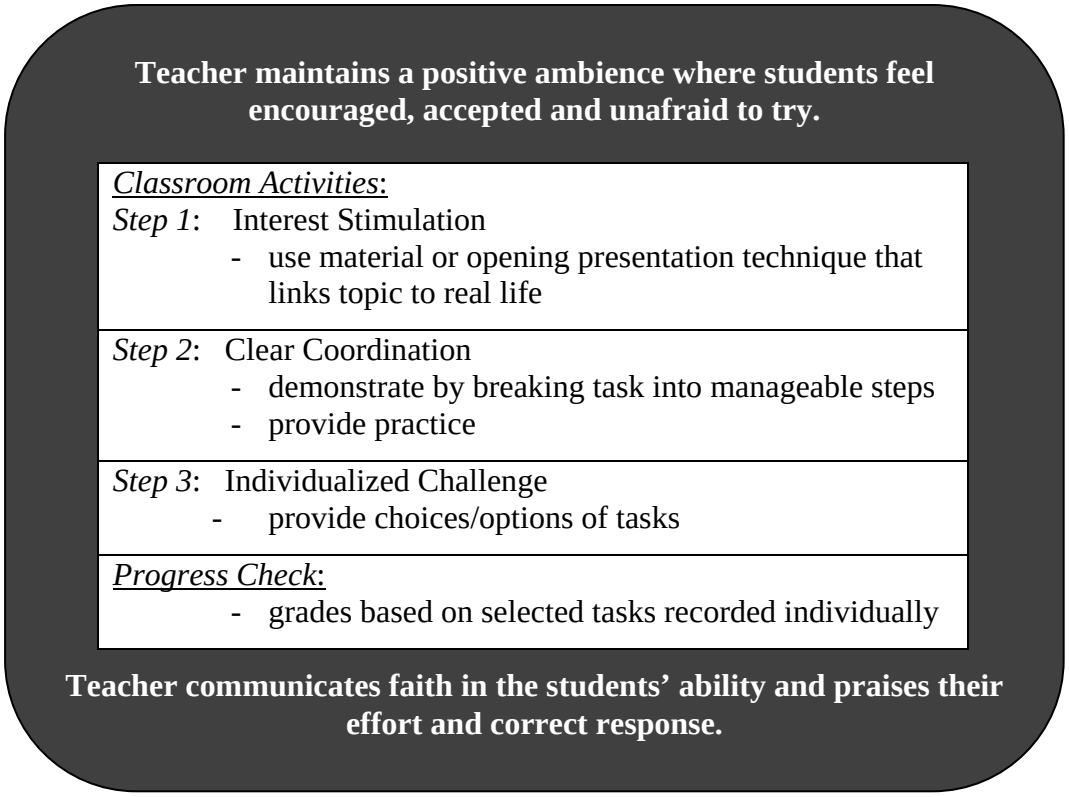
**Table 4.2 Instructional Objectives and Expected Outcome**

| *INSTRUCTIONAL PRINCIPLES* | *INSTRUCTIONAL OBJECTIVES* | *EXPECTED OUTCOME* |
|---|---|---|
| 1. Promotion of good teacher-student relationship creates a positive learning ambience. | To develop students' positive attitudes towards learning mathematics. | Students will show a positive attitude towards learning mathematics. |
| 2. The use of teaching materials or opening presentation technique that link topic to real life makes learning meaningful to students. | To sustain students' interest on task by linking topic to real life. | Students will display attentiveness on the lesson during mathematics instruction. |
| 3. Modeling of tasks in masterable steps makes the tasks more easily achievable. | To demonstrate or model a worked example by breaking up task into smaller manageable steps. | Students will gain mastery in specific mathematics topic learned. |
| 4. Arranging tasks that allows students to experience consistent success gives them a feeling of competence. | To structure activities in ways that brings success to the students. | Students will show confidence in doing mathematics tasks. |
| 5. Providing challenging activities to students at appropriate level which they can accomplish with minimal guidance increases their sense of competence. | To challenge students with tasks that are at their appropriate level. | Students will display motivation in mathematics by asking teacher for help when they encounter difficulty so they can remain on task. |
| 6. Evaluation based on individual progress makes learning non-threatening. | To provide the students with information about their progress based on individual results in mathematics. | Students will show improvement in their grades relative to their past achievement. |
| 7. Encouragement and praise, and expression of faith in the student's ability increase their self-efficacy. | To enhance the student's confidence in learning mathematics. | Students' beliefs in their mathematics competence will be positive. |

(4) Development of the Instructional Procedure

Once the instructional objectives and learning outcomes were established, the instructional procedure was developed which emphasized the teacher's role as a change agent in fostering the lower primary students' motivation and achievement in mathematics. In developing the instructional procedure, the researcher took into consideration that the model developed should be easily applicable for use by primary mathematics teacher so that anyone interested in using it would not have to make much modification to their regular class routine. The teaching steps appear below:

**Figure 4.1 Instructional Procedures**




**Research 2: Validating the Instructional Procedure**

*Validating the instructional procedure by experts*

Three experts in the field of Mathematics Education and Curriculum and Instruction were approached to verify the instructional procedure and sample lesson plans. While all experts agreed on the applicability of the instructional procedure, the following comments were made on the sample lesson plans which the researcher took into consideration in writing the plans for the actual study.

- The teacher's roles and students' roles must be elaborated.
- The materials and teaching aids used in the lesson should be shown in line with other columns (which show teacher's roles, students' roles and activities).
- Progress check must reflect learning and understanding of the objectives.
- Opening presentation should be made more interesting (than the one shown in the sample lesson plan).

**Development 2: Developing and Correcting the Instructional Model**

A second draft of the instructional model was developed based on the suggestions provided by the experts.

**Research 3: Validating the Instructional Procedure by Tryout**

A pilot study was conducted on 10 lower primary students with similar characteristics as the subjects in the main study. The research design involves experimentation of the instructional model, which is the independent variable in this study. After trying out the proposed instructional procedures, the researcher found the study feasible and worthwhile to continue. However, some refinement to the model was needed to improve instruction.

The bonding (Cordiality) stage of the instructional process, which initially was placed only at the start of the lesson, was found to be required at every stage of the lesson. There was occasionally something happening between students during lesson, which affected the children emotionally, and needed to be addressed by the teacher. In such a situation, the teacher had to deviate from the lesson to attend to the children's problem. This situation was unanticipated prior to the pilot study but the researcher found it as an opportunity for bonding with the students as they discussed problems together. Hence, the process of the instruction was refined to allow bonding to be included at every stage of instruction, instead of just at the beginning.

**Development 3: Developing Third Draft of the Instructional Model**

A third draft of the instructional model was developed after refining it by taking into account the results from the tryout.

**Phase 2: EVALUATION OF THE EFFECTIVENESS OF THE MODEL**

**Development 4: Preparing Research Instruments**

(1) Research Design and Sample

This study involved two types of investigation in order to obtain a more comprehensive result. As mentioned in earlier chapters, the purpose of this study was to investigate the effectiveness of the instructional model developed by the researcher in fostering learning motivation and learning achievement of lower primary students.

The first investigation involved a quantitative method to measure the changes in learning motivation as well as the changes in achievement results. The second type involved a qualitative approach to observe the students during lessons in the classroom and interview them at school.

In order to investigate the research questions, a single group interrupted time-series design was used as shown in Figure 4.2. This design involved one group and several observations or assessments before and after the treatment. This particular design was chosen due to the following reasons:

**Figure 4.2 Single Group Time-Series Design**

| **Observe** | **Pretest** | **Treatment** | **Obs6** | **Treatment** | **Obs7** | **Treatment** | **Obs8** | **Treatment** | **Obs9** | **Posttest** |
|---|---|---|---|---|---|---|---|---|---|---|
| OOOOO<br>O1-O5 | Ø | X | UNIT 1 ACHIEVEMENT | X | UNIT 2 ACHIEVEMENT | X | UNIT 3 ACHIEVEMENT | X | UNIT 4 ACHIEVEMENT | Ø |
| | Motivation & Interview | Unit 1 | O 6 | Unit 2 | O 7 | Unit 3 | O 8 | Unit 4 | O 9 | Motivation & Interview |
| *Before Treatment* | | *During Treatment* | | | | | | | | *After Treatment* |

1. A time-series design provides a useful and meaningful way to combine quantitative and qualitative data, which was appropriate for this research study. Furthermore, the results of this combination were communicated clearly through graphics for illustrative interpretation.
2. The design has multiple readings across time accompanied by descriptive statistics, and was valuable in giving evidence to answer research question 3 by showing the trend in the children's mathematics performance.
3. Although the researcher is not the participants' regular mathematics teacher, she has substantial information about the history of the participants that was sufficient to establish a reliable baseline in a time-series design.
4. A single group was used because the researcher herself was implementing the treatment on the participants, and it was unethical and unprofessional to treat the students in a control group (if any) with a feeling of indifference and no positive communication to neutralize the effect of the instructional model.

Prior to implementation of the treatment, the students' motivation in mathematics class was observed and their results from five previous tests were recorded to establish a baseline. Following that, an interview with individual students was made to gain an insight of their personal beliefs about their mathematics competence. Alongside it, a pretest to quantitatively measure the children's motivation to learn mathematics was individually administered to them. All items and response choices in the motivation instrument were read aloud. The students were informed that the responses would not affect their grades as this was not a test. There were two practice items for all participants to ensure that they understood the response format. Administration of the test for each student plus the individual interview took about 10 minutes.

Following that, the independent variable (i.e. the treatment) was applied over 20 lessons for a total duration of 1000 minutes to complete teaching 4 mathematics units. Between each treatment, the participants were given a test based on the mathematics unit just completed, and their results were observed and recorded. When the entire treatment period was completed, the experiment was concluded with another posttest to measure the students' learning motivation in mathematics as well as an interview with individual students. Furthermore, an interview with the participants' science teacher was made after the treatment was completed, to determine if there was any change in the participants' learning motivation in another subject.

This research design required many measurements prior to the introduction of the treatment to establish a stable baseline of how the students perform. Taking many measures of the dependent variable prior to treatment provided such information and allowed the researcher to judge whether the change of the series from just before treatment to just after was unique or merely part of a long-range pattern of change unrelated to treatment. After the treatment, another measurement of the students' learning motivation level provided evidence of the effect of the treatment.

The students involved in this experiment were given a pretest to find a score for their level of motivation towards learning mathematics as measured by the modified version of the instrument Young Children's Academic Intrinsic Motivation Inventory (Y-CAIMI) – Mathematics scale. Pre-intervention observations of the students during their regular mathematics class were done over two weeks and all observations of

their learning behaviour were kept in an anecdotal record. Furthermore, the students were interviewed with questions pertaining to their perceptions of ability and confidence in mathematics learning.

In employing this design, several conditions were considered to minimize the threats to the study. First, to reduce the threat of instrumentation, the researcher ensured that the classroom observation was done during maths lesson which occurred at the same time each day. Secondly, the pretest and posttest on motivation was given only once before the start of the treatment, and another after the entire treatment was completed so that the students did not become too familiar with the test and create subject effects threat such as the Hawthorne effect. Thirdly, the treatment in this study, which was the implementation of the developed instructional model, came as an abrupt intervention that is new to the students' existing learning environment. To avoid the threat of novelty effect, months before the experiment started the researcher formed bonding with the students and volunteered herself in the library to help anyone facing problems in mathematics. Fourthly, to ensure low subject attrition, the researcher ensured that the students involved in the experiment were the same throughout. This was easily feasible because the treatment was done within the same term to the same number of children. Historical threat was minimized with a pre-intervention series of observations and investigations pertaining to the participants' mathematics learning that were long enough to encompass whatever changes were likely to occur. Furthermore, maturation threat was minimized by keeping the experiment to about 6 weeks to ensure that there is no remarkable change in the children's development worthy of concern.

*Methods for statistical analysis*

The SPSS computer package was used to analyse the responses in order to address the research questions and directional hypotheses stated in Chapter One. A parametric statistical test was chosen to analyse the research data. Parametric methods are used when the test distribution is normal, otherwise nonparametric methods will be applied where distribution is not normal. In this study, a One-Sample Kolmogorov-Smirnov Test was first carried out to determine that the test distribution is normal, before parametric test was selected. A p-value on the K-S Test which is greater than the set alpha indicates a normal distribution. Once normal distribution was established,

Paired-samples t-test (also known as T-test for dependent samples) and the mean and standard deviation were performed on the motivation pretest and posttest scores. A time-series sequence chart was further derived from the observed unit test results to show the trend of the participants' mathematics achievement. Additionally, a comparison was made on the students' pre-treatment and post-treatment beliefs about their competence in mathematics.

Research Population

The target population of this research was lower primary students in international schools in Bangkok, specifically those offering Australian curriculum. Among developed western countries, Australia was shown to be at or below TIMSS scale average in the students' mathematics results (Mullis et.al., 2008), which made the researcher interested in studying schools offering Australian curriculum. An international school was selected for this study because of the following reasons:

1. Local schools in Thailand used Thai language as the main medium of instruction. Although English language was taught in local schools, the children's exposure to the language was very minimal. As such, their limited understanding of English would hinder them from the ability to interact, express, and learn actively using the language.

2. Most international schools in Thailand used English as the medium of instruction in all key learning areas such as literacy and mathematics.

3. The researcher was conducting the teaching herself. The researcher was not proficient in Thai language and was carrying out instruction in English.

4. One of the principles of instruction derived in this research focus on communication involving verbal interaction between the teacher and the students. To ensure the accuracy of the instructional model, there must be effective communication taking place.

Research Sample

At the time of the study, there were 40 international primary schools throughout Bangkok metropolitan, and 2 of them offered Australian curriculum. The two schools

were Australian International School of Bangkok and St. Mark's International School. The international schools had diverse numbers in enrolment, with an average class size of 14. Most of the population of the international schools was from the expatriate community, but in recent years there had been an increasing number of Thai children studying there, too. Of the 2 international schools offering Australian curriculum in Bangkok, only 1 school offered primary education, while the other offered only early childhood education.

Purposive sampling was used to select the sample and the international school that met the condition for this study was St. Mark's International School, with a student body of about 80 drawn from 14 nationalities. The school offered an Australian curriculum with Singapore mathematics program, and was known for its academic rigor. The researcher held an administrative role in the selected school, being responsible for teaching and learning in the school. A purposive sampling was done by selecting the lower primary class with subject characteristics most closely resembling that of the target population. The students in Grade 2 class were finally selected to be the research sample where the participants consisted of 11 children studying at the school in the academic year 2010-2011. The students were made up of 45 percent Thais and 55 percent international students of middle to upper class socioeconomic status. Parents of the international students included diplomatic officer, expatriates and business proprietors trading in Thailand. The average age of the students was 7 years 9 months and all children have normal intellectual ability. One of the participants was known to have a history of poor academic results and an apathetic attitude towards learning, with an attitude of learned helplessness.

(2) Research Instruments

**Motivation Instrument**

An important purpose of this research was to study the effect of the instructional model on students' learning motivation. As such, it is crucial that the instrument used for measuring the students' learning motivation be age-appropriate and reliable for use with the lower primary students. An extensive study led to Young Children's Academic Intrinsic Motivation Inventory (Y-CAIMI) for elementary school children in grades 1 to 3 developed by Adele Gottfried, a professor at the Department of Educational Psychology and Counseling of California State University (Gottfried,

1990). The Y-CAIMI was developed to measure academic intrinsic motivation involving enjoyment of school learning characterized by a mastery orientation; persistence; and the learning of challenging, difficult, and novel tasks. This research instrument, which yielded scores on four subscales (reading, mathematics, general, and difficult) as well as a total score, was the first instrument developed to measure young children's academic intrinsic motivation. Each of the Reading, Mathematics and General subscales contained 13 items, making a total of 39 items on the entire test. Its validity for use with young children is indicated by two factors: (1) The items, response format and administrative procedures were clear and appropriate for young children. (2) The items were developed to reduce response acquiescence wherein reverse-scoring items were included. This instrument has a reliability coefficient alpha of .84 ($p<.001$) for the Math scale. No normed data are available for this instrument. Total subscale scores were used for data analyses, with higher scores corresponding to higher motivation.

The researcher analysed the items in the Math scale of the Y-CAIMI and tested them on some children who were not included in the actual study. All items were clear to the children except for one, "I like to do easy math work", which was interpreted by all the children as something positive, when in fact a response of "Very True" indicates low motivation. Thus, from the original 13-item Math Scale, the above-mentioned item (I like to do easy math work) was removed. Furthermore, in the administration guidelines of Y-CAIMI the author stated that "the Y-CAIMI should not be administered to children who are not fluent in English language."

After considering that the participants in the current study would include Thai children of non-English background, the researcher added four items to the instrument in order to check the consistency of the participants' answers to existing items in Y-CAIMI (Math scale). The four items (numbers 7, 8, 12 and 16) were written in basic English language which the students would understand easily. Furthermore, the researcher consulted the author and publisher of Y-CAIMI, and received approval to modify the research instrument for the purpose of this study (see Appendix B). The result is a 16-item instrument as shown in Table 4.3.

The questions on the instrument were the same in the pretest and posttest but the sequence of asking those questions were changed on those two occasions so that the

children would not remember it as the same test, and hence should not have any retention effect that might affect the children's answers to the tests. Each item was scored based on a three-point Likert-scale, so possible scores ranged between 16 and 48 points.

**Table 4.3 Young Children's Mathematics Learning Motivation Instrument**

| Items | Very True | A Little True | Not True |
|---|---|---|---|
| 1. I like learning new things in maths. | | | |
| 2. Maths is not interesting. | | | |
| 3. I feel good inside when I learn something new in maths. | | | |
| 4. I like to do as much work as I can in maths. | | | |
| 5. I don't like to practise new maths work. | | | |
| 6. I would like to learn more about maths. | | | |
| 7. Maths is my favourite subject.* | | | |
| 8. I think doing maths is fun.* | | | |
| 9. I don't like to figure out new maths problems. | | | |
| 10. I like to do hard maths work. | | | |
| 11. I like to find answers to questions in maths. | | | |
| 12. I enjoy doing maths.* | | | |
| 13. I don't give up until I understand my maths work. | | | |
| 14. I would not like to learn more about maths. | | | |
| 15. I think maths is interesting. | | | |
| 16. I think working with numbers is fun.* | | | |

* new items

Four items on this instrument (items 2, 5, 9 and 14) were reversed items. Those items were given appropriate values as reversed from the other items. This meant that students' positive responses to the statements in the four reversed items gave them a lower score instead of a higher score. The students' scores obtained from the motivation scale provided the quantitative data in this study.

**Interview Checklist**

To cover the depth of the issue at hand, the researcher additionally used a qualitative method such as semi-structured interviews to provide richer and deeper understanding of the students' learning motivation. The interviews were conducted once before the

treatment started, and another after the treatment period ended. Research question number four, which is to determine if there is a component in the instructional model that is most effective for increasing primary students' learning motivation, was answered through individual interview questions and classroom observations. A set of interview questions as seen in Table 4.4 were prepared to verify which component of the instructional process has profound effect in fostering the students' motivation to learn mathematics.

