Chapter One

Introduction

The purpose of this study is to find out the relationships among self-concept, self-efficacy, and achievement. Research motivation, the purpose of the research, the research hypothesis, definition, and the research area and the limitation are introduced in this chapter.

1.1 Research Motivation

Studies about personal beliefs suggest that individuals with positive view of themselves strive to succeed and be able to solve difficulties in their life. In contrast, people with weak or negative self-beliefs tend to fail to reach their fullest potential. Self-concept and self-efficacy are the two most well-researched self-constructs that have contributed significantly to the understanding of how students assess themselves and how beneficial it is when using to predict or explain students' achievement. Hackett and Betz (1989) suggested that "mathematics teachers should pay as much attention to students' self-evaluation of competence as to actual performance (p. 271)." It seems that it is important to assess students' self-efficacy in order to provide classroom teachers with additional insight about their students' subsequent performance. In many cases, individuals with inaccurate perceptions of mathematics capability, and poor preparation or lack of skill, will be critical for avoidance of mathematics-related courses and careers (Pajares & Miller, 1994). Mathematics is chosen as the specific behavioral domain of interest in this study mainly because mathematics experience appears

to play a critical role in shaping student's later stage of occupational options. Three questions will be discuss later: Why self-concept and self-efficacy are chosen as research constructs? Why mathematics is chosen in the present study? Why use Programme for International Student Assessment (PISA) database (Organization for Economic Cooperation and Development, OECD, 2004))?

1.1.1 Why Self-concept and Self-efficacy are chosen?

Pajares (1996) proposed that academic self-concept and academic self-efficacy might not be separable at the domain level of specificity. The cognitive academic self-concept factor was empirically indistinguishable from the academic self-efficacy factor (Pietsch, 1999; Skaalvik & Rankin, 1996a). However, there are still debates about whether the perceived competence component in self-concept is identical to perception of self-efficacy. These two beliefs sometimes provide different psychological and behavioral outcomes. Reexamining the specificity of academic self-concept and academic self-efficacy is necessary, which is another motivation of the study.

Questions about educational effectiveness can be partly answered with data on the average performance from PISA database. How self-efficacy and self-concept influence academic achievement? This is the important question because, among other things, skill acquisition during schooling influences individuals' further education and their success in their future career, and their lifelong learning. The researcher hopes to provide some educational insights for Taiwan by assessing the psychological traits and academic performance of students in OECD

countries.

1.1.2 Why Choose Mathematics?

In a rapidly developed technical world, mathematics is the key to many areas of activity both inside and outside of school. It is important for individuals to have the skills and knowledge to participate in today's knowledge-based economy and also have strong foundation to continue with learning throughout life. In PISA (OECD, 2003), mathematical literacy is defined as:

"An individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet the need that individual's life as a constructive, concerned and reflective citizen" (pg. 15).

As defined above, mathematics is about the ability of students to analyse, reason, and communicate ideas effectively by using mathematical language, modeling, and problem solving skills. The process of mathematics is defined by general mathematical competencies (OECD, 2003). On the other hand, the level of student engagement in mathematics is important for acquiring skills and knowledge and be more receptive to the new knowledge. The learning attitude that students have may also affect their ability to succeed in school, course selection, educational pathways, and their future career. If students have ability to set their own objects, they will be able to continue their learning process in their life time even they leave schools. Student engagement is measured by the extent to which individual believe they can succeed in mathematics, what their feel are about learning mathematics, and their

emotional feelings about mathematics. Therefore, this study is going to assess the importance of self-related cognitions in mathematics among OECD countries.

From the mathematics achievement reports in PISA database, Asia countries (such as Taiwan, Hong Kong, Singapore, Korea, Japan, etc.) show highest performance in mathematics assessment. Although their average performance in mathematics is high, students do not express strong interest in mathematics (OECD, 2004). Interest in the subject and performance may be reinforcing to each other and may also be affected by other factors, such as the social backgrounds of students and their schools; the causal of this relationship may be complex.

