UNIVERSITI PUTRA MALAYSIA

INFLUENCES OF MATHEMATICAL AND PSYCHOLOGICAL CONSTRUCTS ON MATHEMATICS ACHIEVEMENT AMONG 8TH GRADE IRANIAN STUDENTS

HAJAR KAMALIMOGHADDAM

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By

HAJAR KAMALIMOGHADDAM

Thesis Submitted to the School of Graduate Studies, University Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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DEDICATION

This thesis is dedicated to my late father whose unconditional love will always be my inspiration, my kind mother, my kind husband, Mostafa, for all the love and support he has given selflessly, my devoted sister, Fariba, for her supported, and my lovely son, Arashk who has always comprehended my commitment to my objective.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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Chairperson : Associate Prof. Rohani Ahmad Tarmizi, PhD
Faculty : Institute for Mathematical Research

The current study explored the critical connections between students' mathematical problem solving skills, mathematics beliefs, prior mathematics achievements, mathematics self-efficacy and mathematics achievement among 400 middle school students across Iran who were in grade eight.

Ten structural equation models, one measurement model and twelve individual models were tested to understand (1) direct and indirect relationships between students' mathematical problem solving skills, students' mathematics beliefs, students' prior mathematics achievement, and students' mathematics achievements; (2) direct influences of students' mathematical problem solving skills, students' mathematics beliefs, students' prior mathematics achievement on students' mathematics self-efficacy; and (3) direct relationship between student's mathematics self-efficacy and students' mathematics achievements.

The structural equation models tested in this study suggested that students' mathematical problem solving skills, students' mathematics beliefs, and students' prior mathematics achievement directly influence students' mathematics achievements (Chi-sq=2.80, GFI=.94, CFI=.97, AGFI=.91, IFI=.97, NFI=.95, TLI=.96, RMSEA=.06). Also, direct model indicated correlation coefficient from low to high (.11 to .79), factor loading (.56 to .93) and critical ratio more than 1.96 for all of paths. Moreover, students' mathematical problem solving skills, students' mathematics beliefs, and students' prior mathematics achievements indirectly influence students' mathematics achievement through students' mathematics self-efficacy (Full Structural Model, Chi-sq=2.49, GFI=.94, CFI=.98, AGFI=.91, IFI=.98, NFI=.96, TLI=.97, RMSEA=.06). Also, mediation model indicated correlation coefficient from low to high (-.08 to .58), factor loading (.57 to .95) and critical ratio more than 1.96 for all of paths). The implications for future research along with the limitations are discussed.

Abstrak tesis yang dikemukakan kepada Senate Unversiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

PENGARUH KONSTRUK MATEMATIK DAN PSIKOLOGI KE ATAS PENCAPAIAN MATEMATIK DI KALANGAN PELAJAR-PELAJAR IRAN GRED 8

Oleh

HAJAR KAMALIMOGHADDAM

Januari 2016

Pengerusi : Profesor Msdya Rohani Ahmad Tarmizi, PhD
Fakulti : Institut Penyelidikan Matematik

Kajian semasa ini meneroka ke dalam perhubungan kritikal di antara kemahiran menyelesaikan masalah Matematik pelajar, kepercayaan matematik, pencapaian matematik terdahulu, kecekapan-kendiri matematik dan pencapaian matematik di kalangan 400 orang pelajar sekolah menengah di seluruh Iran yang berada dalam gred 8.

Sepuluh model persamaan struktur, satu model pengukuran dan dua belas model individu telah diuji untuk memahami (1) perhubungan langsung dan tidak langsung di antara kemahiran menyelesaikan masalah Matematik pelajar, kepercayaan matematik, pencapaian matematik terdahulu dan pencapaian matematik pelajar; (2) pengaruh langsung kemahiran menyelesaikan masalah Matematik pelajar, kepercayaan Matematik mereka, pencapaian terdahulu ke atas kecekapan-kendiri subjek berkenaan; dan (3) perhubungan langsung di antara kecekapan-kendiri matematik pelajar dan pencapaian matematik pelajar.

Model-model persamaan struktur yang diuji dalam kajian ini mencadangkan bahawa kemahiran menyelesaikan masalah Matematik pelajar, kepercayaan dan pencapaian matematik terdahulu secara langsung mempengaruhi pencapaian matematik mereka (Chi-sq=2.80, GFI=.94, CFI=.97, AGFI=.91, IFI=.97, NFI=.95, TLI=.96, RMSEA=.06). Seterusnya, model langsung menunjukkan koefisien korelasi dari rendah kepada tinggi (.11 to .79), beban faktor (.56 to .93) dan nisbah kritikal lebih dari 1.96 untuk semua laluan. Tambahan pula, kemahiran menyelesaikan masalah Matematik pelajar, kepercayaan matematik pelajar, dan pencapaian terdahulu mereka dalam subjek ini mempengaruhi pencapaian matematik mereka yang lepas melalui pencapaian matematik mereka melalui kecekapan-kendiri matematik pelajar (Model Struktur Penuh, Chi-sq=2.49, GFI=.94, CFI=.98, AGFI=.91, IFI=.98, NFI=.96, TLI=.97, RMSEA=.06). Seterusnya, model mediasi menunjukkan koefisien korelasi dari rendah kepada tinggi

(-.08 to .58), beban faktor (.57 to .95) dan nisbah kritikal lebih dari 1.96 untuk semua laluan). Implikasi untuk kajian-kajian yang akan datang, berserta dengan batasan-batasannya akan dibincangkan.