**Table 4.4 Interview Questions (1)**

| Questions | Structured Responses | Components |
|---|---|---|
| 1. Do you like maths? Why (not)? | - The way my teacher teaches me<br>- My teacher does special activities like games/quiz<br>- My teacher allows me to be teacher<br>- My teacher uses many ways to teach (tell story/use materials) | - Clarity<br>- Challenge<br>- Coordination<br>- Collection |
| 2. Do you like any of these activities in maths class? | - Problem-posing<br>- Modeling a teacher | - Challenge |
| 3. Do you feel afraid in your maths class? Why (not)? | - My teacher allows me to share ideas<br>- My teacher makes me feel important<br>- My teacher always encourages me to do my best | - Cordiality<br>- Cordiality<br>- Communication |
| 4. What do you think of your maths teacher? | - Friendly<br>- Encouraging<br>- Approachable | - Cordiality<br>- Communication<br>- Cordiality |

The researcher also sought to determine if there was a change in the students' self-efficacy in mathematics using the following interview questions which many researches have used to assess perceived academic competence (Stipek, 1993, p.162).

**Table 4.5 Interview Questions (2)**

| Questions | Responses |
|---|---|
| 1. How confident are you in doing maths? | Very confident / Confident / Somewhat confident / Not confident |
| 2. What do you expect to get in your maths exam? | Less than 80 percent / More than 80 percent |
| 3. Is your achievement in maths up to your expectation? | Free response |

**Experts' Validation of Instruments**

An important component in test development is providing evidence that the items created are measuring the content they are defined to measure. Prior to implementation, an independent expert panel of three professionals in the education field was consulted to check the validity of the questions and response items in measuring the effect of the instructional process on children's motivation. The content experts' evaluations of items were then measured using the index of item-objective congruence (IOC) which was originally introduced by Rovinelli and Hambleton (Turner, 2003).

An evaluation using the index of IOC is a process where content experts rate individual items on the degree to which they do or do not measure specific objectives listed. The content expert evaluated each item by giving the item a rating of 1 (for clearly measuring), -1 (for clearly not measuring), or 0 (degree to which it measures the content area is unclear) for each objective. The experts were not told which objective the individual items were intended to measure, so that they remained independent and unbiased evaluators. The following is an example of what the evaluation was like:

**Table 4.6 Sample of Evaluation using Index of IOC**

| Items | Cordiality | Collection | Clarity | Coordination | Challenge | Confirmation | Communication |
|---|---|---|---|---|---|---|---|
| 1. I like maths because my teacher uses many ways to teach. | -1 | 1 | -1 | -1 | -1 | -1 | -1 |
| 2. I like maths class because my teacher always encourages me to do my best. | -1 | -1 | -1 | -1 | -1 | -1 | 1 |

Crocker and Algina (1986, in Turner and Carlson, 2003) provided a simplified version of Rovinelli and Hambleton's formula to measure the index of item-objective congruence as follows:

$$I_{ik} = [N/(2N-2)] (X_k - X)$$

where

$I_{ik}$ = the index of item-objective congruence for item i on objective k,
N = the number of objectives,
$X_k$ = the experts' mean rating of item i on objective k, and
X = the experts' mean rating of item i on all objectives

An index value of 1.00 indicated that all experts agreed that the item was clearly measuring a valid objective. Generally, a score of +0.70 is considered acceptable for item inclusion, while items with indices between +0.50 and +0.69 should be examined individually to decide to accept, revise or reject them.

After receiving the experts' responses, a couple of structured response items from two questions in the interview checklist were removed due to complete incongruence on what the items intended to measure. From question 1 "Do you like maths? Why?" the response item deleted was "Because my teacher tells me how maths applies to my life". From question 4 "What do you think of your maths teacher?" the response item deleted was "Threatening". Three items had an IOC index score of between +0.50 and +0.69 but were accepted because all experts gave a rating of 1 for the particular objective they intended to measure. All other items had an IOC index score of higher than +0.70 so they were all included.

**Observation Checklist**

In gathering more qualitative data to gain understanding of the children's learning traits, the researcher conducted classroom observations using a structured checklist as appeared in Table 4.7. The checklist was adapted from the instrument Identifying Motivation Problems developed by Deborah Stipek (1993). For each item on the checklist, a score of -1 indicates 'not usually true' and a score of +1 indicates 'usually true'. Between April and August 2010, the researcher observed the children in their mathematics class. Records of observation were made, especially of those children with a history of weak mathematics performance.

In the same way as the interview checklist, the observation checklist was sent to three education experts for validation. Of the eleven items, three had an IOC index score above +0.70 which meant they were acceptable for inclusion. Another seven items had scores between +0.50 and +0.69. Upon examining that each of those items had one objective where all experts agreed that the item measured, all the seven items

were included. One last item about “students given a choice” had an IOC index score of 0.42. For the objective that the item intended to measure, two experts were in agreement, while the third expert rated it as unclear. Considering that this item was useful in assessing the children’s motivation through the choice of task, which is one of the highlights of the developed instructional process, the researcher decided to retain this item.

**Table 4.7 Observation Checklist**

| DOES THE STUDENT ….. | Usually True | Not Usually True | Expected Outcome Measured |
|---|---|---|---|
| Pay attention to the teacher – not talking or fidgeting with things? | | | Attentiveness |
| Volunteer answers in class? | | | Confidence |
| Begin work on tasks immediately? | | | Attitude |
| Maintain attention until tasks are completed – not getting out of seat to move around the class? | | | Attentiveness |
| Persist in trying to solve problems rather than giving up as soon as the problem appears difficult to solve? | | | Confidence |
| Work autonomously unless problem arises then will ask for help? | | | Motivation |
| Ask for assistance when it is really needed? | | | Confidence |
| Turn assignments in on time? | | | Attitude |
| Turn in complete and accurate work? | | | Mastery |
| When given a choice, at least select one of the challenging tasks? | | | Mastery |
| Engage in learning activities beyond requirements – request to do extra tasks? | | | Confidence |

(3) Reliability test on motivation instrument

To assess the reliability of the modified instrument measuring motivation in learning mathematics, a pilot exercise was carried out in which 43 primary students from another international school in Bangkok were asked to complete the test. Those students were not included in the actual study. Cronbach’s Alpha, which is generally used for items that are not scored right or wrong as in this case, was computed using the Statistical Package for Social Studies (SPSS) to determine the reliability of the instrument. Generally, the closer the Cronbach’s Alpha coefficient is to one, the

higher the reliability estimate of the instrument responses. An acceptable range of reliability for coefficients for most instrument is 0.70 to 0.90 (McMillan & Schumacher, 1997). According to McMillan and Schumacher, a reliability of 0.80 or above is generally expected for achievement variables, whereas estimates of 0.65 may be acceptable for measuring personality traits. Motivation is a part of traits. In this case where motivation was being measured, the instrument yielded an alpha coefficient of 0.907, showing that the instrument was highly reliable in measuring the students' motivation in learning mathematics.

(4) Unit tests preparation

The selected school for this study provided tests for the students right from Pre-Preparatory class at age 4. At the primary school level, the students were given a test at the end of each mathematics unit, and a summative assessment at the end of each semester. The researcher had to prepare the test papers for each lesson unit, taking into account that the test items should assess the students' understanding of the particular unit related to the planned lesson objectives.

The average number of items prepared for the unit tests was 34, and the average duration of each test was 38 minutes. The students took the tests during their regular mathematics period. The test papers were sent to three experts in mathematics – one primary school mathematics teacher and two university lecturers in mathematics – and received verification that the content of the test papers was valid for the research participants. Results from the unit tests were accumulated for use in measuring the students' mathematics achievement. These test results provided a quantitative data for evaluating the effectiveness of the developed model in enhancing the students' mathematics achievement.

(5) Writing lesson plans using the instructional procedures

The school selected for this research made a yearly and weekly plan for its mathematics curriculum, to guide the teacher's daily lesson planning. For this reason, the researcher had to meet with the school's mathematics teacher for discussions about the mathematics units that the researcher would teach in order not to cause disruption to the school's mathematics program.

The mathematics curriculum used in the selected school was based on Jerome Bruner's theory of a spiral approach where each unit is repeated every year, but increasing in breadth and depth. Consequently, the researcher had to refer not only to the course books currently used by the class, but also to course books of previous year, in order to gain more understanding of the students' background and prior learning in each of the mathematics units. Altogether there were 4 units prepared by the researcher as listed in the table below.

**Table 4.8 Lesson Units**

| Unit | Topics | Time |
|---|---|---|
| 1 | **Money, Measures and Mensuration** (MONEY)<br>- Dollars and cents<br>- Decimal notation of money<br>- Comparing amounts of money<br>- Adding money<br>- Subtracting money | 250 minutes |
| 2 | **Fractions** (FRACTION)<br>- Unit fractions<br>- Writing fractions<br>- Parts and whole<br>- Comparing and ordering fractions<br>- Adding fractions | 250 minutes |
| 3 | **Money, Measures and Mensuration** (TIME)<br>- On the hour<br>- Minutes and hours<br>- Time interval<br>- Before and after<br>- More on before and after | 250 minutes |
| 4 | **Statistics** (GRAPHS)<br>- Introduction<br>- Picture graphs<br>- Making picture graphs<br>- Interpreting picture graphs<br>- Solving problems involving graphs | 250 minutes |

The mathematics lesson plans were orchestrated according to the teaching procedure that has been developed. A summary of the lesson plans for the Unit on Money is shown in the following table.

**Table 4.9 Summary of lesson plans on Money**

| No. | Lesson | Procedures | Duration |
|---|---|---|---|
| 1 | Dollars and cents | Teacher maintains a positive ambience where students feel encouraged, accepted, and unafraid to try.<br>Start the class with a conviction that everyone can learn and has the ability to excel in maths.<br>Step 1: teacher tells the Teddy Bear Story<br>Step 2: teach how to read the price and then provide practice in course book<br>Step 3: provide options of tasks from activity book, work card, or problem-posing<br>Step 4: teacher grades students on their selected task | 50 min. |
| 2 | Decimal notation of money | Say why maths is important for everyone. Give some examples of using money in our daily life.<br>Step 1: lay out play money in the centre of the circle. Ask the children to show the amount that teacher stated<br>Step 2: use real money to demonstrate that 100¢ = $1. Then, give the children some money and ask each one to present by stating the amount they got.<br>Step 3: provide task options from activity book, work card, or problem-posing.<br>Step 4: teacher grades students on their selected task | 50 min. |
| 3 | Comparing amounts of money | Share experiences of making choices in our purchases.<br>Step 1: hold up 2 toys and their prices and ask the class to say which is cheaper.<br>Step 2: demonstrate how to make comparison involving dollars and cents.<br>Hand out picture of an item to each child, ask 2 children to come to the front and tell the class whose item costs more.<br>Step 3: provide options of tasks from activity book, work card, or problem-posing<br>Step 4: teacher grades students on their selected task | 50 min. |
| 4 | Adding money | Share stories of paying for purchases while getting the children to work unconsciously on their addition.<br>Step 1: show 2 items and ask the class to tell how much altogether.<br>Step 2: demonstrate that adding money is like adding numbers: the parts make a whole.<br>Pair up children to present to the class the total price of 2 items using the heuristics just learnt.<br>Step 3: provide options of tasks from course book, work card, or problem-posing<br>Step 4: teacher grades students on their selected task | 50 min. |
| 5 | Subtracting money | State admiration for efforts put in throughout the week.<br>Step 1: Set up shops and pair children to a shop. Play shopping game to achieve the goal as being the pair with the highest amount of money<br>Step 2: demonstrate that subtracting money is like subtracting numbers: parts and whole model.<br>Ask two children to present to the class solution to the problems in course book.<br>Step 3: provide options of tasks from activity book, work card, or problem-posing<br>Step 4: teacher grades students on their selected task<br>Teacher communicates faith in the students' ability and praises their effort and correct response. | 50 min. |

(6) Preparing Teaching Materials

The researcher prepared materials for teaching which included collecting and making teaching aids to use during lessons. To do this, the researcher had to study each unit in the mathematics course book and plan how the lessons would be conducted, before deciding on the items to make and the appropriate work cards to use. For example, for the unit on Time, the researcher made a display clock and eleven smaller individual clocks for each of the students. For the unit on Money, the researcher had to make Singapore dollar notes and coins, enough for the students to play shopping, and also prepare the local Thai currency which is related to the students' real-life experience to introduce the lesson.

Preparation of materials also involved sourcing and compiling the independent work cards according to the topic for each lesson unit. There are several publishers responsible for making the mathematics course books used in schools throughout Singapore. All the units in those books were the same and the objectives of each unit were also congruent. This enabled the researcher to use the activities contained in those alternative textbooks as the work cards in the current study. The work cards were filed according to the 4 main Units, and the researcher brought out the folder pertaining to the Unit only when the particular Unit was taught. Each time the class was over, the work card folder would be kept by the researcher such that the children would not have access to it. This was done to reduce the children's familiarity over the problems in the folder. As for problem posing, blank notebooks were prepared for each participant to pose or author their own problems pertaining to the Unit being taught.

# CHAPTER 5

## RESEARCH FINDINGS

The purpose of this research study was (1) to develop an instructional model to foster learning motivation and learning achievement based on self-efficacy and social cognitive development theories for lower primary students in international schools in Bangkok and (2) to evaluate the effectiveness of the developed model on the two dependent variables, i.e. learning motivation and achievement in mathematics.

Phase 1 of the research has been elaborated in Chapter 3 and is summarized below to answer Research Question 1 about what the instructional model looks like.

**Table 5.1 Summary of Phase 1 of Research and Development**

| *1. Synthesis of main principles of Self-Efficacy and Social Cognitive Development Theories* |
|---|
| **Self-Efficacy Theory**<br>1. Teacher structures tasks in masterable steps to ensure that the students achieve a high level of initial success. Once this is achieved, tasks that are at appropriate challenging level can be assigned, to raise their feelings of competence upon successful completion of it.<br>2. Teacher models the requisite skills for successful completion of task, and provide students the opportunity to model teaching.<br>3. Teacher persuades students that they have the ability to acquire the skills and gives them explicit feedback on their progress.<br>4. Teacher creates a classroom atmosphere that is conducive for learning, where students feel safe and encouraged to perform.<br>**Social Cognitive Development Theory**<br>1. A positive teacher-student relationship makes learning a positive experience. Teacher models positive attitudes such as respect and hopeful determination. Teacher models by demonstrating to the children the skill to be learned. The children model the same skill while teacher facilitates their learning. More able children can be assigned to teach the less able.<br>2. Teacher assigns work that is at the appropriate challenging level for the child and assists only as and when is necessary.<br>3. Teacher uses a variety of teaching materials and presentation methods to engage students' interest. Teacher relates learning to students' real-life experiences so they find learning meaningful. |
| *2. Development of Instructional Principles for Current Study* |
| 1. Promotion of good teacher-student relationship creates a positive learning ambience.<br>2. Collection of variety of teaching materials and provision of choice of tasks make learning appropriate and meaningful to students.<br>3. Modeling of tasks in masterable steps makes the tasks more easily achievable.<br>4. Arranging tasks that allows students to experience consistent success gives them a feeling of competence.<br>5. Providing challenging activities to students at appropriate level which they can accomplish with minimal guidance increases their sense of competence.<br>6. Evaluation based on individual progress makes learning non-threatening.<br>7. Encouragement and praise, and expression of faith in the student's ability increase their self-efficacy. |

*3. Specifying Instructional Objectives for Current Study*

1. To develop students' positive attitudes towards learning mathematics.
2. To provide variety and choice of tasks to sustain students' engagement on task.
3. To demonstrate or model a worked example by breaking up task into smaller manageable steps.
4. To structure activities in ways that brings success to the students.
5. To challenge students with tasks that are at their appropriate level.
6. To provide the students with information about their progress based on individual results in maths.
7. To enhance the student's confidence in learning mathematics.

*4. Developing Instructional Procedure for Current Study*

**7 Cs FOR TEACHER'S ROLES**

**CORDIALITY**: Teacher models warmth, respect, and caring attitude. Before lesson starts, teacher greets students by name as they enter the classroom.
**COLLECTION**: Teacher uses a variety of material/tool or opening presentation method to start the lesson.
**CLARITY**: Teacher demonstrates to students the steps and procedure involved in solving the mathematics task by doing worked examples.
**COORDINATION**: Teacher provides students with initial tasks that are certain to bring success to the students, including asking students to paraphrase the modeled steps/procedure and providing them practice in applying the procedure.
**CHALLENGE**: Provide options of tasks for children to choose – from coursebook, independent work card, or problem-posing – that gives them optimal challenge.
**CONFIRMATION**: Record students' results in individual file for evaluation of progress. The result should not be compared with other students' results.
**COMMUNICATION**: Communicate faith in the children's ability. Praise them for their effort. Challenge them to do their best.

*5. Teaching Procedure*

**Teacher maintains a positive ambience where children feel encouraged, accepted and unafraid to try.**

*Classroom Activities*:
*Step 1*: Interest Stimulation
- use material or opening presentation technique that links topic to real life

*Step 2*: Clear Coordination
- demonstrate by breaking task into manageable steps
- provide practice

*Step 3*: Individualized Challenge
- provide choices/options of tasks

*Progress Check*:
- grades based on selected tasks recorded individually

**Teacher communicates faith in the students' ability and praises their effort and correct response.**

This chapter also focuses on Phase 2 of the research and development to illuminate the result of the implementation of the instructional model to foster learning motivation and learning achievement in mathematics of the lower primary students. This phase sought to answer the research questions stated in Chapter 1, and determine whether to accept or reject the related research hypotheses.

*Research Question 2:*

What is the effect of the instructional model on primary students' learning motivation in mathematics?

*Research Hypothesis 1:*

After the treatment, the students will show higher learning motivation at the $p \leq .05$ significant level as measured by the modified Young Children Academic Intrinsic Motivation Inventory scale, than before treatment.

In order to answer this research question, the Young Children's Mathematics Learning Motivation instrument (see Appendix D), adapted from Young Children's Academic Intrinsic Motivation Inventory (Y-CAIMI) – Mathematics scale, was administered to the participants during both the pretest and posttest of the study. As mentioned in Chapter 4, only the Math section of the Y-CAIMI was selected for this study. It was further adapted by removing one question which the students were not able to answer as expected, and adding four questions to increase the reliability of the instrument, making it a 16-item instrument. Table 5.2 shows the mean and standard deviation of the students' motivation scores for both pretest and posttest.