1.1.3 Why Use PISA Database?

In the century of knowledge-based economy, knowledge and learning are closely related to each other. Education is the core of knowledge-based economy and learning is the tool for improving oneself and organizations. Lifelong learning has been viewed as most important strategy for the development of economy which is also connected with knowledge-base economy. It is critical for economic growth and social welfare. However, the skills and knowledge that individuals bring to their further studies, to their jobs and to our society, play an important role in determining our economic success and our overall quality of life. Our economy is shifted from manufacturing to those service industries with advance communication and production technologies; therefore, accelerating changes in the skills for present and future economy is required. In 1996, The United Nations Educational, Scientific and Culture

Organization (UNESCO) used "Learning: the Treasure within" as a theme and promoted lifelong learning with four points: learning to live, learning to know, learning to do and learning to be. It is clear shown that education systems play a central role for solid based for each individual so that their subsequent knowledge and skills can be developed. Students graduating from secondary education with weak foundation may face difficulty in their postsecondary education or their work places. As a result, they may benefit less when learning opportunities are presented in their later life. In order to address these issues, governments devoted large portions of their budgets to provide high quality in education systems. However, these governments concern about the effectiveness for their investment on the education system. OECD has developed a tool, PISA, to gather information about students. PISA is designed to provide policy-oriented international indicators of the skills and knowledge of 15-year-old students and measures skills that are generally recognized as key outcomes of educational process. The assessment focus on young people's ability to use their knowledge and skills to meet their real life challenges. PISA mainly assesses reading, mathematical and scientific literacy and one of these three domains is chosen as the major domain in every three years, others are considered as minor domains (OECD, 2005). Therefore, one of the motivations of the present study is to assess the mathematics performance in this international student assessment.

1.2 Purpose of Research

The present research is to investigate the relationship among two academic self-beliefs constructs and academic achievement. Self-beliefs constructs are academic self-concept and academic self-efficacy. The purposes of the present study include:

1. To examine the reliability and validity of good measurement models of self-concept and self-efficacy by using EFA.

2. To examine the relationships among mathematics self-concept, mathematics self-efficacy and mathematics achievement by using SEM model.

3. To identify the mediation effect in the structural model.

4. To verify the modified model by using cross-validation.

5. To give suggestions based on the present research for educational practice and future research.

1.3 Research Hypothesis

Based on the research purpose, the research hypotheses are shown below:

Hypothesis 1 Items of mathematics self-concept and mathematics self-efficacy are good measures.

Hypothesis 2 Mathematics self-concept can not directly predict achievement but can indirectly predict achievement through the mediating effect of mathematics self-efficacy.

Hypothesis 3 Self-efficacy acts as a mediator variable that influences the effect of self-concept to mathematics achievement.

Hypothesis 4 The two sets of samples have presented cross validity, the research structural model is highly acceptable.

1.4 Definition

1. Mathematics self-concept

    Academic self-concept refers to individuals' knowledge and perceptions about themselves in learning a subject. Mathematics self-concept is referred to as perceived ability in mathematics. In the present study, self-concept is measured by the PISA 2003 study (cf. p. 24), five items are used and positive scores indicate a positive competency-based of self-concept in mathematics and vice versa.

2. Mathematics self-efficacy

    Academic self-efficacy refers to the beliefs in one's feelings of confidence about being able to solve specific problems. Mathematics self-efficacy referred to as mathematics confidence. In this research, the students' confidence with mathematical task is measured by eight items in PISA 2003 study (cf. p. 25). Positive scores on the index indicate higher levels of self-efficacy and vice versa.

3. Mathematical Literacy

    An individual's capacity to identify and understand the role of mathematics, to make good judgment and to use and engage with mathematics in ways that meet their needs of life. The mathematical content is defined mainly in terms of four "overarching ideas" (quantity, space and shape, change and relationships and uncertainty) and only secondarily in relation to "curricular strands" (such as numbers, algebra and geometry) (OECD, 2003).

4. Programme for International Student Assessment (PISA)

PISA was started by the member countries of OECD. It provides policy-oriented international indicators of the skills and knowledge of 15-year-old students. This assessment focuses on students' performance and data collection about the students, as well as about the families and institutional factors potentially affecting performance. PISA mainly assesses reading, mathematical and scientific literacy. For each data collection, one of these three domains is chosen as the major domain, others are considered as minor domains which is repeated every three years with each cycle. Mathematical literacy was the major domain in PISA 2003 and in addition to reading and science, a third minor domain – problem-solving skills is included (OECD, 2005).