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I certify that a Thesis Examination Committee has met on 6 January 2016 to conduct the final examination of Hajar Kamalimoghaddam on her thesis entitled "Influences of Mathematical and Psychological Constructs on Mathematics Achievement among 8th Grade Iranian Students " in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

Members of the Thesis Examination Committee were as follows:

Tajularipin bin Sulaiman, PhD
Associate Professor
Faculty of Educational Studies
Universiti Putra Malaysia
(Chairman)

Mat Rofa bin Ismail, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Internal Examiner)

Samsilah binti Roslan, PhD
Associate Professor
Faculty of Educational Studies
Universiti Putra Malaysia
(Internal Examiner)

Zsolt Lavicza, PhD
Associate Professor
University of Cambridge
United Kingdom
(External Examiner)

ZULKARNAIN ZAINAL, PhD
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 16 February 2016

This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

Rohani Ahmad Tarmizi, PhD
Associate Professor
Institute for Mathematical Research
Universiti Putra Malaysia
(Chairman)

Ahmad Fauzi Mohd Ayub, PhD
Associate Professor
Institute for Mathematical Research
Universiti Putra Malaysia
(Member)

Wan Marzuki Wan Jaafar, PhD
Doctor
Faculty of Educational Studies
Universiti Putra Malaysia
(Member)

BUJANG BIN KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

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This is to confirm that:

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Signature: ________________________
Name of Chairman of Supervisory Committee: Rohani Ahmad Tarmizi, PhD

Signature: ________________________
Name of Member of Supervisory Committee: Ahmad Fauzi Mohd Ayub, PhD

Signature: ________________________
Name of Member of Supervisory Committee: Wan Marzuki Wan Jaafar, PhD

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LIST OF ABBREVIATIONS

GPA	Grade Point Average
NCTM	National Council of Teachers of Mathematics
TIMSS	Trends in International Mathematics and Science Study
SE	Self-Efficacy
MPS	Mathematical Problem Solving Skills
SEM	Structural Equation Modelling
IRI	Islamic Republic of Iran
MM	Measurement Model
SCT	Social Cognitive Theory
MPST	Mathematical Problem Solving Theory
MOE	Ministry Of Education
MA	Mathematics Achievement
MB	Mathematics Beliefs
PMA	Prior Mathematics Achievement
ICT	Information and Communication Technology
SM	Structural Model
NM	New Math

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Learning mathematics at school has been the general practice but has been debated widely. This is a complex question which has been addressed by many mathematics educators. Both national and international evaluations have shown that mathematics knowledge of learners upon completion of basic education were not achieving well or as expected. Many reports showed that the goals of mathematics are not achieved and that many learners do not like mathematics and that mathematics teaching approaches need to be realigned (Trends in Mathematics and Science Study, 1999, 2003, 2007, 2011; Programme for International Student Assessment, 2010; Kiamanesh & Mohsenpour, 2009).

In Iran, the official acquisition of mathematics starts in pre-school and extends to high school. Schools are regarded as one of the most crucial social organizations, which assume to extend mathematics knowledge besides its other responsibilities (Ministry of Education, Iran, 2010). School mathematics follows two basic goals; firstly, to teach the individuals who are entering the labour force in technology and industrial positions to obtain mathematical knowledge and be able to survive in their respective vocation, and secondly, to educate individuals who would select mathematics as their pre-occupation and become mathematicians.

According to Goya and Azad, 2001, the goal of mathematics education in Iran are varied and consisted of:

1. Educating primary numeracy skills to all students;
2. Teaching practical mathematics (arithmetic, elementary algebra, plane and solid geometry, trigonometry) to students, so that they can pursue into science, technology or business vocation;
3. Training abstract mathematical notions (such as set and function);
4. Educating fields of mathematics such as Euclidean geometry;
5. Educating fields of mathematics such as calculus;
6. Teaching advanced mathematics to those students who hope to chase a job in Science, Technology, Engineering, and Mathematics (STEM) fields;
7. Instructing heuristics and other problem-solving strategies to solve non-routine problems.

The above goals in mathematics education are in accordance to the goals as stated by Romberg (1992). In a layman sense, Romberg summarises that "schools should prepare students so that they can be productive citizens in society" (p. 756). In addition, Romberg presents that: mathematics enhances and improves one's ability to think logically; mathematics trains and increases the stamina, so that the students are prepared and more easily can tackle situations and problems in the future where endurance is needed for succeeding in resolving the issues at hand (Romberg, 1992, p. 758-759).