**Table 5.2 Mean Pretest and Posttest on Motivation (n=11)**

| | | Pretest | | Posttest | |
|---|---|---|---|---|---|
| | **Items** | **Mean** | SD | **Mean** | SD |
| 1 | I like learning new things in maths. | **2.73** | .467 | **3.00** | .000 |
| 2 | Maths is not interesting. | **2.55** | .522 | **3.00** | .000 |
| 3 | I feel good inside when I learn something new in maths. | **2.82** | .405 | **2.82** | .405 |
| 4 | I like to do as much work as I can in maths. | **2.18** | .603 | **2.82** | .405 |
| 5 | I don't like to practice new maths work. | **2.64** | .505 | **3.00** | .000 |
| 6 | I would like to learn more about maths. | **2.55** | .522 | **3.00** | .000 |
| 7 | Maths is my favourite subject. | **2.18** | .751 | **2.64** | .505 |
| 8 | I think doing maths is fun. | **2.27** | .467 | **3.00** | .000 |
| 9 | I don't like to figure out new maths problems. | **2.45** | .522 | **3.00** | .000 |
| 10 | I like to do hard maths work. | **1.64** | .674 | **2.45** | .522 |

| | | | | | |
|---|---|---|---|---|---|
| 11 | I like to find answers to questions in maths. | **2.55** | .522 | **2.82** | .405 |
| 12 | I enjoy doing maths. | **2.45** | .522 | **2.91** | .302 |
| 13 | I don't give up until I understand my maths work. | **2.64** | .505 | **3.00** | .000 |
| 14 | I would not like to learn more about maths. | **2.73** | .467 | **2.82** | .603 |
| 15 | I think maths is interesting. | **2.64** | .505 | **2.91** | .302 |
| 16 | I think working with numbers is fun. | **2.36** | .505 | **2.91** | .302 |
| | ***Total Mean Score*** | ***2.46*** | *.362* | ***2.88*** | *.127* |

At Pre-test, the Mean score of the participants' motivation was 2.46 (SD = .362) out of a total possible score of 3. For items such as "I like to do as much work as I can in maths" and "I like to do hard maths work", the scores were well below the Grand Mean Score. After the intervention, the Grand Mean motivation scores of the 11 participants increased to 2.88 (SD = .127) at the Posttest. Prior to using parametric statistics test, the researcher performed a One-Sample Kolmogorov-Smirnov Test (K-S Test) to determine that there is a normal distribution in the research sample. From the One-Sample K-S Test, it was found that the pretest p-value = 0.849 and posttest p-value = 0.653 are both greater than $\alpha = 0.05$ (see Appendix E). Therefore, a conclusion was made that the results are normally distributed, and parametric statistical testing could be performed to continue analysing the research data.

The Means on the participants' motivation before and after the treatment were compared, and it was found that there was a difference in the two means. A paired *t*-test was executed to examine if this difference in means was significant. Table 5.3 shows the *t*-test for paired samples yielding a *t* of 4.60, and Sig. (2-Tailed) value of .001. This p-value is less than .01, giving a 99% Confidence Level that the test was statistically significant. Because of this, it can be concluded that there is a statistically significant difference between the Means of the Pretest and the Posttest. Since the paired-samples statistics box (Table 5.4) revealed that the Mean for the Posttest was greater than the Mean for the Pretest, it showed that the participants' motivation in learning mathematics was significantly higher after the implementation of the treatment.

**Table 5.3 Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Posttest - Pretest | .42091 | .30323 | .09143 | .21720 | .62462 | 4.604 | 10 | .001 |

**Table 5.4 Paired Samples Statistics**

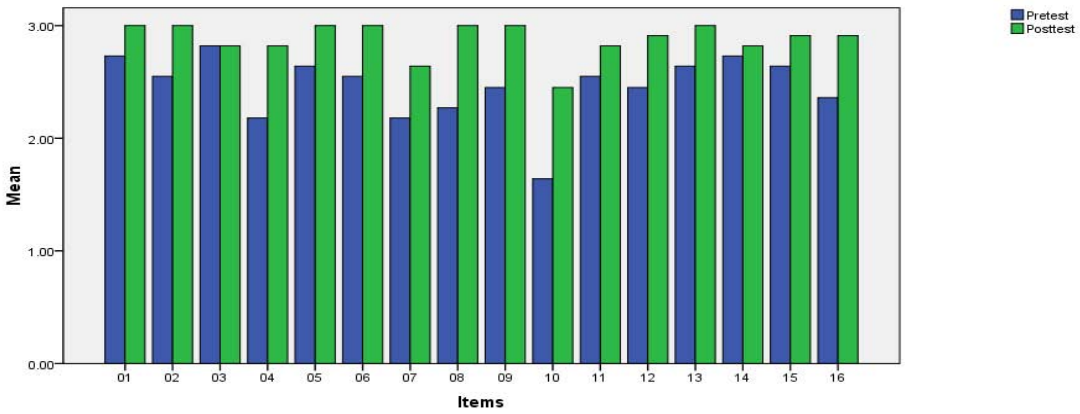
| | | Mean | n | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | Posttest | 2.8818 | 11 | .12750 | .03844 |
| | Pretest | 2.4609 | 11 | .36198 | .10914 |

**Table 5.5 Descriptive Statistics**

| | n | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Posttest | 11 | 2.56 | 3.00 | 2.8818 | .12750 |
| Pretest | 11 | 1.81 | 2.94 | 2.4609 | .36198 |

Moreover, the Posttest minimum score on mathematics learning motivation of 2.56 was still higher than the mean score of the Pretest of 2.46 (see Table 5.5). Further examination of the students' responses indicated that their responses to each of the statements on the motivation instrument improved markedly after the treatment. For instance, all the participants responded very positively to seven items in the instrument at the Posttest compared to the same items at Pretest. A further analysis of the participants' responses to each item on the instrument is depicted graphically in Figure 5.1.

**Figure 5.1 Motivation Instrument: Item Means of Pretest and Posttest**



For all the 16 items on the instrument as listed in Table 5.1, there was an improvement in the participants' responses about their motivation towards mathematics learning, except for item #3 "I feel good inside when I learn something new in maths" in which both the pretest and posttest yielded the same results of 2.82 (SD=.405). There was a substantial improvement ($\bar{x}$=2.45, SD=.522) in the students' response to item #10 "I like to do hard maths work" which scored the lowest at Pretest ($\bar{x}$=1.64, SD=.674). Other items which showed marked improvement included responses to "I like to do as much work as I can in maths" (item #4), "I think doing maths is fun" (#8), and "I thinking working with numbers is fun" (#16).

Furthermore, comparing the observation records of the participants in their maths class before and after the treatment, it was found that more students were willing to volunteer answering questions after the treatment than before. They showed more courage to try answering even though it was not always the correct answer. The variety in opening techniques that the researcher used, especially storytelling, helped to capture and maintain the students' attention. The students' interest in stories was confirmed when the researcher had a chance to talk randomly with four of the participants many weeks after the treatment was over, and all of them mentioned they enjoyed and still remembered the stories told in the class.

With regards to work attitude, the students were observed to work more independently after the treatment, asking for teacher's assistance only when it was necessary. The most striking change was seen in the students' initiative to request for extra mathematics work. On one occasion during the treatment period, when the participants' extra-curricular class was cancelled due to the teacher's medical leave, one student mentioned:

> *Child J: "Why don't we [use the time to] learn maths?"*
> *Other students immediately echoed in agreement: "Yes! Yes! Can you teach us, please?"*

So, the researcher used the time to play some games with them related to the day's mathematics topic learnt in class. Later that same day, when the participants' had a free period after lunch, three students requested if they could learn mathematics again instead. There were several other occasions when the students requested to

return to maths class during their lunch break and used the time to do some mathematics-related activities. Considering that the participants had taken the initiative using their free time to learn mathematics, the researcher was convinced of the students' genuine motivation in learning the subject.

From these findings, it can be concluded that the effect of the instructional model on lower primary students' mathematics learning motivation was a positive one as indicated by the participants showing higher motivation in learning mathematics after receiving the treatment from the developed model. The null hypothesis was therefore rejected and research hypothesis 1 accepted.

*Research Question 3:*

Is there an improvement in the students' mathematics achievement as a result of the treatment?

*Research Hypothesis 2:*

After the treatment, the students will achieve test scores at the set minimum criteria of 80% or higher.

Results from the participants' past 5 unit tests in Grade 2 mathematics were observed to set the baseline of the students' mathematics achievement. After treatment started, a total of 4 unit tests were administered, each was carried out after completion of teaching the unit using the instructional model developed. Observed test results were compiled as shown in Table 5.5. A time-series sequence chart as shown in Figure 5.2 was then performed to answer the above-mentioned research question, where a minimum score of 80 percent was set as the criteria of achievement in mathematics to consider the treatment as effective in enhancing the students' mathematics achievement.

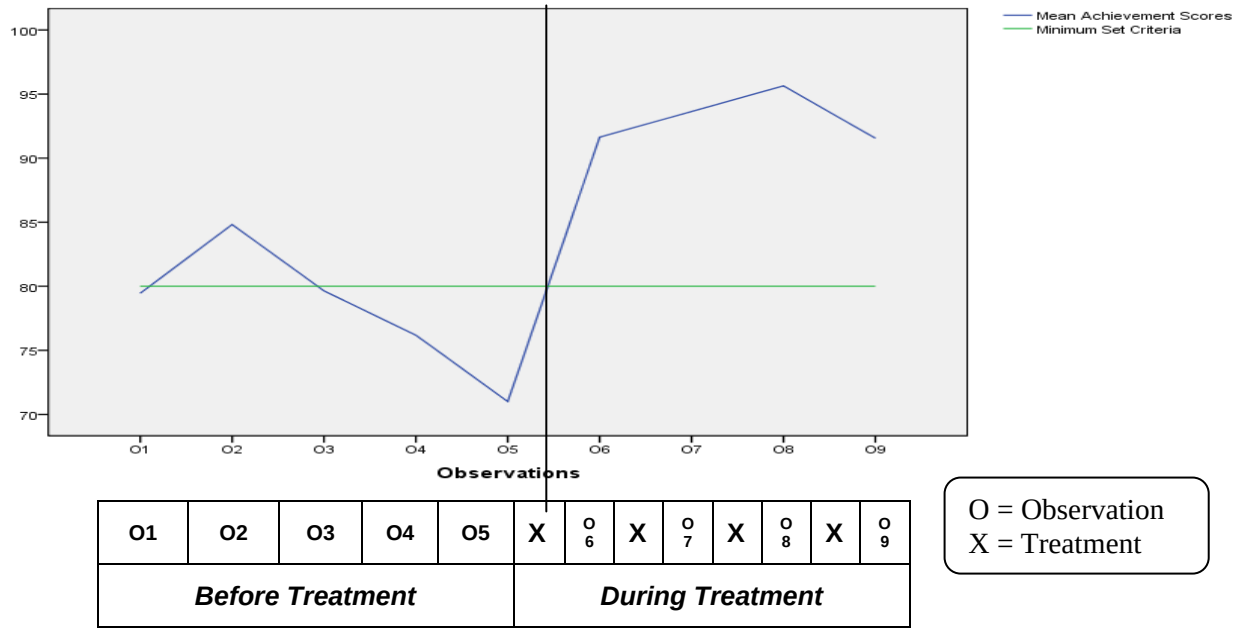
From the results shown in Table 5.6, prior to the treatment, the participants' Overall Mean Scores for mathematics were generally below 80%. Right after Test 2 where the average overall score was 84.82, the participants' results have been plummeting all the way to the start of the treatment.

**Table 5.6 Observed mathematics achievement results (n=11) segregated by Pre-Treatment Confidence level with Group A being Very Confident, Group B Confident, Group C Somewhat Confident and Group D Not Confident**

| *Period* | *Test #* | *Grp A = 4 (%)* | *Grp B = 1 (%)* | *Grp C = 5 (%)* | *Grp D = 1 (%)* | *Overall Mean Score (%)* |
|---|---|---|---|---|---|---|
| **Before Treatment** | 1 | 80 | 98 | 74.4 | 84 | 79.45 |
| | 2 | 84.8 | 100 | 82.4 | 82 | 84.82 |
| | 3 | 80.3 | 100 | 79.4 | 58 | 79.64 |
| | 4 | 77 | 87 | 77 | 60 | 76.18 |
| | 5 | 67.25 | 80 | 72.2 | 71 | 71.00 |
| **During Treatment** | 6 | 92 | 98 | 90.6 | 89 | 91.64 |
| | 7 | 94.3 | 98 | 93 | 90 | 93.64 |
| | 8 | 98 | 96 | 93.6 | 96 | 95.64 |
| | 9 | 92.3 | 100 | 91.4 | 81 | 91.55 |

The vertical line on the chart divided the baseline period from the treatment period. Once treatment started, there was an increase in the mean score, leaping by about 20 points in the overall mean score of the last pre-treatment test (Observation 5) to the first post-treatment test (Observation 6). A more subtle increase was seen in overall mean score of the 2 subsequent tests (Observations 7 and 8), with a slight dip in the overall mean score of the last post-treatment test (Observation 9) to a level similar to that of the first post-treatment test.

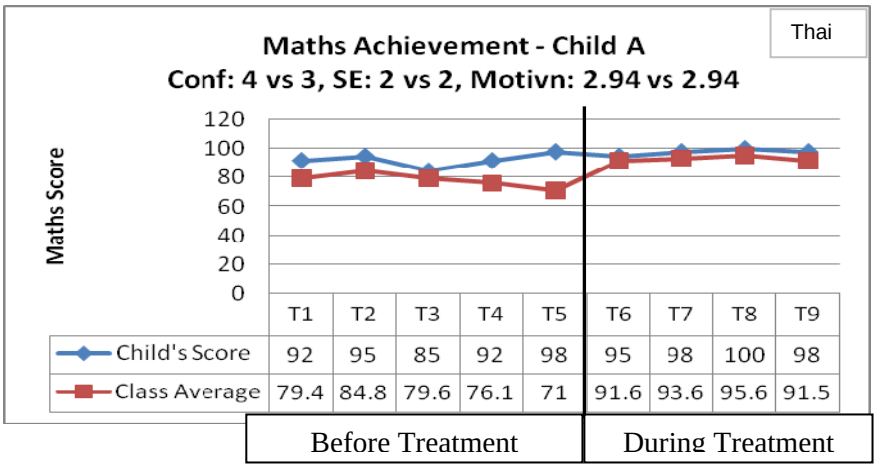
**Figure 5.2 Mathematics Achievement Before and After Treatment**



The slight drop in the class average at the last observation (unit test on Graphs) was investigated by the researcher. After analyzing that the students' prior knowledge in multiplication and division was a pre-requisite for the topic on Graphs, the researcher examined the participants' past test results on Multiplication and Division (Observations 3 and 5), and linked that the dip in the test scores on Graph was due to the reason that the participants' foundation on Multiplication was not as concrete as it should have been. However, considering that the class average score for the Graph test was more than the required minimum criteria of 80 percent despite the dip, this decrease was inadequate to cause any concern about the students' mathematics progress collectively.

The graphs that follow illustrate the individual participants' mathematics achievement as compared with the class average for each unit test. Tests taken before the treatment are indicated as T1 to T5. Tests taken during the treatment are indicated as T6 to T9. Data of the students' Confidence (Conf) and Self-efficacy (SE) levels obtained from the structured interview responses are also shown for each child. The students' individual responses to the items in Motivation Instrument (Motivn) are also displayed in each graph. The numbers that appear after Conf, SE and Motivn show the results of Pre-Treatment versus Post-Treatment levels. The first 6 graphs pertain to those students who are the higher achievers in the class, while the remaining 5 graphs show the results of the low-achieving students.

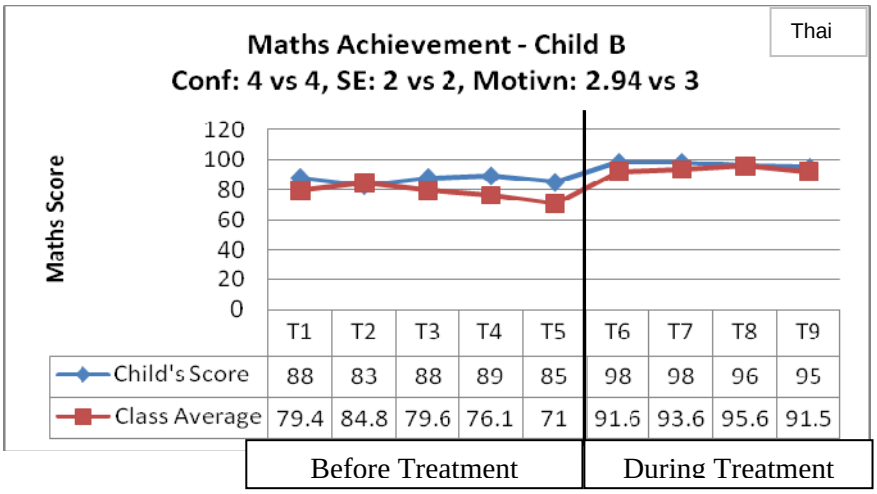
**Figure 5.3 Mathematics Achievement of Child A**




Child A's achievement in maths had been consistently above the class average. Her motivation to learn maths was high before treatment and she was able to maintain this motivation throughout the treatment period. However, her confidence

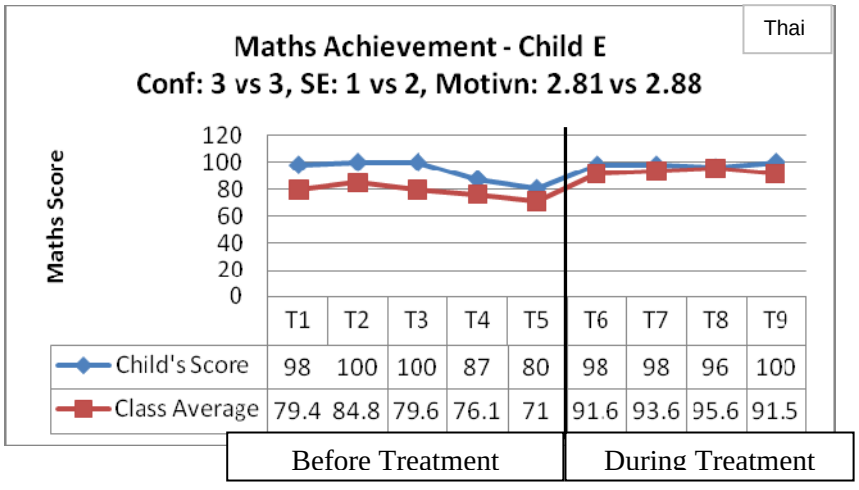
level dropped slightly after the treatment. Before treatment, she answered 'Very Confident' to the question "How confident are you in doing maths?" After treatment she answered 'Confident. Sometimes I make mistakes.'

**Figure 5.4 Mathematics Achievement of Child B**




Child B had been very consistent in her maths achievement, generally getting above average scores. Her responses to the questions about confidence, self-efficacy and motivation showed that she has been a conscientious learner of maths. She was able to maintain her confidence and self-efficacy and increase her motivation level after the treatment.