Hence, there are crucial needs to identify factors related to mathematics learning and teaching which results in “students’ quality of understanding and achievement in mathematics”. Choudhury and Das (2013) expressed many factors which influence the achievement in mathematics. According to the Choudhury and Das, knowledge of basic concepts of mathematics, confidence in learning mathematics, conceptual forerunner to mathematics self-efficacy, has consistently been found to predict mathematics achievement. Attainment in mathematics is very much based on the mastery of fundamental skills. Mathematics education in school curriculum, especially at secondary school stage, is very necessary and important. The natural scope of mathematics and its unique role in solving problems in day-to-day activities, has given consideration that mathematics be included as one of the core subjects in school curriculum, both at the primary and secondary school level.

Therefore, in today`s modern world, students critically need mathematics for everyday life. The goals of teaching mathematics generally are classified into two categories, namely cognitive goals and affective goals (Anderson & Krathwohl, 2001). According to Anderson and Krathwohl’s Taxonomy (2001), cognitive domain is classified into six categories, which include remembering, understanding, applying, analysing, evaluating and creating. In fact, cognitive goals are constitute of theoretical and knowledge of mathematics, and typically are presented in the form of content and course texts. On the second goal of teaching mathematics which is the affective domain, Choudhury and Das (2013) mention that, many variables were found to influence the learning of mathematics, namely, self-concept, mathematics anxiety, attribution, and perceived usefulness of mathematics. Also, they suggested that beliefs towards mathematics and mathematics ability which includes arithmetic ability, algebraic ability, geometrical ability may play important role in problem solving behaviour, and that confidence in one’s ability to solve problems often enhances achievement in mathematics.

For attaining the two goals of mathematics teaching as mentioned above, the roles of mathematics teachings approaches are important. In Iran mathematics teachings are conducted using several methods or approaches. As Zadshir, Kiamanesh and Abolmaali (2013) said, there are four main methods for teaching mathematics in Iran:

1) Conventional method which is the step by step teacher instruction of mathematical concepts and ideas. This approach begins hierarchically, with arithmetic, then Euclidean geometry and followed by primary algebra. A well-trained teacher in primary mathematics is needed, as the logic of the subject determines further mathematics curriculum.
2) Classical education which is part of the classical education curriculum of the middle ages that was typically instructed based on Euclid’s elements as a paradigm of deductive reasoning.

3) Historical approach which focuses on educating of improvement of mathematics within a cultural, social, and historical context.
4) Relational method which involves discussions during class and used to solve routine problems and to connect them to today`s events. In this method many uses of mathematics are focused and pupils are helped to figure out the reason of learning and to apply mathematics to actual situations in their lives (Zadshir, Kiamanesh & Abolmaali, 2013).

In addition, mathematics education goals in Iran are set at the national level by the Ministry of Education, and they develop the mathematics syllabus and textbooks. Mathematics textbooks are distributed all over the country for each school year, hence all students have the same mathematics textbooks. Mathematics teachers are requested to utilize these textbooks as the main teaching material (Ministry of Education, 2010).

Recently, in 2008, a new school mathematics curricula reform was introduced where modelling and application in mathematics were emphasized. Concurrently, there were some changes in the mathematics textbooks for grades eight, nine, ten and eleven. The textbooks have similar contents except that the sequence of the chapters was rearranged. One of the topics of this new version of mathematics textbook was modelling and application approach. It is envisioned that the introduction of modeling and applications will provide students with a good background in mathematics, thus they should be able to apply their mathematical knowledge in solving real world problems (Rafiepour, Stacey & Goya, 2012).

The above curriculum changes may have an impact on learners affects. In context, the learners' involvement in mathematics implies their motivations for acquiring mathematics along with the learners' confidence for having such capability to be successful in mathematics. The learners' involvement and engagement in mathematics are determinant in learning the mathematics skills and know-how. The ones who show more tendencies toward the learning process would certainly acquire better understanding in mathematics. The learners' engagement would likewise affect the course selection, educational paths, and as well as future vocational selections (Stigler & Hiebert, 2004).

A voluminous amount of study has explored the association between learners' individualities and their mathematical achievement. On the whole, many surveys such as Suthar (2013); Kiamanesh et al., (2008); Zan & Mantino (2007); Kabiri et al., (2004); Papanastasiou (2002) have determined the relation between many psychological attributes like students' self-concepts, their attitudes of mathematics, their family backgrounds along with their motivation and students' mathematics achievement.

Students' attitude toward mathematics influences how often or how well they do learn mathematics, and how much they enjoy learning mathematics. Attitude is described as a mental opinion, preparation to react and the psychological foundation of attitudes, students` learned nature, their evaluative character and their durability. It consists of ideas, situations, places, students, or objects. Attitudes are not just in active conclusions of last happenings; rather they cause actions and direct their etiquette (Choudhury & Das, 2013; Yenilmez, Girginer, & Uzun, 2007; Guimaraest, 2005).

Bandura (1986) examined affective variables such as the influence of students' beliefs and self-efficacy on mathematics achievement. Bandura (1997) accentuates that the impacts of other determinants of performance are mediated by the self-efficacy beliefs on the consequent performance. In other words, by the time there is a control on such determinants, the self-efficacy judgments would predict the performance more efficiently. Moreover, similar to self-efficacy beliefs, some constructs are declared by Bandura to affect the achievement outcome which include self-concept, anxiety, and perceived usefulness. Nevertheless, the mentioned constructs are majorly the consequences of self-efficacy judgments while it is asserted that their impacts mostly depend on the confidence of the students to deal with a given activity. Bandura (1997) also suggested a crucial role of prior achievement and its impact on pupils' ensuing achievement.

As Schoenfeld (2010) revealed, skills in mathematical problem solving can be considered as cognitive factor which also relates to mathematics achievement. In fact, cognitive skills knowledge will guide pupils make a plan of thinking that includes problem solving skills and plans to solve the mathematical problems. This plan of thinking is related to the students' understanding of the related mathematical formulas, symbols, rules or theorems to be used in solving the mathematical problems. During solving the problems, pupils will use two steps such as understanding of the mathematical language and then executing the computation process.

Pajares and Schunk (2001) suggested that prior achievement in mathematics and self-efficacy as affective variables have influence on mathematics achievement. In fact, Pajares and Schunk (2001) presented that prior achievement in mathematics is a powerful predictor of ensuing mathematics achievement. Additionally, they showed that prior achievement had an indirect influence on mathematics achievement through its impact on self-efficacy beliefs. Later study by Snyder and Lopez (2007) provided support to Pajares and Schunk (2001) study. Based on Snyder and Lopez (2007) research, self-efficacy is affected directly by prior achievement and its intermediates the influences of prior achievement on further achievements.

In addition, Zarch and Kadivar (2006) suggests that mathematics self-concept, perceived usefulness of mathematics, mathematics anxiety, mathematics belief, and mathematics self-efficacy have an impact on mathematics achievement. Furthermore, they investigated self-efficacy as a mediating factor affecting the other factors that influence the mathematics achievement. The role of self-efficacy as an exclusive prophecy among learners has been shown as substantial to mathematics achievement. In fact, the learners who have a high sense of efficacy are those who believe they will be successful in doing the task and have higher achievements in mathematics than the others.

Based on the numerous literature of self-efficacy's roles, namely being predictive and meditational, learners' self-efficacy are usually significant for the success particularly in mathematics achievement. Hence, the current research has been aimed to examine the predictive and the meditational roles of mathematics self-efficacy onto students' mathematics achievement by employing the Structural Equation Model. Besides, it also aimed to determine the extent to which prior mathematics achievement, mathematical problem solving ability, and mathematics beliefs would have direct and indirect influences on mathematics achievements of Iranian middle school students.

1.2 Problem Statement

Globally, many researchers have shown poor mathematics achievement among students and addressed an assortment of obstacles to efficient mathematical understanding and reasons or justification for poor mathematical achievement among learners (Choudhury & Das, 2013; Ismail, 2009; Kiamanesh & Mahdavi-Hezaveh, 2008).

Generally, obstacles to mathematics understanding which resulted in poor mathematics achievement can be examined based on three bases: curriculum, teacher, and learners. Each of these parameters has been shown to significantly influence mathematics achievement. These three variables can be considered as opposite sides of a triangle, so each one may singularly or collaboratively influence learners' mathematics achievement (Nejad, 2009).

As mentioned earlier, according to Zadshir et al. (2013), mathematics is often considered as a difficult subject to both learners and teachers in Iran. Learners think mathematics is tiring and unalluring subject, and teachers consider it hard to teach and to make students interested in learning mathematics. These have been the general problems in teaching and learning mathematics at both the primary and secondary level. Ministry of Education in Iran (2010), have given evidence that the student's difficulties with mathematics low performance in secondary school are directly related to their motivation, beliefs about mathematics, and background in mathematics. In addition, in primary and middle school learners face difficulties that are related to problem solving skills (Zadsuir et al., 2013).

Whilst mathematics achievement has been the common problems among Iran learners, little attention has been given to learners at the middle school level, which is grade eight. Therefore this study will examine several factors (cognitive and affective domains) related to mathematics achievement.

Arani, Kakia and Karimi (2012) also suggest that the mathematics education literature in Iran have given little attention to students feelings or opinions about the mathematics nature, and also on self-regulation, self-efficacy, and problem solving or thinking competency which may effect on mathematics understanding or achievement.

The research centers of the Ministry of Education, Iran, however tried to diagnose the weak and strong areas of mathematics education. Furthermore it seeks to discover the hindering and facilitating factors of the teaching-learning process in mathematics at school levels. Since international comparative studies such as Trends in International Mathematics and Science Study (TIMSS) evaluates key and basic courses (science, mathematics and reading comprehension) in the educational system of each of the participating countries. Ministry of Education, Iran are now focusing on the scientific development index (Ministry of Education, 2008). The international findings of TIMSS reveal that the mathematics performance of Iranian students is not satisfactory. According to the two international findings of TIMSS the ranking and position of the Islamic Republic of Iran has been lower than the international performance mean for TIMSS periods during 1995, 1999, 2003, 2007 and 2011 (Mullis et al., 2012).