**Figure 5.5 Mathematics Achievement of Child E**




Child E's mathematics achievement has consistently been above the class average and he was able to maintain this state throughout the treatment period. When asked "What do you expect to get in your maths exam?" to measure the child's self-efficacy, his answer changed from "Less than 80%" before treatment to "More than 80%" after treatment was implemented. When asked why he felt only confident

(instead of very confident) in Maths, he said it was because he was uncertain of the level of difficulty of Maths in the future.

Child G's mathematics achievement in the graph below shows that this student has been doing fairly well in the subject. Her 2 pre-treatment test scores fell below the 80% threshold and caused her to lack confidence in her ability to achieve in mathematics. However, there was an improvement with regards to her learning traits following the treatment. She was able to maintain her mathematics scores to be on par with the class' higher average during treatment.

**Figure 5.6 Mathematics Achievement of Child G**

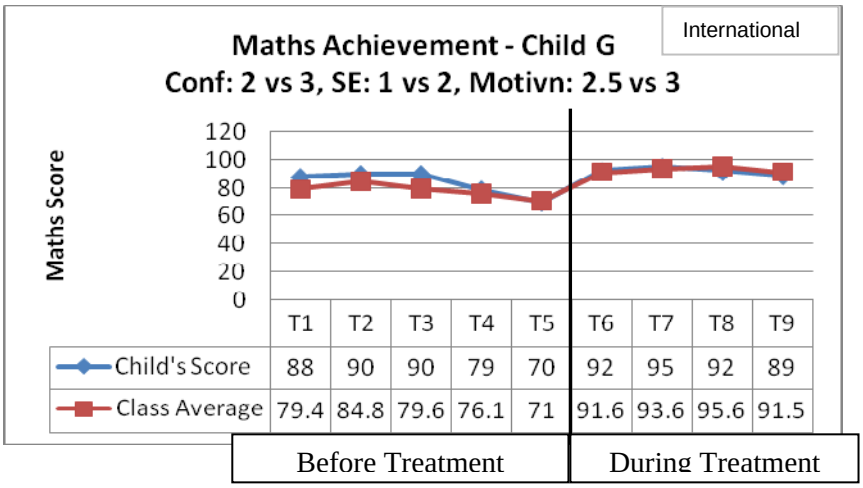
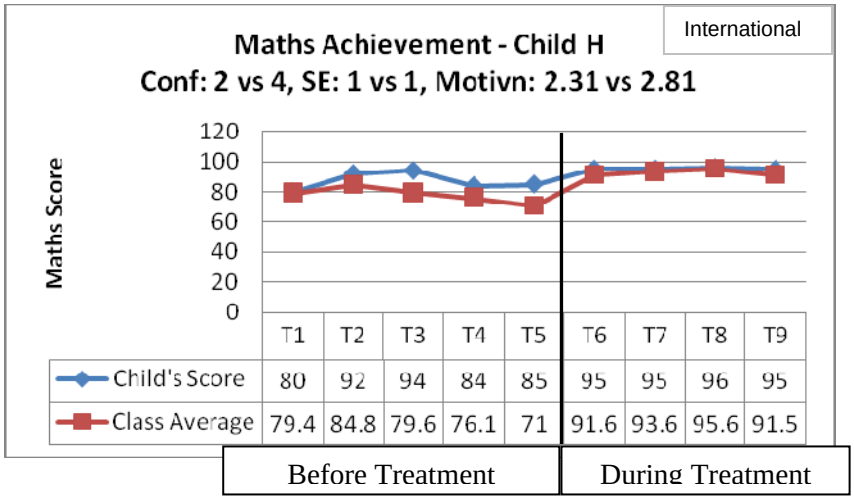



**Figure 5.7 Mathematics Achievement of Child H**




The test results shown in the graph indicate that Child H has the ability to achieve in mathematics, always achieving higher than the class average. What is interesting to note is that her confidence, self-efficacy and motivation prior to the treatment were fairly low compared to her classmates whose test results were much

lower than hers. Following the treatment, there was an increase in her confidence and motivation levels, with no change in her self-efficacy. Furthermore, she was able to maintain her excellent scores in all mathematics tests.

Child J has been consistent in achieving high scores in her maths tests before treatment and she was able to maintain this capability during the treatment period. The remarkable change in this student was in her confidence, self-efficacy and learning motivation pertaining to mathematics, which showed a positive change.

**Figure 5.8 Mathematics Achievement of Child J**

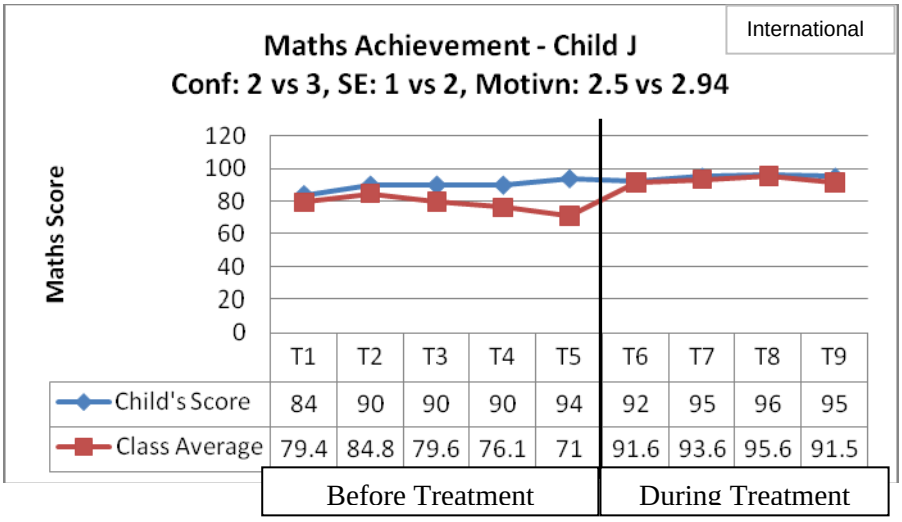
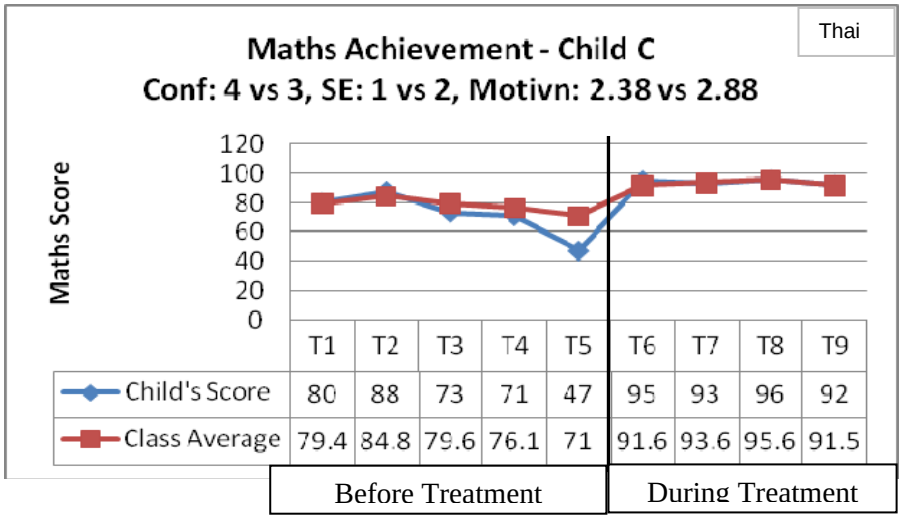


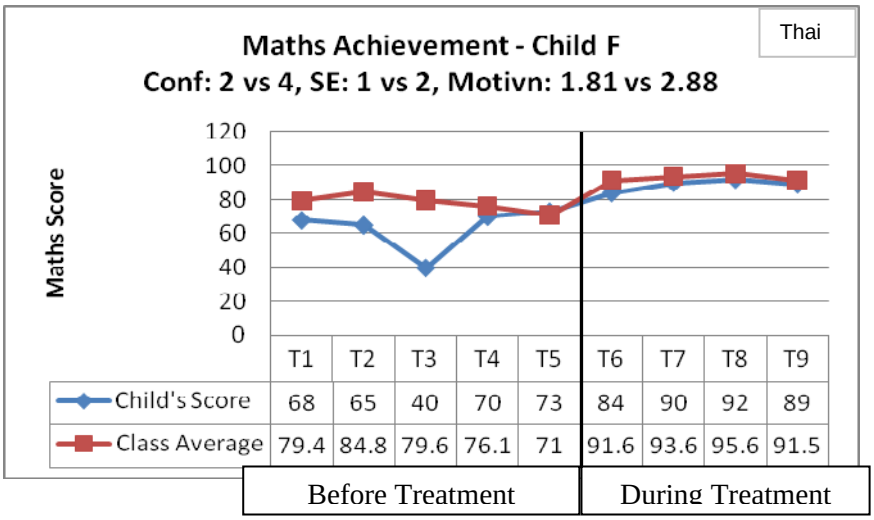

**Figure 5.9 Mathematics Achievement of Child C**




Before treatment started, Child C's performance in maths was usually at or below the class average, failing in the test on Multiplication (T5). Although he claimed to be very confident in doing maths, he did not have much personal belief

that he would score higher than 80 percent. After treatment started, the test scores showed improvement in T6 to T9, generally with scores above the class average. His confidence level after treatment dropped slightly, but his belief in his capability to do well in maths and his motivation to learn maths both showed a positive increase.

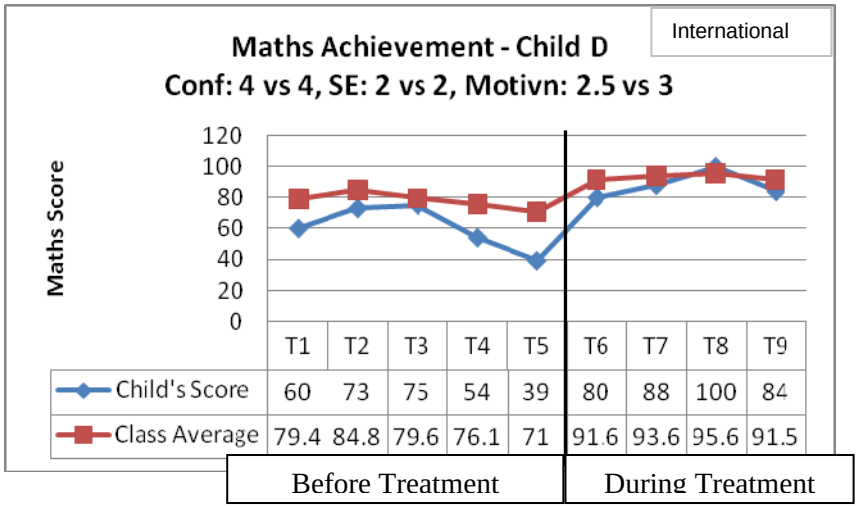
**Figure 5.10 Mathematics Achievement of Child F**




Child F has a history of poor academic performance in important subject areas, including mathematics. She has an attitude of learned helplessness and indifferent towards learning, and was the least motivated in her class. Despite being aware of her lack of ability, she felt apathetic about her incompetence and poor performance in the class. When asked “Do you know that you got the lowest score?”, she simply replied “I don’t care.” After the treatment, her motivation level saw a considerable increase, and she was very confident and believed that she could do well in mathematics. Furthermore, there was an incremental change in her test scores, making the gap between her score and the class average to become smaller.

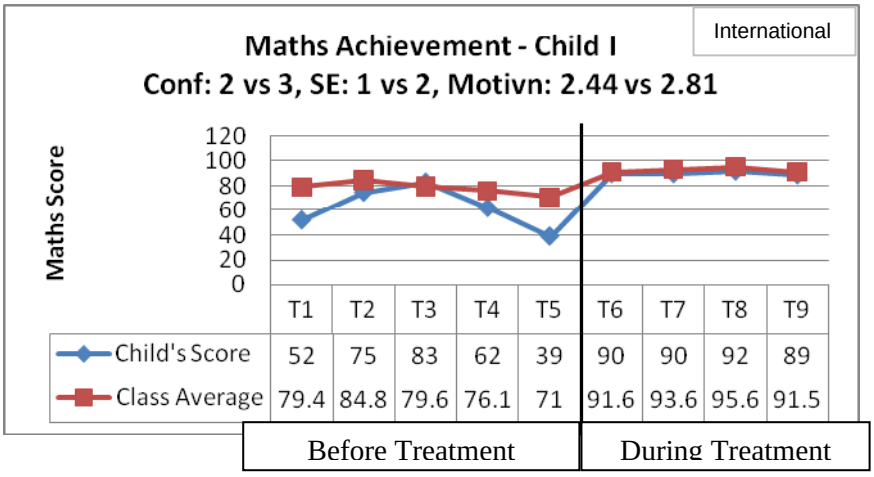
The graph below shows Child D’s poor performance in maths. The test scores obtained before treatment were below the class average, failing in the test on Multiplication (T5). After treatment started, an incremental change in her scores was observed, making the difference between her score and the class average smaller.

**Figure 5.11 Mathematics Achievement of Child D**



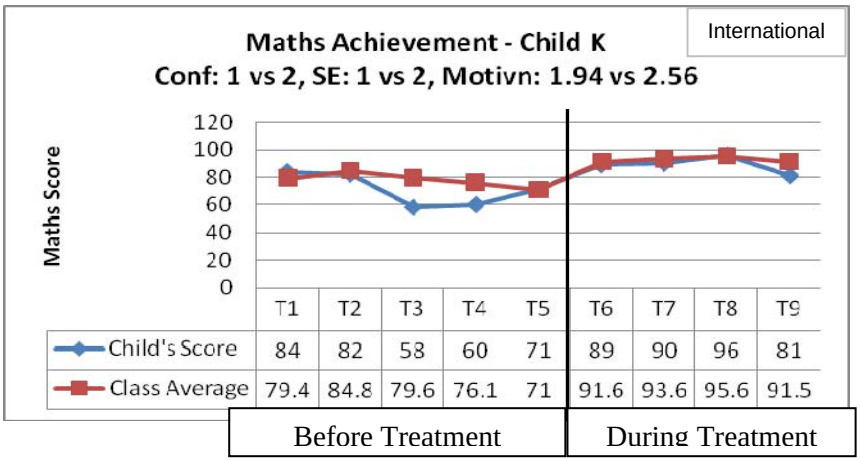

For Child I, his achievement in maths was fairly poor, dipping to a mere 39% in the test on Multiplication (T5). A positive change was seen in his test results once the treatment started, in which he maintained it throughout the treatment period. He was more confident in doing mathematics, and believed that he has the ability to do it well. His motivation to learn the subject also showed an increase.

**Figure 5.12 Mathematics Achievement of Child I**




Child K was one of the least motivated students in the mathematics class. She was low in confidence and self-efficacy levels pertaining to maths. Prior to treatment, there was a considerable gap between her scores and the class average on 2 tests, in which her scores were lower. Following treatment, an improvement was seen in her mathematics achievement as well as her learning traits.

**Figure 5.13 Mathematics Achievement of Child K**




From the collective data above, the researcher concluded that there was an improvement in the students' mathematics performance as a result of the treatment, and rejected the null hypothesis. Research hypothesis 2, that the students will achieve test scores at the set minimum criteria of 80% or higher, was therefore accepted.

*Research Question 4:*

Which component in the instructional model is effective for increasing primary students' learning motivation?

*Research Hypothesis 3:*

All components in the developed model will be effective for increasing primary students' learning motivation.

The above research question examines if there was any component in the instructional model that is most effective for increasing primary students' learning motivation.

Results from the interview and classroom observations were used to answer this research question. During the individual interview, the participants were asked some questions that were directed at helping the researcher reaffirm which component of the instructional process – Cordiality (C1), Collection (C2), Clear Coordination (C3), Challenge (C4), Communication (C5), Confirmation (C6) – was effective in motivating the students to learn. The research participants were asked the same questions before and after the treatment and their responses appear in Table 5.7.

**Table 5.7 Responses to Interview Questions**

| *Questions* | *Pre-treatment responses* | *Post-treatment responses* |
|---|---|---|
| 1. Do you like maths? Why (not)? Because….<br>- The way my teacher teaches me (C3)<br>- My teacher does special activities like games/quiz (C4)<br>- My teacher allows me to be teacher (C3)<br>- My teacher uses many ways to teach (tell story/use materials) (C2) | 7 students said they liked maths because of the way the teacher taught them, and 4 said they liked it only some of the time. 1 student further said he did not like hard maths.<br>3 students liked maths because of the special activities while the other 8 felt that special activities were done only some of the time.<br>7 of them said they never had a chance to be teacher and another 4 said they had it.<br>8 of them felt that there were not many ways used in teaching. Another 3 said that the teacher "use things but not tell a story." | 10 students responded positively to the question and 1 said she liked the way the teacher taught some of the time.<br>10 students liked maths because of the special activities that the teacher did, and 1 said special activities were done only some of the time. 2 of them specifically mentioned they liked being given choices of tasks.<br>7 students liked the chance to be teachers, and 4 students said they liked it some of the time.<br>All 11 students responded they liked the stories told in maths class as well as the different materials used. |
| 2. Do you like any of these activities in maths class? (C4)<br>- Problem-posing<br>- Modeling a teacher | 9 students said these activities were never done in the class. 2 students said it was done some of the time. | 6 students responded they liked these activities in maths class. The other 5 students said they sometimes liked these activities. |
| 3. Do you feel afraid in your maths class? Why (not)?<br>- My teacher allows me to share ideas (C1)<br>- My teacher makes me feel important (C1)<br>- My teacher always encourages me to do my best (C5) | 1 student said she did not feel afraid and answered positively to all three points. The other 10 had mixed responses. 5 felt afraid sometimes and 2 of them said they felt afraid because they did not like to compete or afraid when they could not do the work.<br>6 felt they were allowed to share their ideas only some of the time. 9 said they were made to feel important. 3 felt they were encouraged to do their best. | 9 students said they did not feel afraid in maths class and answered positively to all the three points. 2 students said they sometimes feel shy, but responded positively to all the three points. |
| 4. What do you think of your maths teacher?<br>- Friendly (C1)<br>- Encouraging (C5)<br>- Approachable (C1) | 8 students think the teacher is friendly. 3 students think the teacher is encouraging. 7 students think the teacher is approachable. | All 11 students responded positively to all the three points. |

The following table shows a condensation of the above results to enable clear interpretation of the changes in the students' responses. Only plain positive responses of the students are included in the table below, i.e. responses of 'sometimes' and negative ones are excluded from the comparison.