In addition, the average of the correct responses of Iranian students to the whole mathematics and science of TIMSS 2007 is around 37% whilst the average of the participating countries which is around 50%.This indicated that the mathematics performance of Iranian students is low. However, Iranian eighth graders showed higher achievement than international average in geometry, numbers and algebra, but they performed below international level when total mean scores were taken into consideration (TIMSS 1999, 2003, 2007, 2011).

During the last decades, students' poor performance in mathematics has turned into a rocketing worldwide concern. According to the recent findings, the mathematics attainment need to be given consideration on their affective dimension, focusing on individual learning and social characteristics. Evidence surfaced that learners difficulties with solving the mathematical tasks and efficient usage of strategies would be directly associated with the students' mathematics beliefs, self-regulation, lack of critical thinking, and problem solving ability (Moscardini, 2010; Ismail, 2009; Ismail & Awang, 2008). Therefore, concentrating on the students' mathematics beliefs, self-regulation, problem solving abilities, and mathematics self-efficacy on mathematics learning activities might provide insights into learners' mathematical difficulties.

Based on the mentioned facts, the Ministry of Education of Iran deals with this problem through establishing/holding additional classes in various areas and also in the mathematics institute. A great number of big cities in Iran enjoy rich educational facilities such as mathematics remedial classes, mathematics institution and experienced teachers. One of the cities that have strong universities and departments in the field of mathematics is Shiraz. Unfortunately, students in this city don't have high performance in mathematics course compared to other cities in Iran. The following report from the Internal Standard Examination, Olympiad in Iran showed alarming standing of learners in Shiraz:

Iran's Mathematics Adolescent Olympiad was developed by the educational, cultural and publication institute of Mobtakeran in 2003. Its aim was to run competition in mathematics among intelligent and interested students. The first round was in 2003 and the second was held in 2011 in two phases. The Olympiad contest format was multiple choice of five alternatives for both phases, the questions were to assess students' mathematical capability and thinking, deduction, logic and problem solving skills. Phase one was held for grades six, seven and eight with 5430 participating students. The entry requirement for taking part in the competition was the students must acquire an average of A for grades seven and eight and A+ for grade six students. It was reported that only a few number of state schools met the necessary requirement to take part in this contest and over 90% of the students were from the private schools. This issue indicates that students' mathematics performance in state schools is much lower than the private schools; and it is worth mentioning that none of the Shiraz state schools were eligible to participate in the Olympiad. Of all the achievers in the first phase, only one grade six student was from the public school in Shiraz and the rest were from private schools. None of the grades seven and eight students from the public school in Shiraz were eligible for this Olympiad contest (Mobtakearn Group, 2012).

Although, there are many researchers investigated some studies on mathematics achievement based on a lot of factors in Iran but there are some evidences that show low achievement among Iranian students so this study try to fill this gap by addition some more factors whilst keep the previous factors.

However, literature review in the next chapter will show that the domain of studies were not spread on mathematics factors and their effect on mathematics achievement in Iran. Also, the previous studies almost showed less impact of important factors on the mathematics achievement such as the skills to solve the mathematics problems or prior mathematics achievement whilst as stated above the Ministry of Education considered the students' difficulties on mathematics achievement related to mathematical problem solving and background in mathematics.

Taking into account the existing literature, it can be realized that there is substantial association and influence between the learners' performance in mathematics in Iran and their mathematics beliefs, self-efficacy, prior mathematics achievement, and mathematical problem solving skills. Hence it is pertinent that this study should be carried out to determine the affective or psychological factors and cognitive factors that hinder students in Shiraz to perform well in mathematics.

The current study focused on students' from the Eighth Grade category. The students` difficulties with mathematics low achievement in middle school are directly and indirectly related to motivation, beliefs about mathematics, experiences in mathematics, strategy for problem solving, opinions about the mathematics nature, suitable self-regulation, self-efficacy, and efficient critical thinking and problem solving ability. The findings of TIMSS periods during 1995 to 2011 and Mathematics Adolescent Olympiad findings in 2003 and 2011 were used as a basis to investigate the hypothetical modelling of the influence of affective and cognitive mathematically-related variables on students' mathematics achievement at grade eight.

1.3 Research Objectives

The present study was designed to investigate the influence of affective and cognitive mathematically-related variables on students' mathematics achievement at eighth grade in Shiraz city, Republic of Iran. To achieve this goal, four variables, namely, mathematics self-efficacy, mathematics beliefs, mathematical problem solving skills and prior mathematics achievement were measured and structural equation modelling analysis was conducted to confirm the related model on the basis of theoretical principles in mathematics education.

The specific objectives of the present study are as below:

1. To examine the students' level of mathematical problem solving skills, mathematics self-efficacy, mathematics beliefs, prior mathematics achievement and mathematics achievement.
2. To determine the direct influence of mathematical problem solving skills, mathematics beliefs, and prior mathematics achievement on students' mathematics self-efficacy.
3. To examine the direct influence of mathematical problem solving skills, mathematics self-efficacy, mathematics beliefs, and prior mathematics achievement on students' mathematics achievement.
4. To examine the indirect influence of mathematical problem solving skills, mathematic beliefs, and prior mathematics achievement through mathematics self-efficacy as mediator on students' mathematics achievement.
5. To explain the role of mediator by using the bootstrapping approach.

1.4 Research Hypotheses

Before testing the effects of mediator variable, the current research needs to meet three important conditions (Baron & Kenny, 1986). Firstly, the examined predictors, namely, student's mathematics beliefs, mathematical problem solving skills, and prior mathematics achievement, are related to the criterion variable, which is students' mathematics achievement. Secondly, predictors such as student's mathematics beliefs, mathematical problem solving skills, and prior mathematics achievement, are also associated with the mediator construct, which is mathematics self-efficacy. Third, the mediator construct, which is mathematics self-efficacy, is related to mathematics achievement. Based on the relevant related literature, the major hypotheses of this study of four public schools of grade eight students in Iran include the following:

Hypothesis 1: Students' mathematics beliefs have a direct influence on their mathematics achievement.

Hypothesis 2: Students' mathematical problem solving skills have a direct influence on their mathematics achievement.

Hypothesis 3: Students' mathematics self-efficacy have a direct influence on their mathematics achievement.

Hypothesis 4: Students' prior mathematics achievement have a direct influence on their mathematics achievement.

Hypothesis 5: Students' mathematics beliefs directly influence their mathematics self-efficacy.

Hypothesis 6: Students' mathematical problem solving skills directly influence their mathematics self-efficacy.

Hypothesis 7: Students' prior mathematics achievement directly influences their mathematics self-efficacy.

Hypothesis 8: Students' mathematics beliefs, mathematical problem solving skills and prior mathematics achievement have a direct influence on mathematics achievement.

Hypothesis 9: Students' mathematics beliefs, mathematical problem solving skills and prior mathematics achievement have indirect effects on their mathematics achievement through their effects on mathematics self-efficacy.

Hypothesis10: Full structural model is acceptable in terms of explaining the relationship among mathematics beliefs, mathematical problem solving, prior mathematics achievement, and mathematics self-efficacy with mathematics achievement.

1.5 Significance of the Research

Studies had focused on mathematic achievement based on strategies of problem solving which includes four important steps (understand the problem, make a plan, solve the problem, and look back). The role of self-efficacy, prior mathematics achievement and students' beliefs about mathematics on mathematics performance are also highlighted.

It is good to know that the mathematics achievement encompasses a multifaceted interface of factors directly and/or indirectly affecting via other factors the school achievement. It is indispensable to scrutinize the factors which bear major contributions to the Iranian learners' mathematics achievement even though there have been expansive surveys examining the correlation between the mathematics achievement and some factors like self-concept, home background, and attribution. Having kept this in mind, they can be filled the present gap regarding the survey conducted in Iran in this field. Besides, they can be prepared the conditions for more inclusive investigation of comparing the national and international survey results in the 8th grade.

While copious researches have been piloted on the association between the attitude of mathematics and mathematics achievement, by now it is observed that there is somewhat scarcity of inquiries scrutinizing the association between mathematics self-efficacy, mathematical problem solving skills, prior math achievement, and mathematics achievement. Additionally, there is a lack of scrutiny dealing with large-scale samples nationwide in Iran. Moreover, the findings resulted from the current survey will expectantly develop the knowledge base of mathematics education in the interconnected fields such as the individuals' beliefs, mathematics self-efficacy, mathematical problem solving skills, and academic ability in multiplicity of career building discipline.

Besides, the current research will bring contributions to recognizing the implications consequential from the integrated analysis of critical thinking and problem solving in mathematics ability, particularly as applied via supportive survey responses, to improve the students' mathematics beliefs, mathematics self-efficacy, and mathematical problem solving skills. The current study strengthens a conceptual framework which revolves around theoretical foundations and empirical researchers. Likewise, this study will engender empirical proofs besides research direction and a framework for students' mathematics beliefs, mathematics self-efficacy learning, and skills in mathematics ability to be employed for enhancing their beliefs, study beliefs, study habits, and ability in mathematics.

This study hopes to accomplish a perfect framework for educators, students, and the Ministry of Education. The obtained results of the current study will bring advantages to the researchers, educators, policy makers, government and non-government agencies that are all concerned with enhancing the education nationally or locally. The results would also benefit the parents and students who are looking for the most effectual education to be provided at the schools. This research is an attempt to expand their know-how of middle school as well as the impact it exerts on higher levels in the mathematics ability. We underline the fact that the educators (institutional administration) are required to continually enhance themselves and enhance their work; by this, it is anticipated that the students will conceivably gain the mathematics education with the uppermost quality.

Additionally, this study hopes to improve previous findings and add new findings concerning the 8th grade students in Iran. This study will also utilize the mathematical problem solving and mathematics self-efficacy instrument which are new in conducting research in Iran and modified to suit the 8th grade students.

1.6 Limitation of the Research

There are several limitations that need to be taken into account when interpreting the findings of the present investigation. First, several studies had investigated the relationship between self-efficacy and performance under the influence of different factors using experimental design such as by Pajares and Schunk (2001). Because of the fact that the present research is not experimental, it is not possible to define causal statements. This research merely tends to explore the relationships among the variables and does not designate the cause and effect relations.