**Table 5.8 Interview Results Segregated by Components**

| ***Components*** | ***Description*** | ***Pre-Treatment*** **(n=11)** | ***Post-Treatment*** **(n=11)** | ***Difference*** |
|---|---|---|---|---|
| C3=Clear Coordination | The way teacher teach | 7 | 10 | +3 |
| C4=Challenge | Challenging activities/Choices | 3 | 10 | +7 |
| C3=Clear Coordination | Student 'Teacher' | 4 | 7 | +3 |
| C2=Collection | Stories/Teaching Aids | 3 | 11 | +8 |
| C4=Challenge | Problem-posing | 2 | 6 | +4 |
| C1=Cordiality | Allowed to share ideas | 1 | 11 | +10 |
| C1=Cordiality | Made to feel important | 9 | 11 | +2 |
| C5=Communication | Teacher encouragement | 3 | 11 | +8 |
| C1=Cordiality | Friendly teacher | 8 | 11 | +3 |
| C5=Communication | Encouraging teacher | 3 | 11 | +8 |
| C1=Cordiality | Approachable teacher | 7 | 11 | +4 |

All the components brought positive changes to the students' responses, but the components which brought the most substantial changes were Challenge, Collection, Cordiality, and Communication. The Challenge component showed there was an increase in the number of students who liked mathematics for the challenging activities and choices of tasks that the teacher provided (*Pre: 3 vs. Post: 10*). More participants liked mathematics for the stories and different materials that the teacher used to teach as shown by their responses to Collection component (*Pre: 3 vs. Post: 11*). The Cordiality that the participants welcomed most was the ability to share their ideas in class (*Pre: 1 vs. Post: 11*). There was also a notable change in the responses to the Communication component about Teacher being encouraging (*Pre: 3 vs. Post: 11*).

Furthermore, records of classroom observations were used to gather more evidence to answer the research question and reaffirm the effectiveness of each of the components of the model, including Confirmation component related to the students' grades in mathematics. From observations, the researcher noticed the followings:

- During observation prior to the start of the experimental treatment, the researcher had seen Child C crawling on the floor and hiding under the table during two of the maths lessons. Child C came from another international

school and joined the school at the start of the academic year that this research study was undertaken. He showed traits of having short attention span and an apathy towards seatwork. At another observation, he was heard making rude noises that did not stop despite the maths teacher's warning, until he was sent for a time-out. On another occasion when the teacher was teaching, he did not stop rocking his chair despite warnings, so the chair was taken away. During the experiment, the researcher found that Child C's behaviour improved as compared with earlier observations. The only trait that was occasionally still seen in him was his short daydream during seatwork. He might have finally adjusted well to the new school environment by the time the experiment was conducted, but the researcher did not rule out the possibility of the change in Child C's behaviour as a result of the treatment, as revealed in other observations below.

- The participants showed excitement and enthusiasm when they were told to choose the tasks to do for the day. They were always given three options, namely, tasks in the textbook, tasks in the independent work cards, or tasks they create in their individual problem-posing book. Many students opted for independent work cards where they had the chance to further choose which work card to do. On three occasions, Child C was heard saying "Yes!" and seen jumping out of his seat to rush towards the Independent Work Cards folder. One time, the researcher spotted Child I, who was known for being slow-moving, walking quickly towards the Work Card folder to choose his work. Child K, one of the least-motivated in class, avoided the Work Cards or Problem-posing at the start of the treatment, preferring to do tasks in the textbook. After a few days of repeatedly witnessing her friends' keenness in making different choices, K was heard saying enthusiastically "I want to do the work card" or "I want to do problem-posing". Despite the regular practice of having the same choices at every maths lesson, the students' interest in this practice remained high and did not diminish towards the end of the treatment period. They would not hesitate to ask for help from teacher or peers whenever they encountered difficulty on the task. This is an evidence that the Challenge that came from having the control to choose what they want to do and the feeling of competence from being able to do the chosen task, resulted in a very

positive learning experience, which in turn helped foster motivation in the students.

- All the students displayed enthusiasm and eagerness to participate in challenging activities which involved social interaction like “Show Me the Money” and “Let’s Go Shopping” on the topic of Money, “What’s the Time, Mr. Wolf?” when we learned about Time, “Happy Birthday Cake” and “Paper Folding” on the topic about Fraction, and doing the survey on “Our Favourite Sports” when we learned about Graph. The researcher made this observation by examining the students’ facial expressions and natural cheerful reactions at the mention of, and throughout, the activities. Where the activity involved teamwork, there was a lot of talking and lively discussions among the team members, and showing cooperation to protect the members’ best interest. Here are some of the statements made by the research participants to their partners during a “shopping” activity on the topic of “Money”:

  *“We need some change for the 5 dollar note. Wait, let me think…I think we need 4 one-dollar and 2 fifty-cents.”*

  *“Quick, go and buy the toy from that shop. I saw the price was really cheap! Here, take this money.”*

  *“We don’t have enough small change to give to our customers. I’m going to ask other shop for change. Oh, wait…. I can go to the ‘bank’.”*

- The students sometimes had differing opinions about how things should be done, and had arguments about it, especially when they felt anxious to be the best or winning team. Upon witnessing the low-performers being shunned by the better maths students, and hearing the high-performers complain when the low-performers got into their team, the researcher-teacher used those occasions to communicate to the students the followings:

  *“We must learn to work peacefully and harmoniously with others. Everyone can be good in mathematics. Winning or losing is not related to having the highest- or lowest- achievers in your team. And the most important thing in life is not always about winning, but in doing our best.”*

Such communication practice has made the low-performing students show motivation to do their best and gain approval and recognition from their team members. On the individual level, the students also liked doing challenging quizzes on Fraction and Time, where they had to write their answers on individual mini boards and kept track of their own scores on their individual board. The students were seen to like the fact that their scores were kept individually. The researcher also witnessed positive expressions on the students' faces when they checked their scores in the personal file. However, she also noticed the students showing keenness to announce their marks publicly, especially when they received high scores. This may imply that announcing the students' grades publicly would benefit the students only if they attained high score. For other observations above, the researcher is convinced that teacher's Collection of activities and teaching materials goes a long way in making the lesson motivating for the children. And the thrill that comes from being able to take the Challenge in those activities further increase the students' enthusiasm to do their best. More importantly, those activities provided an opportunity to show Cordiality – through social interaction among all class members, building good teamwork, and resolving conflict peacefully.

- On different days, the researcher received colourful pictures drawn by 6 female participants with messages like:

  *"Thank you for teaching us maths."*

  *"I am very happy that you are my teacher."*

  *"You are the best!"*

  *"I wish you could teach us math everyday so we can get better and better in math."*

  *"Love you very much."*

  *"Thank you, I'm going to keep up from now on. I'm even going to do my homework by myself."*

  Earlier on, when the experiment started, the researcher had given feedback to the students about their progress or performance, by drawing smiley pictures on the students' good work where effort was apparent, or writing comments like "Well done", "Great effort" or "Your persistence in completing your work

is really pleasing to see. I'm really proud of you." The above-mentioned messages that were subsequently received from the students showed that the students had modeled the researcher's behaviour by using the same Communication method to give positive feedback. Towards the end of the experiment, parents of 2 other students told the researcher during a casual conversation, that at home their children verbally expressed the desire to do their maths work independently, and ask for help only when necessary. It was evident that these children were inspired to take up the challenge by taking more responsibility for their own learning as they generated knowledge of their capability and the psychological rewards gained from self-reliance.

- A notable transformation was seen in Child F. Previously, she failed her maths tests on many occasions, used to avoid maths whenever possible – such as not doing her homework – even at the start of the treatment period, and felt indifferent towards school in general. Aware of Child F's poor learning behavior, the researcher worked closely with her throughout the treatment period. Initially, the researcher often had conversations like this with Child F:

  *Child F: "I can't do it!" (referring to a mathematics task that she learnt before). She showed helplessness and expected to be spoonfed with the solution.*

  *Researcher: "Let's see….. Can you read the question for me?"*

  *Child F finished reading the question. The researcher then guided her by prompting with questions that lead her to arrive at the answer herself.*

  *Researcher: "OK, what information do we have here? How much is the ball?"*

  *Child F: "4 dollars 50 cents."*

  *Researcher: "How much is the eraser?"*

  *Child F: "20 cents."*

  *Researcher: "What can we do to add them up? What do we add first?"*

  *Child F: "Umm…the cents."*

  *Researcher: "You're right… so how many cents are there altogether?"*

  *Child F: "Umm… 70 cents?"*

*Researcher: "Exactly! Now, how many dollars are there?"*

*Child F: "4 dollars…. Oh, I know already! 4 dollars and 70 cents."*

*Researcher: "You got it! See, I knew you can do it. You are smart, but you were not keen to think. Next time I want you to try yourself first before coming to me. Agree?"*

*Child F smiled and expressed pride for her success on the task.*

Her reliance on teacher's help gradually reduced as she became more self-efficacious in mathematics and made attempts to tackle subsequent tasks herself. In fact, towards the end of the experiment, the researcher noticed that Child F often came to her to ask for extra mathematics work to do. One time, when the researcher was busy and overlooked her request, she came to the office to remind the researcher that she has not received her worksheet yet!

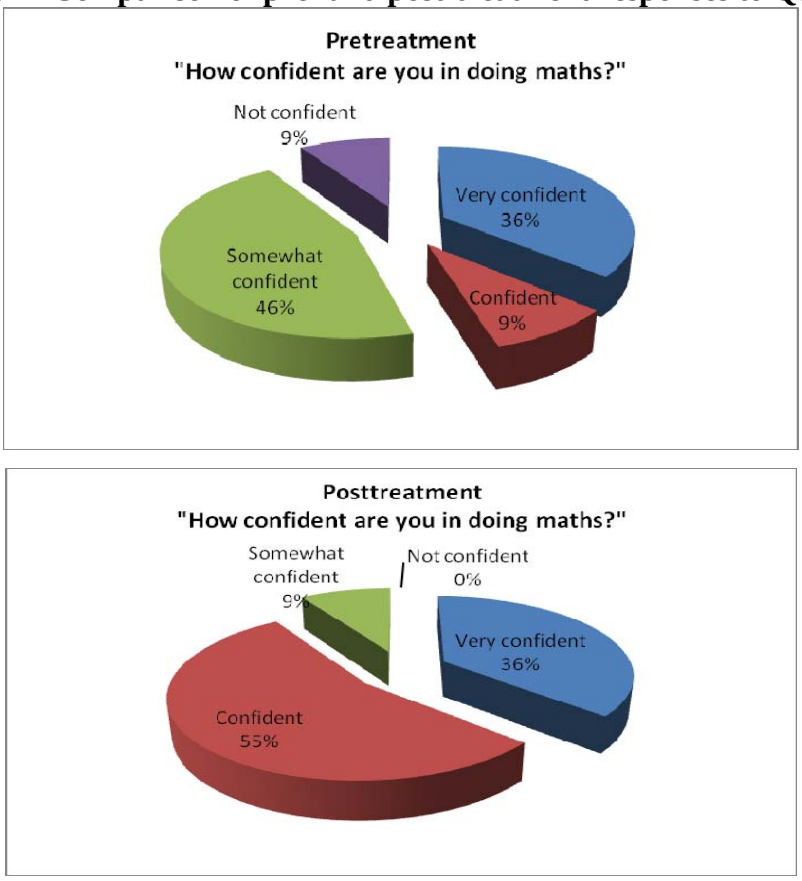
The interview results above suggested that Cordiality, Communication, Collection, and Challenge components in the developed model were most effective for increasing primary students' learning motivation. There was also some evidence from the students' test results that suggest Clear Coordination and Confirmation progress check method contributed to fostering the participants' confidence and achievement in mathematics. As there was sufficient evidence to support that all components of the model showed effectiveness in fostering motivation, the null hypothesis was rejected. Research hypothesis 3 was therefore accepted.

Other related questions

The researcher did an additional investigation outside the research questions, to see if there was any change in the participants' personal beliefs in their own competence in mathematics before and after the implementation of the instructional model.

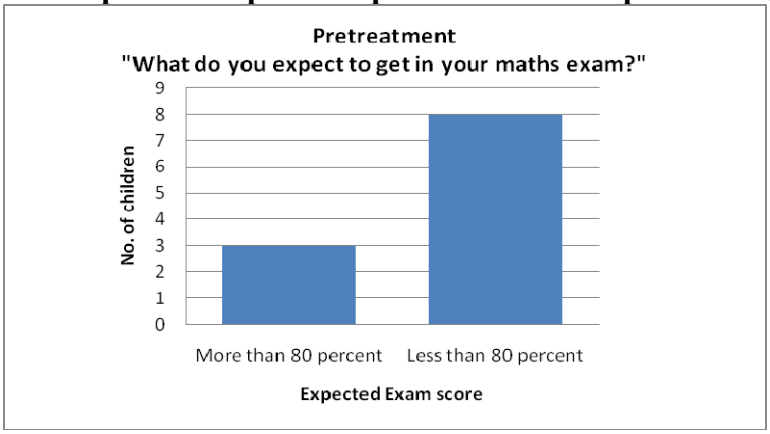
The participants were individually interviewed by the researcher on three questions pertaining to their self-efficacy in mathematics. The questions were: (1) How confident are you in doing maths? (2) What do you expect to get in your maths exam? and (3) Is your achievement in maths up to your expectation? The results of the participants' responses are shown below.

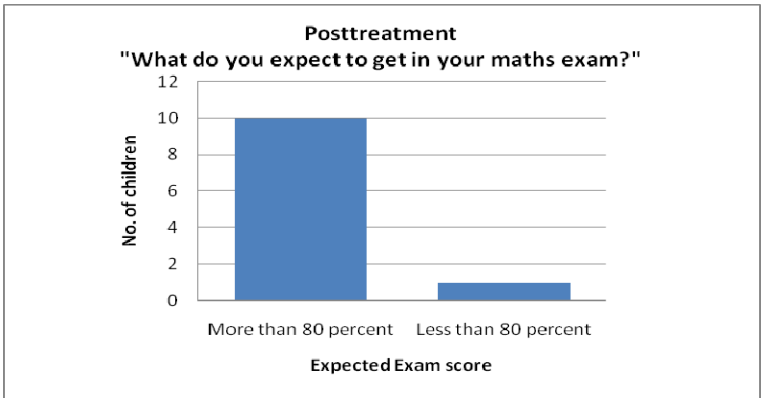
**Figure 5.14 Comparison of pre- and post-treatment responses to Question 1**




The interview results from pre-treatment showed that initially 45% of the students were either confident or very confident in doing maths, while 55% of the class expressed low or no confidence in doing maths. After the treatment, 91% of the students expressed high confidence in doing maths and 9% felt somewhat confident in doing maths. There was no student who expressed no confidence in doing maths when interviewed after the treatment, as opposed to 9% who had no confidence prior to the treatment. As for the second question about their expected scores in maths, the participants responded as follow.

**Figure 5.15 Comparison of pre- and post-treatment responses to Question 2**






The pretreatment responses saw 8 of the participants expected to get less than 80 percent in their maths exam, while only 3 expected to get more than 80 percent. Following the treatment, the number of participants expecting to get less than 80 percent dropped drastically to just 1 and the remaining 10 students expected to get more than 80 percent. Furthermore, at post-treatment interview, 2 of the participants mentioned very confidently that they expected to get 100% in their maths exam. Such a response did not occur during the pre-treatment interview.

In answering Question 3 about whether their achievement was up to their expectation, the participants could respond freely to the question. Their responses are shown in Table 5.9.

**Table 5.9 Participants' Responses to Interview Question 3**

| ***Question 3: Is your achievement in mathematics up to your expectation?*** | |
|---|---|
| ***Pre-treatment responses*** | ***Post-treatment responses*** |
| 4 students responded with a 'Yes', i.e. they have achieved the results that they expected.<br>5 students responded with a 'No' or 'Not really'.<br>2 students said 'I'm not sure' or 'I don't know'. | 6 students responded with a 'Yes'.<br>1 student said 'It's quite up to my expectation, but I want to do better'.<br>2 students said 'Yes, in some of the tests'.<br>1 student said 'Not really. I got 100% in some of them, which is unexpected because the tests were quite hard'.<br>1 student answered 'No, except in one test when I got 100%'. |

During the interview, the researcher also asked if the participants think they have improved in mathematics. All of them responded positively to the question. One of them reasoned that the improvement was due to the effort put in. On being asked

"What advice would you give to the Year 1 students who are going to study Year 2 Maths next year?", 9 students mentioned "Practice" while another 2 said "Listen to the teacher". 5 of the 9 students who answered "Practice" also said "Listen to the teacher". These responses suggested that the children have learnt to take more responsibility for their own learning and believed in exerting effort to achieve mastery. Some of the participants' other interview responses worth mentioning include:

> *"When I'm swimming, I think of the times table. I also apply what I've learnt, like Time, in my daily life."*
>
> *"Ask your parents if you don't know how to do your homework."*
>
> *"Ask someone for help if you get stuck [when doing your work]."*
>
> *"Ask mum and dad to test you."*
>
> *"If you finish early, do extra work. Exercise your brain so you get used to hard questions or problems."*

The results gathered above provided evidence that there was a positive change in the students' beliefs about their competence in mathematics following the treatment. The expected outcomes about the students showing confidence in doing maths and developing positive beliefs in their mathematics performance have therefore been achieved, and lend support to the effectiveness of Clear Coordination and Communication.

A further investigation was made at the end of the treatment to determine if the primary students displayed any change in their learning motivation in another subject. The subject chosen to answer this question was Science, the content-based subject most often associated with mathematics. The Science teacher, who was not the same teacher as the mathematics teacher, had been teaching the children since they were in Grade 1. She was below 30 years old, friendly and firm with the students. The researcher interviewed her and asked about any noticeable change in the research participants during the Science classes coinciding with the experimental treatment in mathematics class.

According to the Science teacher, out of the 11 students, 8 of them who had a good record in Science classes remained somewhat the same in class with regards to their motivation in learning the subject. Out of the other 3 students who were low-performers in Science, two of them showed little improvement and still remained weak in the subject. One of them had problem concentrating in class – often getting easily bored when teacher was explaining, and another student fared poorly because of not having follow-up at home and lacking revision. The third low-performing student had a history of failed Science tests and little interest in the subject. However, as at the time of this interview, this child had shown some improvement in the class by being more articulate, confident and involved during discussions, and displayed an improved work attitude wherein she tried to do her best in class. Except for this third child, there was no clear indication from the majority of the students that there was a noticeable improvement in their learning attitude. Hence, the researcher could not determine that the participants displayed a change in their learning motivation in Science.

# CHAPTER 6

## DISCUSSIONS AND CONCLUSION

The purpose of this study was to develop an instructional model to foster learning motivation and learning achievement for lower primary students, and to evaluate the effectiveness of the model. This chapter highlights and discusses various important findings of the present study in the light of the literature reviewed in Chapter 2. Discussions are made to provide plausible explanations within the variables involved. The findings of this research are going to be discussed in light of the effectiveness of the developed instructional model in relation to the students' motivation to learn and their learning achievement.

### 6.1 The Developed Instructional Model and the Students' Learning Motivation

Theories that led to the development of the instructional model were mainly based on the significance and influence of the social context to a child's learning behaviour. Self-Efficacy theory purports that the child's experiences in achieving success, along with verbal persuasion from significant others, would determine the child's personal beliefs in their own capability. Social Cognitive Development theory views social interaction between teacher and students as playing a fundamental role in the development of cognition. Putting the two theories together, the instructional model was fundamentally social and cognitive in its effort to foster the children's motivation in learning mathematics.