Second, this research is limited as the data are self-reported gathered by means of questionnaires and tests set. However, the researcher followed the ground rules such as exam times, location of the exams, and research procedures from the Ministry of Education in Shira, Iran.

Third, the current study did not have the opportunity to consider four educational districts as the sample in Shiraz. Therefore, the results cannot be generalized to all middle school students in Iran. On the other hand, all four sampled schools are situated in one of the districts of Shiraz; consequently, the results might not be totally applicable to the other miscellaneous teaching milieus (schools).

Fourth, the present study determined students' mathematics beliefs, students' mathematics problem solving skills, students' prior mathematics achievement, and students' mathematics self-efficacy to explain students' mathematics performance. There are other factors that may influence students' performance (such as parents' education, gender, socio economic status, home background, individual differences). However the present investigation does not intend to take into consideration all of the factors that may impact the mathematics achievement among year 8 learners.

Fifth, students' interpretation of the survey questions may not match the researcher's interpretation, which limits the conclusions of the study. In other words, students' temporary emotional feelings may have impacted their responses. In addition, classroom strategies vary from class to class and this might influence the students' awareness of the mathematical acquisition and attainment. Sixth, all the participants in this study were 8th grade students in Iran; as a result, the results might not be applied to other disciplines and dissimilar age groups.

Seventh and finally, structural equation modelling was used to analyse the data. The specifications of the structural models were based on an extensive review of literature and theory. Even though several models were tested it is highly possible to specify numerous models to explain the same phenomena (Kline, 2011). Moreover, using different frameworks, researchers can generate different structural models to examine the relationship between students' mathematics beliefs, mathematics problem solving, prior mathematics achievement, mathematics self-efficacy and achievement. More specifically, student mathematical problem solving can be considered to be the mediating variable that influences students' mathematics achievement or can researchers may create bidirectional relationships between variables. Having discussed potential limitations of the study, it is important to interpret findings of this study with caution.

1.7 Conceptual and Operational Definitions of Terms

What follows is a succinct definition provided for the key constructs used in this study.

1.7.1 Mathematics Problem Solving Skills

Problem solving is the foundation of much mathematical activity (Reyes, Lindquist, Lambdin, Smith, & Suydam, 2004). It is so important that the National Council of Teachers of Mathematics (NCTM, 2000) has identified it as one of the five fundamental mathematical processes. Problem solving in mathematics commonly encompasses the acts offered having a written problem wherein the students need to understand the problem, plan a technique to solve it, pursue some mathematical processes in order to attain the result and finally to examine the result to find out whether it is satisfactory or not (Schoenfeld, 2013; Wood, 2002). There are four stages involved in problem solving as proposed by Polya (1973) and Schonfeld (2013): interpreting the problem, developing a plan, performing the plan, as well as rechecking everything.

In this study, mathematics problem solving skills include the four steps. Every problem will be measured using rubric scoring on these four steps in mathematics topics related to 8th grade (algebra, geometry, arithmetic, and statistics). The four steps are: understand the problem, make a plan, solve the problem, and look back. These skills are measured by using a set of instrument consisting of 12 questions (see Appendix A). Every question is marked on 4 points- scale. The total score for this construct is 48.

1.7.2 Mathematics Self-Efficacy

Self-efficacy expectations have been said by Bandura (1997) a set of belief possessed by individuals regarding the person's capability to effectively accomplish a specified piece of work or behavior. On the other hand, Bandura (1997) addresses the self-efficacy expectations as the chief mediators of behavior as well as the behavior change. Math self-efficacy has been referred to as "a situational appraisal for the persons' confidences in their capabilities for effectively executing or achieving a certain mathematical task or problem" (Kiamanesh, Hejazi, & Esfahani, 2004, p.17).

In this study, the mathematics self-efficacy scale is meant for appraising the beliefs concerning the capability of executing numerous math-related tasks and activities. In the present study, mathematics self-efficacy comprised of two subscales namely mathematics behaviours used in everyday life (everyday mathematics tasks) and perceptions of performance capability in relationship to mathematics problems among the mathematics students.

Students' mathematics behaviours used in everyday life subscale measures whether students hold complex and strong behaviours about mathematics during everyday life. This subscale was measured using 11 items. These items such as "Calculating the profit given to your saving account for a one year period" and "Determining the tax levied on dress/clothes at the time of purchase" were related to behaviours about mathematics during everyday life. For each item, students were rated on a 9-point Likert scale from "1" as "no confidence at all" to " 9" as "complete confidence" for their agreement (see Appendix B).

Students' perceptions of performance capability in relationship to mathematics problem subscale measured whether students held complex and strong perceptions about performance ability in relationship to mathematics problem. Students' perceptions of performance capability in relationship to math problem subscale was measured using 11 items. These items such as "Discovering other ways to solve a mathematics problem other than those offered by the teacher" and "Mental addition of two great numbers such as 7532+6735" were related to perceptions on mathematics problem. For each item, students were rated for their agreement on a 9-point Likert scale from "1" as "no confidence at all" to "9" as "complete confidence" (see Appendix B).

1.7.3 Mathematics Beliefs

Referred to mathematics Pehkonen and Pietilä (2003), belief as people's subjective knowledge and feelings regarding the entities and relations. Indeed, the beliefs lend their basis to the individuals' particular experiences. Additionally, beliefs can be a set of the persons' individual expectations of the nature of reality. The prominence of beliefs in learners' lives is restated as such expectations would establish the goal-oriented action. For leading the individuals' insights and behaviours, beliefs would have a noteworthy part. In the learning settings, the learners' belief may spread the impression for capability, attainments, and evenness of learning. In the mathematics learning process, the students' mathematics belief encompasses and deals with the mathematics nature along with the mathematics as a subject, the nature of the mathematical tasks, the origin of the mathematical knowledge, and the association between the mathematics and the empirical world (Pehkonen & Pietilä, 2003).

In this study, students' mathematics beliefs are made of three subscales including the students' beliefs about mathematics, beliefs about importance of mathematics and beliefs about one's ability of mathematics with mathematics ability among the mathematics students in Iran.

The students' beliefs about mathematics subscale tend to quantify if they are able to establish multifaceted and strong beliefs about mathematics for the duration of the learning processing. The students' beliefs about mathematics subscale were estimated by making use of six items. The items like "mathematics is considered as one of the interesting subjects in my school studies" and "I get inspiration on completion of complex mathematics problem" could be attributed to the beliefs about mathematics. For each item, students could determine their opinion using a 5-point Likert scale from “1” for “strongly disagree” to “5” for “strongly agree” (see Appendix C).

The beliefs about importance of mathematics subscale was an effort to determine if students consider mathematics as an imperative subject at school for the duration of their personal learning process and problem solving. Their beliefs about importance of mathematics subscale involved five items such as “Mathematics is key to scientific learning” and “Mathematics is a worthwhile and necessary subject” could be attributed to the beliefs about importance of mathematics. The students used a 5-point Likert scale varying from “1” for “strongly disagree” to “5” for “strongly agree” (see Appendix C).

The students’ beliefs about one’s ability of mathematics subscale measured if the learners were assured of their capabilities in learning mathematics in the text or lecture. This subscale entailed five items like “I consistently make good grades in my mathematics courses” and “I performed better in mathematics compared to other science subjects”. The learners could determine their agreement on a 5-point Likert scale ranging from “1” for “strongly disagree” to “5” for “strongly agree” related to every given item (see Appendix C).

1.7.4 Mathematics Achievement

Mathematics achievement involves a complex interaction of factors on school outcome. According to the Ministry of Education in Iran, mathematics performance in tests are based on schools textbooks level of attainment in any or all mathematics skills (Algebra, geometry, estimation, measurement, arithmetic, statistics).

In this study, mathematics achievement was measured on a standardized examination that was conducted by the Ministry of Education. Mathematics achievement involved all of the mathematics topics learned from textbook in 8th grade in Iran. The mathematics topics consisted of algebra, geometry, statistics, and arithmetic according to the syllabus in Iran. The mathematics examination consisted of 22 questions which were used to measure the mathematics achievements construct. Every question was 5 points so the total score would be 110 (see Appendix D).

Algebra was measured by using 6 questions. Each question was 5 points totalling to 30. In the 8th grade textbook Algebra included Vector, Vector operations, Algebraic expressions, equations, equations solving system (Paivandi, 2012). Geometry was measured by using eight questions. Each question was given five points, so the total score was 40. In the 8th grade textbook, geometry included Angle, circle, central angle, dividing a circle to equal arcs, surrounding Angles, Regular polygon, Pythagorean relationship, use the Pythagorean relationship, Parallel Lines, Thales theorem, Similarity, Volume, Rotation (Paivandi, 2012).

Statistics was measured by using 2 questions. Each question was given 5 points so the total score was 10. In the 8th grade textbook statistics included set of real numbers, column chart, Average (Paivandi, 2012). Arithmetic was measured by using 6 questions. Each question was given 5 points, so the total score was 30. In the 8th grade textbook arithmetic included Natural numbers, Primes, Power, Square, Integers, Operations on the integers, Rational numbers, Operations on the Rational numbers, Fraction, Equation (Paivandi, 2012).

1.7.5 Prior Mathematics Achievement

As Goya (2012) said, prior mathematics achievement is the individual mathematics background. Individual mathematics background included mathematics knowledge based on mathematics education that students learned during their own educational years.

In this study, student's prior mathematics achievement means the prior knowledge in mathematics. Students' prior mathematics achievement is measured by the grade point average (GPA) from year 7th mathematics subject. Topics included were Algebra, Geometry, Statistics, and Arithmetic. Based on grading system in Iran rang of the prior mathematics achievement scores were 0-20. The pupils must score at least a 10 to be promoted. The scale is roughly equivalent to the American A, B, C, D scales as follows:

A = 17-20,
B = 14-16.9,
C = 12-13.9,
D = 10-11.9,
F = below 10. (see Appendix E).

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