Results from this research study show that the lower primary children (n=11) who were participants in the experimental treatment portrayed higher motivation level after the treatment as measured by the modified Y-CAIMI instrument. The children's responses to the items on Y-CAIMI showed a positive change, and there was a statistically significant difference between the means of pretest and posttest scores at 99% confidence level. However, as motivation is best displayed in the person's behavior, this study did not rely only on the data collected based on the motivation scale alone. Observations of the children's learning behaviour during mathematics

class were collected to provide stronger evidence about the change in the participants' motivation towards learning the subject. Furthermore, responses made to the structured interview questions as appeared in Table 5.6 were used to reveal more insightful thoughts into the actual change in learning motivation. The following discussion will now relate learning motivation to each of the components in the instructional model, starting off with the most effective components.

*1. Challenge and Learning Motivation*

For the students to have control over their own learning, they need to be able to make personal decisions that will affect the outcome of their choices. As per interview report, the researcher's introduction of choices of tasks and challenging activities for the students has increased the number of children who liked mathematics (Pretreatment: 3 vs. Posttreatment: 10). These findings are consistent with the results of several studies in which some autonomy, where the students had control over the work they did based on a modest amount of choices, was shown to be an essential ingredient of intrinsic motivation (Lewin, Lippitt, and White, 1939 cited in Stipek 1993, p.106; Swann and Pittman, 1977, p.1128; Wilson, 2011; Zuckerman, Porac, Lathin, Smith, and Deci, 1978). Furthermore, the feeling of competence derived from completing the tasks successfully increased the students' confidence in their ability to understand the learning material and fostered greater motivation towards learning it. In fact, Bruner (1966, p.120) had mentioned similar findings based on several research done earlier on.

Six children responded that they liked problem posing, which was newly introduced by the researcher during the experimental treatment as one of the task choices and also as a class activity occasionally. George Polya (1954) considered problem posing as an inseparable part of problem solving. Kilpatrick (1987, p.123) had suggested that the experience of "creating one's own mathematics problem ought to be part of every student's education". Learners who have difficulty with mathematics are sometimes characterized by a syndrome of fear and avoidance known as mathematics anxiety (Silver, 1994, p.21). Such anxiety can be reduced through problem posing because problem posing made mathematics seem less intimidating. In the present study, the children were not formally trained on the procedures of problem posing and they were given only brief description about how

to generate problems similar to the ones they had seen in their textbook. Problem posing was generally introduced to the children as a choice, and since it was not mandatory to do, not everyone preferred to choose it most of the time, albeit everyone making an attempt to do it at least once during the treatment. This could possibly be due to the highly challenging nature of problem posing, or due to general time constraint, or that the children did not have proper training on the method of problem posing. Consequently, no conclusive evidence can be drawn to suggest that the children's learning motivation resulted from being challenged through problem posing. Nevertheless, the researcher was pleased to witness some of the children's ability to pose challenging problems (see Appendix F).

*2. Cordiality and Learning Motivation*

Bruner (1966, p.123) emphasized that in the process of teaching, the teacher imparts attitudes toward a subject and toward learning itself. Indeed, the teacher's role is very important. Teachers, just as medical doctors and lawyers, have universal codes of ethics that govern their practice. The National Association for the Education of Young Children in the United States has developed codes of ethics for teachers of young children (Morrison, 2001). Among others, teachers are expected to have the following important qualities:

1. Personal character - high morals and values, compassion, patience, kindness, courteous interaction with children, dedication, respect, enthusiasm, motivation
2. Emotional qualities – caring, warmth, love and respect for children, understanding of children, empathy, friendliness, sensitivity, trust, tolerance
3. Mental health – a positive outlook on life, optimism, attentiveness, self-confidence, self-respect

When a teacher shows a sense of trust, security, and support, the children will echo those feelings and behaviours. Teachers should be happy people who can laugh and use their sense of humour wisely. Teachers need to be fair-minded, showing concern for all, regardless of the children's differences (Gordon, 1996). These teacher qualities mentioned are not unique to America, but are also required in Thailand. The Teachers' Council of Thailand (2010) stipulated that teachers "must

have love, faith, honesty and responsibility for the profession and ….treat students with love, compassion, concern, help, and support. [They] must not act with antagonism regarding the physical, mental, psychological, emotional and social growth of students".

Results from this study show that the number of children who felt fearful in maths class declined after the treatment was introduced. In his Self-Efficacy theory, Bandura (1997, p.107) specified that the physiological state of the child is one of the factors that influenced the child's learning. This is confirmed in the current study where it was found that once the participants' anxiety diminished, and they felt a positive relationship with the people in their environment, they were able to focus their attention more on making personal progress than being concerned about appearing smart or dumb.

To create a non-threatening learning experience, the researcher further applied Vygotsky's theory of learning in social context by rearranging the children's seating positions based on the following considerations: (1) those who were better in maths were seated with the less talented; (2) those who tend to speak Thai were seated with the English-speaking students so they could be helped to understand questions requiring stronger English language ability; and (3) the more active students were seated with the quieter ones. This arrangement had resulted in the low-achievers gaining more confidence, especially when they were paired with their sitting partners to make class presentations. The low-achievers learned from the more able students, and after they witnessed recurrent successes in their collaborative work, feelings of competence and accomplishment naturally followed. This is truly a testimony of the effectiveness of having a More Knowledgeable Others, which include peers, to facilitate learning until the child reached the stage of internalization and eventually the ability to do the task without assistance. The number of children who volunteered to answer questions in class also increased and, more importantly, the low-achievers showed more courage to participate despite giving incorrect answers.

Other factors that have apparently helped to create a positive teacher-student relationship include the bonding that the researcher made with the participants to understand their perspectives better. For instance, the researcher talked casually to the children at every opportunity, such as during lunch break or after school. The topics

discussed were personal ones including favourite games, what they did during their free time, which maths topic they enjoy and why, the books that they liked reading, etc. Seeing the researcher's genuine interest in their life, the children learnt to appreciate it and reciprocate with their delight in seeing her each time they entered the maths class. Some days, the researcher took a few minutes of the class time to share with the children stories from some favourite books containing moral values, which the children always welcome the opportunities. Some of the stories related to conflicts among friends, and the researcher usually chose them after hearing the children bickering in class. The researcher tried to minimize disruptions to the class through storytelling because resolving conflicts among the children could be time-consuming and often took away the concentration from the children involved. When the treatment period was over and the research participants did not see the researcher as often as they used to, some of them visited her in the office to say hello or share their own stories about their joy or sorrow. They also drew pictures and write messages to the researcher. What can be deduced from this change in the children's behavior was that observational learning as explained by Self-Efficacy theory had taken place. The children had observed the researcher modeling a caring attitude, taking the time to recount to the children things that were meaningful, and expressing encouraging words and positive feedback to them. As a result, they learnt to do the same. This finding is consistent with the results of earlier studies about the importance of a positive teacher-student relationship in enhancing learning motivation (Osterman, 2000, p.323; Stipek, 2006, p.46).

*3. Communication and Learning Motivation*

From the start of the experiment, the researcher had clearly communicated to the children of her faith in their ability to do well in maths and that they were expected to do their best. Expressions like "I do my best!", "I love maths", and "Maths is fun" were posted on the classroom wall where everyone can see every day. Initially, the researcher often had to use words to edify and encourage the children, some of whom were plainly attention-seeking and displaying learned helplessness. Whenever anyone in the class was heard saying "I can't do it" to a maths task, the researcher would quickly intervene affirmatively with "That's not true. Try it again. You can do it!" and then went over to check whether the child was genuinely needing

assistance or just being inefficient. If the child genuinely needed help, the researcher would guide them through until they arrived at their own answer, and then verbalise "See, I knew you can do it!" As the verbal persuasion came from a teacher and was reinforced by the child's real success experience, it became effective in bolstering their confidence on the task. As time went by, negative expressions of ability were gradually unheard, even among the lowest-achievers. This finding from the current study is consistent with the results that Schunk (1989, p.23) found in his research and thereby strengthens Bandura's Self-Efficacy theory about enactive mastery experiences coupled with verbal persuasion resulting in greater self-efficacy.

On another occasion, the researcher-teacher announced her pleasure that every one did very well in the test, just as she had expected. Immediately Child A, who is a high-achiever, exclaimed, "Even Child F [did well]?". Another child followed with similar question "Even Child I?". At that moment, the expression shown on Child I's face was that of embarrassment, while Child F's expression showed hopelessness. In fact, Child F's attitude is an example of what researchers refer to as "learned helplessness". The researcher explicitly replied "Child I and Child F are capable of getting high marks, just like every one else here." Immediately there was a glow of confidence on both Child I and F's faces. After that incidence, offending remarks like that was never heard again in the maths class throughout the remaining treatment period. Moreover, the researcher noticed that Child I's efficiency in completing his assignments increased considerably from that day onwards. The teacher's words had apparently shown power and influence to effectively improve the children's perception in their ability.

Earlier research by Mason and Stipek (1989, cited in Stipek 1993, p.182) show dramatic improvements in students' expectations and behaviour over a short period of time as a result of being in a new classroom with a new teacher. Similar finding is seen in the present study. As mentioned earlier, the children were aware of the researcher's high expectation for them and apparently have retained it in their mind, for it was shown from their responses to the interview question "What advice would you give to the Year 1 students who are going to Year 2?" Many of them said they should practice, and several mentioned trying their best. "Practice" and "Try your best" were words that have been often used by the researcher to indicate the

importance of effort. All these results verify that when children observe a behaviour modeled repeatedly or they hear something said frequently, they retain this information and later produce similar kind of behaviour. There was strong evidence from this study to indicate that children learn quickly by observation, and their perceptions of own ability can be changed by the persuasion of significant others. The finding from this study confirms that the teacher qualities compiled by Wlodkowski and Jaynes (1990, p.19) based on various research about effective and motivating teachers are true.

*4. Collection and Learning Motivation*

In comparing the before and after treatment results, the number of children who seemed to like the opportunity to learn through stories and using materials increased (Pre: 3, Post: 11). What the researcher discovered from this study was that stories are effective in engaging and sustaining the children's attention during mathematics class, especially where the stories are easily linked to the children's life experiences. Such stories have the power to move the children out of the confines of their classroom walls and bring them to a world more familiar to them. It also helped the children to see the usefulness of mathematics in daily life and not view it as just a mandated subject. When the experiment was all over, the researcher randomly asked some children if they still remembered the teddy bear story told in one maths class at the start of the experiment (see Appendix G). All of the children asked were able to retell it. This shows that the children had a strong recollection of the story even many weeks after it was told. Bruner (1966, p.116) explained that while young children are notoriously wandering in their attention, they can be kept in a state of rapt and prolonged attentiveness by being told compelling stories. This premise certainly held true in the present study.

The opportunity to apply mathematics to real situations through the many different math-related group activities had created interest and the thirst for more learning. A notable incident about the importance of relating the lesson to the children's real-life experiences was recorded at the time when we were learning about Money. After being told the reason and usefulness of learning about this topic, one child shared about her shopping experience where she was given the wrong change by the shopkeeper. The researcher-teacher immediately took the opportunity to use that

child's experience as an incidental learning for the whole class. As the story came from the real life of their classmate, it became more meaningful and significant to the class and they were seen paying attention to the rest of the lesson.

For children of 7 to 8 years old like the research participants, the use of manipulatives in games and quizzes still proved effective in capturing their attention and interest. Jerome Bruner (1977, p.73) suggested that a learning environment in the mathematics classroom should encourage exploration using manipulatives, present mathematical ideas in a concrete manner, and does not equate failure with punishment. The current study had provided such a learning environment for the children, and the result is apparent in the participants' higher motivation. However, there should be a variety of ideas or items prepared for each unit, such that each lesson would arouse the children's curiosity and challenge them to think. Overall, the participants seemed to enjoy the classes for the collection of ideas and items that the researcher had prepared.

*5. Clear Coordination and Learning Motivation*

In the Clarity and Coordination components that formed the Clear Coordination step of the teaching procedure, the evidence of a change to the children's learning motivation as a result of this step was based on the participants' interview responses. The growth in the children's confidence in doing maths tasks, and their gaining mastery in the particular mathematics units learned, seemed to support that Clarity and Coordination have been useful in helping achieve the expected outcome. Moreover, as research findings on teacher effectiveness reported the importance of clarity and coordination as having a strong, positive relationship to pupil learning (Cruickshank, 1990), the researcher proposed that the importance of Clarity and Coordination components of the developed model in this study should not be overlooked.

*6. Confirmation and Learning Motivation*

Although there was only weak indication from observations to verify that the method used in this study to grade the children and keep their scores had helped foster their learning motivation, the students' improvement in their test scores relative to

their past achievement provided sufficient evidence that the Confirmation component has helped instill a less-threatening learning environment, especially for those who were usually anxious about announcement of their results or those who believed they were incapable of higher achievement in mathematics. The researcher suggests that if the children can be rewarded in a fair and consistent way for performing better than their own past performance level, perhaps this might be able to raise their personal beliefs that success is attainable, and subsequently increase their motivation to learn.

## 6.2 The Developed Instructional Model and the Students' Learning Achievement

*1. Challenge and Mathematics Achievement*

In the present study, the researcher had provided choices of tasks and challenging activities such as quizzes for the students, which increased the number of children who liked mathematics. Although the students' higher mathematics achievement after the treatment cannot be directly attributed to the Challenge component, the researcher believes that the children's initiative to seek assistance from teachers, peers or parents in doing their tasks, had helped to enable the children to attain higher achievement.

*2. Communication and Mathematics Achievement*

Results from this study suggested that verbal persuasions expressing teacher's high expectation for success for all students, as well as conveying faith in the students' capability and praising them for effort exerted, seemed to contribute to the children's higher achievement in mathematics. Furthermore, the researcher's explicit, compelling feedback to the less talented students that forcefully disputed their pre-existing disbelief in their capabilities had seemingly enhanced those students' beliefs in their maths competence and achievement in mathematics, by the way.

*3. Clear Coordination and Mathematics Achievement*

From the results gathered, it was obvious that prior to the treatment, majority of the participants were discontented with their mathematics achievement. They were

uncertain of their ability to do well in the subject, and this was reflected in the majority of the class having low or no confidence in doing maths. Jere Brophy (1998, p.54) stated that "the simplest way to ensure that students expect success is to make sure that they achieve it consistently." This was attested in the present study where after consistently witnessing their own success in mathematics tasks during the treatment period, 10 out of 11 children revealed their expectation to get more than 80% in their mathematics exam, as compared with only 3 out of 11 prior to the treatment. Two children specifically mentioned that they expected to get 100% in their exam, and both of them did obtain high scores. It can therefore be concluded that the Clarity and Coordination components have helped the children gain mastery and confidence in the mathematics unit learnt, and seemingly helped further enhance the children's achievement in mathematics.

*4. Collection and Mathematics Achievement*

The researcher's effort to apply mathematics to real situations through the many different math-related group activities had sparked enthusiasm in the children. They were noticed to display attentiveness during lesson and often show eagerness to participate in the activities. Although the children's higher achievement results cannot be directly attributed to the Collection component, there seemed sufficient evidence to indicate that by the children paying attention, they gained better understanding of the topic through the use of different teaching methods and materials, thereby enabling them to retain their learning. The result was then shown in their higher achievement.

*5. Cordiality and Mathematics Achievement*

The Cordiality component of the current instructional model was designed to play an important role in developing the children's positive attitude towards learning mathematics. Although there is no conclusive evidence that this component would necessarily lead to the children's higher achievement, the researcher is confident that with a positive attitude towards learning, the students will be able to achieve higher results. Various reviews of research have identified that teacher's cordiality is associated with teaching effectiveness (Cruickshank, 1990, p.72). Just as described in the developed instructional model the qualities teachers should have, research also

indicate that effective teachers are warm, enthusiastic, stimulating, encouraging, trusting, are able to express feelings, and have good listening skills.

*6. Confirmation and Mathematics Achievement*

The method used to record the children's results in this study differed from the traditional mass marking and subsequent public announcement of the results for comparison. While the latter benefits the high performers, it has an adverse effect on the less talented students. Based on observations in this study, the Confirmation component of the developed model was found to bring a positive feeling to the children, whereby the less talented students were more willing to take up challenges and risks, knowing that they would not be compared with their peers. Such an improvement in their learning attitude would undoubtedly bring about higher achievement, suggesting that Confirmation component did contribute to the children's improvement in their test results.

## 6.3 Conclusion

The original intention of the researcher was to develop a simple but effective way to put academic success in equal reach of all students, regardless of their entry skills. For this to happen, teachers need to understand students' learning motivation and tap into it by reaching to the students' hearts through developing a positive relationship with them. The instructional model developed in the present study has incorporated socio-cognitive and affective factors, and has appeared to work effectively in fostering lower primary students' motivation to learn mathematics, especially among the low-achievers. At least, the model developed for this research has proved to help foster in the students a greater learning motivation, higher perception of ability, and improved learning achievement.

## 6.4 Recommendations

- This study has shed light that even unmotivated and low-achieving students can still develop the motivation to learn and achieve. It would thus be useful to

conduct a training session for educators, especially teachers, to develop their thinking disposition and attitude that all children can and will learn.

- Since children learn best in a warm, non-threatening environment, school administrators should not pressure teacher to emphasise on test achievement, but more on the children's progress.

- As there has been an increasing interest in Early Childhood Education, and that children can be taught anything at any age, implementation of the instructional model to teach mathematics to younger children of preschool age may shed interesting results useful to parents and early childhood educators.

- Application of the instructional model for a longer treatment period will be useful in understanding the longitudinal effect of the model on the children's motivation to learn mathematics. Furthermore, results from a longitudinal study which follow the participants to high school graduation would provide insights as to whether or not children retain their motivation to learn once they develop a strong foundation of it at the primary school level.

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# APPENDICES

# Appendix A

Professor Albert Bandura's validation

## Appendix B

Approval from author and publisher of Y-CAIMI to modify and use the instrument.

# Appendix C

Classroom observation at a school in Singapore

On July 13th, 2010, the researcher obtained permission from the Principal of Jurong West Primary School in Singapore to conduct a classroom observation during a Primary 2 Mathematics lesson. As the researcher would be using Singapore's mathematics textbook to teach the research participants, the main objective of the school visit was to gain insight into how mathematics is taught by a teacher who has been trained in using the Singapore mathematics textbook. A video recording was made during the lesson to reinforce any observation recorded.

There were 30 students in the class, and one boy had hearing disability. The lesson on Fraction went for more than an hour. The teacher explained that although maths was scheduled as a 50-minute lesson, the teacher was allowed to go beyond that time if necessary. Whatever time was taken from the next period, would be compensated by the next maths class that the class had on another day. This arrangement could be flexible because the teacher was responsible for teaching the main key learning areas and had control of the time.

The researcher pictured with the Primary 2 Form Teacher and students of Primary 2 class

# Appendix D

Young Children's Mathematics Learning Motivation

**Adapted from Young Children's Academic Intrinsic Motivation Inventory (Y-CAIMI)**

by Adele Eskeles Gottfried (1988)



Directions: Read all directions and items aloud to the child.

Say to the child: I'm interested in finding out what you think about maths. The reason I'm interested is so that I can find out more about what you like and what is most interesting to you. There are no right or wrong answers to any of the questions, and this is not a test. I only want to find out what you really think and hope that you will answer the best that you can. Please give your very own answers.

Each question can have a different answer. When I read the question, think about whether it is VERY TRUE for you, A LITTLE TRUE for you, or NOT TRUE for you. Then tell me whether your answer is VERY TRUE, A LITTLE TRUE, or NOT TRUE. I will not tell anybody your answers.

Here is an example:

I like ice cream. Is this VERY TRUE, A LITTLE TRUE, or NOT TRUE?

I like chili. Is this VERY TRUE, A LITTLE TRUE, or NOT TRUE?

If you have any questions, or you don't understand something, please let me know.

***Directions: Say to the child: These questions are about maths. Think about maths when you answer.***

1. I like learning new things in maths.
2. Maths is not interesting.
3. I feel good inside when I learn something new in maths.
4. I like to do as much work as I can in maths.
5. I don't like to practice new maths work.
6. I would like to learn more about maths.
7. Maths is my favourite subject.
8. I think doing maths is fun.
9. I don't like to figure out new maths problems.
10. I like to do hard maths work.
11. I like to find answers to questions in maths.
12. I enjoy doing maths.
13. I don't give up until I understand my maths work.
14. I would not like to learn more about maths.
15. I think maths is interesting.
16. I think working with numbers is fun.

**YOUNG CHILDREN'S MATHEMATICS LEARNING MOTIVATION**

**Scoring Form**

Adapted from Young Children's Academic Intrinsic Motivation Inventory (Y-CAIMI)
by Adele Eskeles Gottfried (1988)



Name: Grade: Gender:

Age (Date of Birth): Date:

Directions: Circle the child's answer

| | | | |
|---|---|---|---|
| 1. | VT | LT | NT |
| 2. | VT | LT | NT |
| 3. | VT | LT | NT |
| 4. | VT | LT | NT |
| 5. | VT | LT | NT |
| 6. | VT | LT | NT |
| 7. | VT | LT | NT |
| 8. | VT | LT | NT |
| 9. | VT | LT | NT |
| 10. | VT | LT | NT |
| 11. | VT | LT | NT |
| 12. | VT | LT | NT |
| 13. | VT | LT | NT |
| 14. | VT | LT | NT |
| 15. | VT | LT | NT |
| 16. | VT | LT | NT |
| Total: | | | |

Items # 1, 3, 4, 6, 7, 8, 10, 11, 12, 13, 15, 16

Scoring: Very True = 3; A Little True = 2; Not True = 1

Items # 2, 5, 9, 14

Scoring: Very True = 1; A Little True = 2; Not True = 3

## Appendix E

Test to show that the research sample has a normal distribution and therefore, parametric testing can be performed in this study.

**NON-PARAMETRIC TESTS**

## Students' Mean Scores on Motivation Scale

**One-Sample Kolmogorov-Smirnov Test**

| | | Pretest |
|---|---|---|
| N | | 11 |
| Normal Parameters[a] | Mean | 2.4609 |
| | Std. Deviation | .36198 |
| Most Extreme Differences | Absolute | .184 |
| | Positive | .184 |
| | Negative | -.157 |
| Kolmogorov-Smirnov Z | | .611 |
| Asymp. Sig. (2-tailed) | | .849 |

**a. Test distribution is Normal.**

**One-Sample Kolmogorov-Smirnov Test**

| | | Posttest |
|---|---|---|
| N | | 11 |
| Normal Parameters[a] | Mean | 2.8818 |
| | Std. Deviation | .12750 |
| Most Extreme Differences | Absolute | .222 |
| | Positive | .177 |
| | Negative | -.222 |
| Kolmogorov-Smirnov Z | | .735 |
| Asymp. Sig. (2-tailed) | | .653 |

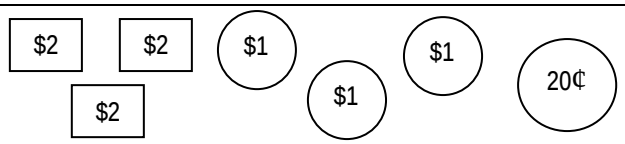
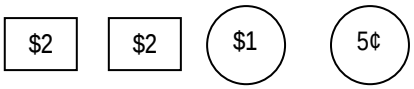
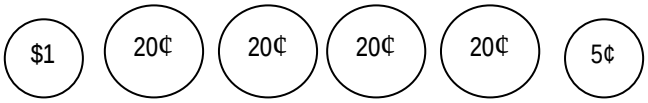
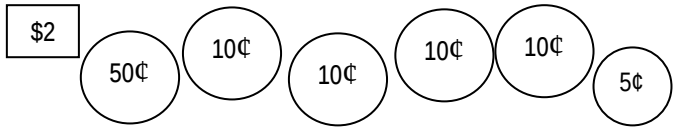
**a. Test distribution is Normal.**

## Appendix F

Questions that the research participants made for problem posing:

***On the Unit of "Money"***

Match

| | | |
|---|---|---|
| $9.20 |   | 295¢ |
| $2.95 |   | 800¢ |
| $8.00 |   | 185¢ |
| $1.85 |   | 505¢ |
| $5.05 |   | 920¢ |

Who saves more money?

A $2.50 B $5.60

Who saves less money?

A $8.05 B $7.05

***On the Unit of "Fraction"***

Which one is greater?

½ or ⅓

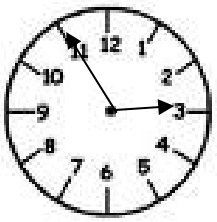
2/6 or 2/4

2/8 + 3/8 = ☐

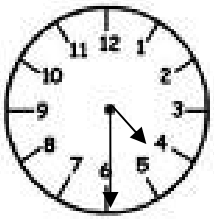
3/10 + 5/10 + 1/10 = ☐

***On the Unit of "Time"***

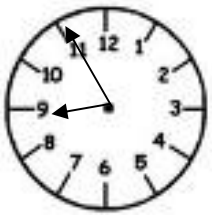
Fill in the blank.



_____



_____



_____

***On the Unit of "Graphs"***

| | | | |
|---|---|---|---|
| | | O | |
| | | O | O |
| O | | O | O |
| O | | O | O |
| O | O | O | O |
| BOW | PURSE | PEN | TOY |

Each O stands for 3 kids.

1. How many kids like pen?

| | | | |
|---|---|---|---|
| ☺ | | | |
| ☺ | | | |
| ☺ | | ☺ | |
| ☺ | ☺ | ☺ | |
| ☺ | ☺ | ☺ | ☺ |
| ☺ | ☺ | ☺ | ☺ |
| ☺ | ☺ | ☺ | ☺ |
| ORANGE | GRAPE | APPLE | CHERRY |

Each ☺ stands for 2 pupils.

2. How many like apples and cherries altogether?

Our Favourite Drinks

| | |
|---|---|
| | ♥ |
| | ♥ |
| | ♥ |
| ♥ | ♥ |
| ♥ | ♥ |
| ♥ | ♥ |
| WATER | MILK |

Each ♥ stands for 9 children.

Questions:

1. How many children like water?
2. How many children like milk?
3. How many more children like milk than water?
4. How many children are there altogether?

**Appendix G**

A story told in Mathematics Class on the Unit of “Money”.

# The Teddy Bear Story

By Listati Sugimin

Hello, boys and girls. My name is Teddy and I am 8 years old.

I belong to Shane, who is as old as I am. Shane’s mum bought me at a toy store many years ago at a cost of ___ (show a price tag with $28 written on it and say “I don’t know how to read this. Can you help tell me how much I cost?”)

Shane loved me very much and brought me everywhere he went. One day, he took me to the zoo and while he was busy looking at the animals, he accidentally dropped me on the ground. He did not know that I had fallen down, so he went home without me.

That day the rain poured and made me wet and dirty. I was crying, when suddenly a poor old woman picked me up. She said, “This is a nice teddy bear. Maybe I can sell it and use the money to buy some food.” So she sold me to a toy shop for this price ___ (show a tag with $11.15 and ask them to read it).

The shop owner washed me up and made me look clean again. He put a new price tag on me ___ (show $19.50 and ask them to read it). I stayed in the shop until one Christmas, a girl named Phoebe came to buy me. Phoebe put me in a box and wrapped it up beautifully. She bought me as a gift for her friend.

From inside the box, I could hear a familiar voice saying, “Thank you, Phoebe, and Merry Christmas.” I could hardly wait to see who my new owner would be. I became more excited as I heard the wrapping paper being torn and the lid of the box opened. And what a surprise I had, for who should I see but …… Shane, my long-lost owner. He was overjoyed to see me again and gave me a tight cuddle.

Believe me, that Christmas was the best ever for Shane and me.

# Appendix H

Lesson Plans on the Unit “Fractions”

PRIMARY 2 MATHEMATICS

**Unit 4: FRACTIONS** **Lesson 1: Unit Fractions** **Time: 50 minutes**

| Objectives: | Materials: |
|---|---|
| - to recognize ½ and ¼ | - Pictorial story about David's Pizza - Square paper<br>- Flash cards showing the symbols ½ and ¼, and the words HALF and QUARTER<br>- A set of paper cut-outs for each group of 4 children |

| *Type of Instructional Activity* | *Time in minutes* | *Activities* | *Teacher's Role* | *Students' Role* | *Materials/ Teaching Aids* |
|---|---|---|---|---|---|
| Interest Stimulation | 5 | "David's Pizza" Story | Gather children on the mat.<br>• Tell a story about David and his pizza share as more and more friends came to see him.<br>• Referring to the pictures in the story, ask the subjective question "Why do you think David look happy in the first picture but not in the last one? | - Listen to the story. Relate it to own experiences.<br>- Respond with "the more people come, the less pizza David gets". | - Pictorial story |
| Clear Coordination | 25 | Paper-folding | Demonstrate to children:<br>• Hold up a square paper and fold it into 2 EQUAL parts. Emphasize that the 2 parts are equal.<br>• Colour 1 of the parts and unfold.<br>• Say "1 out of 2 parts is coloured." Show the symbol ½ on flashcard. "We say that half of the paper is coloured." Show the word HALF on flashcard.<br>• Repeat the above paper-folding demonstration with QUARTER. ½ and ¼ are examples of fractions.<br>Hand out the paper cut-outs for children to practice. | - Observe teacher's steps to see that in fractions, the parts must be equal.<br>- Repeat "1 out of 2 is half".<br>- Repeat "1 out of 4 is one-fourth or one quarter".<br>- Apply knowledge through practice. | - Square paper<br>- Flash cards<br>- Paper cut-outs |
| Individualised Challenge | 10 | What's Your Choice Today? | Provide options of tasks that meet the lesson objective:<br>1. Activity Book Unit 4 Activity 1<br>2. Work Card<br>3. Problem-posing based on today's lesson (with answer key)<br>Walk around the class to facilitate when needs arise, e.g. ask questions that require student explanation such as "How did you get this answer?" | - Choose one of the options for the day to work on.<br>- Ask for teacher's help when necessary, in order to remain on task. | - Activity book<br>- Work cards<br>- Problem books |
| Progress Check | 10 | Just Checking! | • Grade students' completed work on their selected option, and record scores in individual folders. (Convert scores into percentage for comparison and evaluation of progress or as a guideline for improvement. Compare only with the child's previous grades.)<br>• If the child scores below 80%, teacher asks questions to ensure student understands according to set objectives. | - Check their own grades in the individual folder to see their progress or need for improvement.<br>- Choose another option to do, if time permits. | - Students' progress record |

PRIMARY 2 MATHEMATICS

**Unit 4: FRACTIONS** **Lesson 2: Writing Fractions** **Time: 50 minutes**

| Objectives: | Materials: |
|---|---|
| - to recognize and write unit fractions up to 1/12<br>- to recognize and name a fraction of a whole | - Fraction strips<br>- Picture of a square cake (for cutting)<br>- Multilink cubes |

| *Type of Instructional Activity* | *Time in minutes* | *Activities* | *Teacher's Role* | *Students' Role* | *Materials/ Teaching Aids* |
|---|---|---|---|---|---|
| Interest Stimulation | 5 | More Fractions | Show picture of a cake. Cut it into 3 equal parts. Ask "How many parts are there altogether?"<br>• Call a child to the front and give 1 part to him. Ask "How many parts does he have?"<br>• Write ⅓ on the board and introduce 'one-third'.<br>• Do 2 more examples for ⅛ and 1/12. | - Answer "3".<br>- Answer "1 out of 3".<br>- Repeat "one-third".<br>- Say one-eighth; one-twelfth | - Picture of cake |
| Clear Coordination | 25 | What Fraction is Shaded? | Verbalise the steps to read and write fractions, with the aid of a fraction strip:<br>• Check that all parts are equal.<br>• Count how many parts in whole, e.g. 5.<br>• Count how many parts are shaded, e.g. 1.<br>• Write and read the fraction, e.g. 1 out of 5 or 1/5 (one-fifth).<br>Give a few more examples from coursebook p. 74 using multilink cubes, before assigning children to Activity 2. | - Listen and observe teacher's step-by-step demonstration.<br>- Repeat "1 out of 5 is one-fifth".<br>- Apply knowledge by practicing. | - Fraction strip<br>- Course book<br>- Multilink cube |
| Individualised Challenge | 10 | What's Your Choice Today? | Provide options of tasks that meet the lesson objective:<br>1. Activity Book Unit 4 Activity 3<br>2. Work Card<br>3. Problem-posing based on today's lesson (with answer key)<br>Walk around the class to facilitate when needs arise, e.g. ask questions that require student explanation such as "How did you get this answer?" | - Choose one of the options for the day to work on.<br>- Ask for teacher's help when necessary, in order to remain on task. | - Activity book<br>- Work cards<br>- Problem books |
| Progress Check | 10 | Just Checking! | • Grade students' completed work on their selected option, and record scores in individual folders. (Convert scores into percentage for comparison and evaluation of progress or as a guideline for improvement. Compare only with the child's previous grades.)<br>• If the child scores below 80%, teacher asks questions to ensure student understands according to set objectives. | - Check their own grades in the individual folder to see their progress or need for improvement.<br>- Choose another option to do, if time permits. | - Students' progress record |

PRIMARY 2 MATHEMATICS

**Unit 4: FRACTIONS** **Lesson 3: Parts and Whole** **Time: 50 minutes**

| Objectives: | Materials: |
|---|---|
| - to find the fraction that combines with a given fraction to make a whole | - Birthday "cake" - Fraction discs |

| *Type of Instructional Activity* | *Time in minutes* | *Activities* | *Teacher's Role* | *Students' Role* | *Materials/ Teaching Aids* |
|---|---|---|---|---|---|
| Interest Stimulation | 10 | Happy Birthday! | Show the birthday "cake". Recall children to the steps in previous day's lesson.<br>• Ask: "How many parts make this whole cake?" "So 8/8 = 1 whole."<br>• Take 3 pieces out. Ask "Do we still have one whole cake now?"<br>• What fraction of the cake is taken? Write 3/8 on board.<br>• What fraction of the cake is left? Write 5/8 on the board.<br>• Point out that 3/8 and 5/8 make 8/8 or 1 whole. | - Answer "8".<br>- See the cake is no longer whole.<br>- Say "3 out of 8".<br>- Say "5 out of 8".<br>- See that 3/8 and 5/8 equal 8/8 or 1. | - Birthday cake |
| Clear Coordination | 20 | Find the Missing Parts | Use fraction discs for question 1 in the course book to show how to find the missing fractions.<br>1. Use the disc to show the given fraction, e.g. 4/5.<br>2. Arrange the pieces on top of the whole.<br>3. Look for the fraction to make up a whole.<br>4. What is the missing fraction? So, 4/5 and 1/5 make one whole.<br><br>Randomly call out the names of children to solve problems in Activity 4. | - Observe the steps that teacher demonstrates.<br>- Respond with "1/5" and see that 4/5 and 1/5 equal 1.<br>- Present in front of the class solution to the assigned task. | - Fraction discs<br>- Activity book |
| Individualised Challenge | 10 | What's Your Choice Today? | Provide options of tasks that meet the lesson objective:<br>1. Activity Book p.11<br>2. Work Card<br>3. Problem-posing based on today's lesson (with answer key)<br>Walk around the class to facilitate when needs arise, e.g. ask questions that require student explanation such as "How did you get this answer?" | - Choose one of the options for the day to work on.<br>- Ask for teacher's help when necessary, in order to remain on task. | - Activity book<br>- Work cards<br>- Problem books |
| Progress Check | 10 | Just Checking! | • Grade students' completed work on their selected option, and record scores in individual folders. (Convert scores into percentage for comparison and evaluation of progress or as a guideline for improvement. Compare only with the child's previous grades.)<br>• If the child scores below 80%, teacher asks questions to ensure student understands according to set objectives. | - Check their own grades in the individual folder to see their progress or need for improvement.<br>- Choose another option to do, if time permits. | - Students' progress record |

PRIMARY 2 MATHEMATICS

**Unit 4: FRACTIONS** **Lesson 4: Comparing and Ordering Fractions** **Time: 50 minutes**

| Objectives: | Materials: |
|---|---|
| - to compare and order unit fractions and like fractions (fractions with the same denominator) | - Picture of David's Pizza in course book<br>- Fraction strips - Flip charts - Mini board and Marker |

| *Type of Instructional Activity* | *Time in minutes* | *Activities* | *Teacher's Role* | *Students' Role* | *Materials/ Teaching Aids* |
|---|---|---|---|---|---|
| Interest Stimulation | 5 | Make A Guess | Write 3 fractions on the board (½, ¼, ⅛). Show the picture of David's pizza as a clue to make their guess.<br>• Say: "Guess which fraction is the smallest/largest. | - Make a guess. | - Picture of pizza in course book |
| Clear Coordination | 25 | Which Fraction is Greater? | Use fraction strips to show how to compare the unit fractions above.<br>• Fold the strips to determine the fractions represented. Then, make comparison.<br>• Lead them to see that in unit fraction, the bigger the denominator, the smaller the fraction.<br>• Repeat the demonstration using single strip to compare fractions with the same denominator (like fractions), e.g. 2/7, 4/7, 6/7.<br><br>Use flip-chart with 2 fractions to compare on each chart. | - Follow the steps that teacher demonstrates.<br>- See that ½ > ¼ > ⅛<br><br>- See that in like fractions, the bigger the numerator, the bigger the fraction.<br><br>- Choose and write the fraction required by the teacher (e.g. choose the smaller fraction) on mini board. | - Fraction strips<br><br>- Mini-board<br>- Marker |
| Individualised Challenge | 10 | What's Your Choice Today? | Provide options of tasks that meet the lesson objective:<br>1. Activity Book p.13-14<br>2. Work Card<br>3. Problem-posing based on today's lesson (with answer key)<br>Walk around the class to facilitate when needs arise, e.g. ask questions that require student explanation such as "How did you get this answer?" | - Choose one of the options for the day to work on.<br>- Ask for teacher's help when necessary, in order to remain on task. | - Activity book<br>- Work cards<br>- Problem books |
| Progress Check | 10 | Just Checking! | • Grade students' completed work on their selected option, and record scores in individual folders. (Convert scores into percentage for comparison and evaluation of progress or as a guideline for improvement. Compare only with the child's previous grades.)<br>• If the child scores below 80%, teacher asks questions to ensure student understands according to set objectives. | - Check their own grades in the individual folder to see their progress or need for improvement.<br>- Choose another option to do, if time permits. | - Students' progress record |

**Unit 4: FRACTIONS** **Lesson 5: Adding Fractions** **Time: 50 minutes**

| Objectives: | Materials: |
|---|---|
| - to add like fractions (fractions with the same denominator) | - Fraction strips |

| *Type of Instructional Activity* | *Time in minutes* | *Activities* | *Teacher's Role* | *Students' Role* | *Materials/ Teaching Aids* |
|---|---|---|---|---|---|
| Interest Stimulation | 10 | What Fraction of the Class? | Ask how many children are in the class. Have one boy stand. Ask what fraction of the class he is. Review: the denominator is the number of equal parts in the whole; the numerator is the number of parts we're interested in.<br>Ask a second boy to stand. What fraction of the class is he alone? What fraction of the class are all the standing students? Continue adding students and emphasizing the adding of single-student fractions. | - Respond accordingly, e.g. $n$ students in the class; the boy is $1/n$ of the class.<br>- Respond to questions, e.g. the boy is $1/n$ of the class; all the standing students is $2/n$ of the class, etc. | |
| Clear Coordination | 20 | Adding Like Fractions | Use fraction strips to show how to add the fractions above<br>- Write on the board, e.g. ⅛ + ⅛ = 2/8, 2/8 + ⅛ = ⅜.<br>- Ask "Do you see a pattern to what I have written?"<br>- Give other fractions to add. Write ¼ + ¼ = 2/8 on the board, and challenge students to prove why this is wrong.<br>- Point out: add the numerators but not denominators.<br>Have students practise using fraction strips to solve questions on p.81-82. | - See that teacher has added the numerators.<br>- Use fraction strips to add ¼ and ¼ and match this against 2/8. They see that two fourths are greater than two eighths.<br>- Practise using fraction strips. | - Fraction strips<br>- Course book |
| Individualised Challenge | 10 | What's Your Choice Today? | Provide options of tasks that meet the lesson objective:<br>1. Activity Book Unit 4 Activity 6.<br>2. Work Card<br>3. Problem-posing based on today's lesson (with answer key)<br>Walk around the class to facilitate when needs arise, e.g. ask questions that require student explanation such as "How did you get this answer?" | - Choose one of the options for the day to work on.<br>- Ask for teacher's help when necessary, in order to remain on task. | - Activity book<br>- Work cards<br>- Problem books |
| Progress Check | 10 | Just Checking! | • Grade students' completed work on their selected option, and record scores in individual folders. (Convert scores into percentage for comparison and evaluation of progress or as a guideline for improvement. Compare only with the child's previous grades.)<br>• If the child scores below 80%, teacher asks questions to ensure student understands according to set objectives. | - Check their own grades in the individual folder to see their progress or need for improvement.<br>- Choose another option to do, if time permits. | - Students' progress record |

# Appendix I

Instructional Manual

To Foster Learning Motivation and Learning Achievement

Based on Self-Efficacy and Social Cognitive Development Theories

For Lower Primary Students in International Schools

This instructional manual will provide teachers or anyone interested in teaching lower primary students with details about the components of the instructional model. This manual should enable teachers to carry out instruction more effectively towards achieving the expected learning outcome.

This manual is mainly composed of:

1. Fundamental concepts of the model
2. Principles of the model
3. Objectives of the model
4. Instructional procedures based on Self-Efficacy and Social Cognitive Development Theories
5. Roles of teachers and learners
6. Assessment method
7. Guidelines of the instructional model
8. Conditions of the instructional model

## Fundamental Concepts

This model of instruction focuses on learning being the crux of an instruction, propelled by the learner's motivation to learn. To foster a child's learning motivation, there has to be cohesiveness among what the child think, feel and do, as there is a triadic reciprocal relationship among the child's cognition, environment, and behaviour.

A positive teacher-student relationship makes learning an enjoyable experience. Teachers work to improve the student's habits of thinking and beliefs in their own competence. To make learning meaningful, teaching aids should be interesting and related to the students' real life experiences. Work assigned should be challenging yet achievable so that the children develop a feeling of competence in their learning. Teachers should communicate their admiration and faith in the students' learning – progress, attitude, and ability – to increase the students' motivation to learn.

## Principles of Instruction

In applying this model, there are seven teaching principles to follow as shown below:

1. *Promotion of good teacher-student relationship creates a positive learning ambience.*

   Positive, caring relationships are vital for all students, especially the self-doubters. An environment of trust and support creates less anxiety for learning and kindles the students' motivation. Teachers create a warm and positive learning environment by modeling personal openness toward students and encouraging them to ask questions, explain, and share their ideas. Teachers should not put students on the spot, embarrass them with sharp replies, or respond to their questions with frustration. Teachers should engage the students with subjective questions in order to encourage them to share their personal experiences related to the topic. Teachers can cultivate in the students an enthusiasm to learn mathematics by actively modeling enthusiasm when teaching the subject. By their very presence, enthusiastic teachers tell students that they care about what they are teaching, and this value radiates through them with vitality. This part of the instructional process, of establishing good teacher-

student relationship to create positive learning ambience, occurs throughout the time the teacher is in association with the children.

2. *Collection of variety of teaching materials and provision of choice of tasks make learning appropriate and meaningful to students.*

   Teachers should use a variety of materials and teaching methods to engage the students. Tell stories that capture the intellectual and emotional understanding of the child. Research show that the brain cannot easily absorb information without an emotional connection, and listening to a story provides such a connection. Good instruction begins when interest and excitement are sparked. Build lessons around students' interests, talents, and personal goals to attract and sustain attention. Relate the subjects to the everyday experiences and backgrounds of the students, and ask them to imagine how the lesson could be transferred to situations associated with their own life expectations. Provide them the opportunities to choose the work from a selection of tasks so they feel that they are engaging in activities by their own choice.

3. *Modeling of tasks in masterable steps makes the tasks more easily achievable.*

   The importance of modeling in learning extends to the teaching of content. Teachers use modeling when demonstrating the steps involved in solving problems. In teaching mathematics, teachers should directly model the skill for the students and at the same time ask the students questions to direct their attention to the important characteristics of the problems. Teachers should think aloud when modeling the steps, to allow the students to hear the thought processes in solving problems.

4. *Arranging tasks that allows students to experience consistent success gives them a feeling of competence.*

   Once the students are able to reproduce the steps modeled by the teacher, they would be prepared to practice it on their own under the guidance of the teacher. This is typically accomplished with seatwork, during which the teacher has a chance to circulate and monitor student performance. Teachers should coordinate the learning situation such that the students can develop a feeling of competence. This can be done by providing them tasks in which they are likely to achieve success. While circulating around the class, teachers get the

opportunity to give immediate feedback on the students' performance. Teachers can use this time to raise the students' feeling of competence by praising them for their competence, their effort and ability, their persistence in solving the problem, or other learning behaviours that are desirable in them.

5. *Providing challenging activities to students at appropriate level which they can accomplish with minimal guidance increases their sense of competence.*

   Following the students' initial feeling of competence, teacher can sustain their positive feeling by providing choices of tasks related to the day's topic. The choices will give them a feeling of control over their own learning and the successful completion of the task will further increase their feeling of competence. These tasks should be challenging but not impossible to achieve – tasks that can give the children feelings of competency and accomplishment. Tasks associated with a moderate probability of success provide maximum satisfaction and intrinsic motivation.

   The choices of task proposed for use in this model were textbook problems, independent work cards, and problem posing. Textbook problems are, literally, problems that appear in the textbook used in the mathematics class. These are the most familiar to the children because it is used at every lesson and the layout is similar from topic to topic. Independent Work Cards, on the other hand, should be kept by the teacher in separate folders labeled by Units, and each Unit folder presented to the students only when teaching the particular Unit. Of all the three choices, problem posing is the most unfamiliar, as each problem posed or authored by the child would relate to the new Unit taught.

6. *Evaluation based on individual progress makes learning non-threatening.*

   For the students' personal growth, there should be no comparison of grades among the students. Children learn best when they focus on the work at hand and how to master it rather than on how they are performing relative to others. Results of research suggest that this focus can be fostered even among children who believe that their academic ability is low relative to their classmates. Teachers record the children's scores individually and emphasise that their results are only available to them personally. With this, the less mathematically-talented students will be more encouraged and unafraid to try even if it means

making mistakes, because the risk of embarrassment or feeling of inferiority has been removed.

7. *Encouragement and praise, and expression of faith in the student's ability increase their self-efficacy.*

   Teacher should use words to build the students' perception of their academic ability. Students can change their perceptions of competence and become more productive and optimistic if teachers convey faith in the students' capability, provide immediate constructive feedback, and encourage the students along the learning process. Teachers should communicate their admiration, appreciation, and faith in the students' learning – progress, attitude, and ability – and use words to edify, encourage and motivate the students. The praise should be sincere and focusing on the importance of exerting effort in learning.

## Objectives of the Model

The objectives of the instructional model are mainly to foster the children's motivation to learn and their achievement in the subject learned, and these objectives are elaborated below:

1. To develop students' positive attitudes towards learning.
2. To provide variety and choice of tasks to sustain students' engagement.
3. To demonstrate a worked example by breaking up task into smaller manageable steps.
4. To structure activities in ways that brings success to the students.
5. To challenge students with tasks that are at their appropriate level.
6. To provide the students with information about their progress based on their individual results.
7. To enhance the student's confidence in learning the subject.

## Instructional Procedures Based on Self-Efficacy and Social Cognitive Development Theories

There are seven components to the instructional procedures as described below:

1. **CORDIALITY**: Teacher models warmth, respect, and caring attitude. Before lesson starts, teacher greets students by name as they enter the classroom.

2. **COLLECTION**: Teacher uses a variety of material/tool or opening presentation method to start the lesson.
3. **CLARITY**: Teacher demonstrates to students the steps and procedure involved in solving the mathematics task by doing worked examples.
4. **COORDINATION**: Teacher provides students with initial tasks that are certain to bring success to the students, and provide them practice in applying the procedure.
5. **CHALLENGE**: Provide options of tasks for children to choose – textbook, independent work card, or problem-posing – that gives them optimal challenge.
6. **CONFIRMATION**: Record students' results in individual file for evaluation of progress. The result should not be compared with other students' results.
7. **COMMUNICATION**: Communicate faith in the children's ability. Praise them for their effort. Challenge them to do their best.

The above seven components are further condensed into five teaching steps as follow:

**Teaching Procedure**

Teacher maintains a positive ambience where children feel encouraged, accepted and unafraid to try.

CLASSROOM ACTIVITIES:

Step 1: Interest Stimulation
- teacher activates students' existing knowledge in maths (recall of prior knowledge) by using materials or opening presentation technique that link topic to children's real life.

Step 2: Clear Coordination
- teacher demonstrates the steps/procedure of the task by breaking the task into manageable steps.
- teacher provides students with practice in applying the procedure in book and/or by teaching others.

Step 3: Individualised Challenge
- teacher provides students with options of tasks – course book, independent work card, or problem-posing.

PROGRESS CHECK:
- teacher grades students on their selected tasks and record scores in individual folders based on the selected tasks, for progress record or guideline for improvement.

Teacher communicates faith in the students' ability and praises student's effort and correct response.

Elaboration of the teaching procedures appears below to make its implementation more straightforward. An essential mission of teaching is to create a positive learning environment. The two components that must be implemented in the classroom throughout the lesson are Cordiality and Communication.

### *Cordiality*

Teachers must develop a classroom atmosphere that builds positive relationships and fosters mutual respect. They should show cordiality to make the students feel welcomed. They should greet children by name as they enter the class. They should model caring attitude, enthusiasm, and motivation towards learning the subject so that the children learn to pick these traits through their regular observations. Teachers should not allow words of ridicules or insults in the classroom so that no one will feel afraid to make mistakes. Teachers themselves should refrain from making comments that humiliate the children.

### *Communication*

Teachers should communicate faith in the student's ability and high expectations for success for all students. Arrange the learning situation such that children achieve consistent success, so that teachers' praise on the students' ability creates a positive change in the personal efficacy. For children with a low sense of personal efficacy, teachers have to verbally persuade them by expressing explicit, compelling feedback that forcefully disputes the students' pre-existing disbelief in their capabilities.

## Classroom Activities

Step 1: Interest Stimulation Teacher draws the students' attention by using materials, tools or opening presentation methods that link the lesson with the children's prior knowledge and real life experiences. For instance, in teaching Fractions, the teacher starts the lesson with a fraction-related story on the first day, and the next day uses the interlocking cubes to attract attention, and on another day uses the fraction bars to start the lesson. Teachers can also start with a mind-boggling question to generate interest in the lesson, which makes accommodation of new information in their knowledge structure more readily.

Step 2: Clear Coordination This step of the instruction requires teacher demonstration, and student practice in applying the procedure. During initial whole-class instruction, the teacher demonstrates or models the procedure to accomplish a task by using worked examples. If the task is a multi-step problem, it can be broken into smaller manageable steps that the children can learn more easily and increase their experience of mastery. The worked example shows each step of the problem-solving process. The student studies the problem by following through each step of the example. Then, similar example problems are presented for practice.

Initial tasks should ensure success so that the children gain confidence in the subject. Self-modeling and peer modeling can be implemented at this step to provide students with the challenge and opportunity to apply their learning, under the teacher's guidance. The students can implement the procedure by teaching or explaining to the class, and in so doing, the teacher is able to check their understanding. As the children become more skillful, teacher assigns more challenging tasks - those not too easy that the children do not need to exert much effort, nor too difficult that they feel despair.

Step 3: Individualised Challenge In assigning tasks to the students, teachers should consider the physiological states of the students by taking away the tension and anxiety from assigning single task to all students. Instead, provide the children some alternative choice of activity with similar learning objectives. For instance, teachers can provide students with the options of doing the mathematics problems in the textbook, problems on the independent work cards which contain similar problems to the textbook, or the students can pose their own problems similar to those in textbook along with providing the answer keys in individual booklets. This last option is also known as problem posing, which refers to both the generation of new problems and the reformulation of given problems.

**Progress Check**

To ensure progress in personal development, teacher should encourage the students to measure their successes in terms of self-improvement rather than in terms of triumphs over others. Teacher can grade students on their selected tasks and record their scores in individual folders based on the tasks they have chosen, for progress record or guideline for improvement. The teacher should inform the class that their scores will

all be different as they are based on individual chosen tasks, so they should not compare with one another. Social comparisons of achievement (which some research show has detrimental effect on the children's sense of efficacy) can further be avoided by not making public announcement of the children's test scores, or announcing who gets the highest or lowest scores in class. The idea behind this kind of evaluation is that individual students should be made to feel safe in learning, thereby reducing unnecessary stress and anxiety. It also acts as a confirmation to the children that their own progress is valued more than their ability to outdo others. The focus is on improvement, not on comparisons among students.

**Roles of Teachers and Students**

*Teachers*

- Model warmth, respect, and caring attitude.
- Use a variety of material/tool or opening presentation method to start the lesson.
- Demonstrate to students the steps and procedure involved in solving the mathematics task by doing worked examples.
- Provide students with initial tasks that are certain to bring success, followed with practice in applying the procedure.
- Provide options of tasks for children to choose – textbook, independent work card, or problem-posing – that gives them optimal challenge.
- Record students' results in individual file for evaluation of progress. The result should not be compared with other students' results.
- Communicate faith in the children's ability. Praise them for their effort. Challenge them to do their best.

*Students*

- Show a positive attitude towards learning the subject.
- Display attentiveness on the lesson during instruction.
- Practise to gain mastery in specific topic learned.

- Show confidence in doing tasks related to topic.
- Ask teacher for help when they encounter difficulty so they can remain on task.
- Show improvement in their grades relative to their past achievement.
- Have positive beliefs in their own competence in the subject.

**Assessment Method**

***Learning Achievement***

At the end of a lesson

- Teachers can assess individual students by randomly calling them to answer structured questions related to the day's lesson.

At the end of a unit

- Teachers should give students an informal quiz to measure their understanding of the unit taught. The quiz content can be similar to those that appear in the textbook. Students take the quiz as individuals, and the quiz is scored just like in a normal test. The quiz questions can be written on the white board or a flipchart, and the students write their answers on a mini board and then hold it up for the teacher to see their answer, while the teacher checks each student's answer and keeps the score in individual student's folder.
- After the completion of each unit, a paper-and-pencil test should follow to provide the students a more formal assessment of their understanding of the entire unit.

***Learning Motivation***

- This can be done through daily observation of the student's learning behaviour, such as their participation in class and the completion of their daily work.

- Teachers can gather information about each child using structured interview questions at different occasions during the term.

**Guidelines of using the Model**

In using this instructional model, teachers are expected to have the following important qualities as described in the international as well as local professional code of ethics:

1. Personal character - high morals and values, compassion, patience, kindness, courteous interaction with children, dedication, respect, enthusiasm, motivation
2. Emotional qualities – caring, warmth, love and respect for children, understanding of children, empathy, friendliness, sensitivity, trust, tolerance
3. Mental health – a positive outlook on life, optimism, attentiveness, self-confidence, self-respect

The Teachers' Council of Thailand stipulated that teachers must have love, faith, honesty and responsibility for the profession and ….treat students with love, compassion, concern, help, and support. [They] must not act with antagonism regarding the physical, mental, psychological, emotional and social growth of students.

**Conditions of using the Model**

1. Time

   The time taken for each regular lesson is approximately 50 minutes. This should enable the teacher to carry out all the steps that appear in the teaching procedure above. Any extra time available should be used to encourage and bond with the students.

2. Students

   This model was applied to lower primary students. Teachers wishing to apply this model to younger or older children may do so with consideration of the students' interest at various stages of development, so that the first stage of the teaching procedure related to interest stimulation can be carried out effectively.

# BIOGRAPHY

Listati Sugimin graduated with a Bachelor of Business (Banking & Finance) from Curtin University at Perth, Western Australia, in 1991. She obtained a Master of Education (Curriculum & Instruction) from Assumption University, Thailand, in 2005, receiving the Rector's Award for Academic Excellence. Currently, she is the Principal of St. Mark's International School in Bangkok, Thailand.