



**SECONDARY MATHEMATICS TEACHERS'  
BELIEFS AND USE OF INSTRUCTIONAL  
STRATEGIES THAT PROMOTE PROBLEM  
SOLVING: A CASE STUDY IN MALE', MALDIVES**

**BY**

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**A dissertation submitted in fulfilment of the requirement  
for the degree of Master of Education**

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**JULY 2012**

## ABSTRACT

This study examined secondary mathematics teachers' beliefs and use of instructional strategies that promote problem solving. It is a census study conducted in capital city of Maldives, Male' City involving sixty seven secondary mathematics teachers. A self constructed, two part questionnaire was used to determine teachers' beliefs and use of instructional strategies that promote problem solving. It consisted of seven subscales; teachers' self efficacy, importance of problem solving, use of strategies: explaining, sharing, exploring, questioning and coaching and two overall scales; overall belief scale and use of strategies scale. The findings of this study revealed that most of the teachers have strong self efficacy beliefs and strong beliefs about importance of problem solving approach. However teachers had weak beliefs about using technology to promote problem solving where teachers believed that using calculators is not a good habit and computational procedures should not be automatized. The results of teachers' use of strategies that promote problem solving revealed that most of the teachers frequently use these strategies. However, results showed the two least famous strategies among the teachers were presenting students with unfamiliar and open ended problems with very little indication of how to solve them and providing a set of problems and allowing the students to choose a problem they would like to work on. Furthermore, study also showed that there is no gender difference in beliefs and use of strategies. However, a significant difference was found between nationality of teachers, level of professional training and years of experience and some scales of beliefs and use of strategies. Another major finding of the study is that there is a positive relationship between beliefs and use of instructional strategies that promote problem solving. The study also indicated that a relationship exists between self efficacy, explaining and over all beliefs of teachers and the demographic variables which is gender, nationality, professional training and years of experience.

## خلاصة البحث

تتناول الدراسة الحالية انطباعات معلمي مادة الرياضيات في المرحلة الثانوية واستخدام استراتيجيات التعليم التي تعزز حل المشكلات. تعتبر هذه الدراسة ديمغرافية وقد أجريت في مدينة ماليه في دولة جزر المالديف واشتملت على ستة وسبعون مدرساً للرياضيات في المرحلة الثانوية. تم استخدام استبيان من جزئين من إعداد الباحثة لتحديد انطباعات المعلمين واستخدام استراتيجيات التدريس التي تدعم حل المشكلات. ويتكون الاستبيان من سبعة نقاط وهي الثقة بالنفس لدى المعلمين، أهمية حل المشكلات، استخدام استراتيجيات مثل الشرح، المشاركة، الاستكشاف، طرح الأسئلة، والتدريب، بالإضافة إلى معيارين عامين، معيار للانطباع العام، ومعيار للاستراتيجيات. بينت نتائج الدراسة أن أغلب المعلمين لديهم ثقة بالنفس قوية وانطباعات قوية بأهمية حل المشاكل. وأوضحت نتائج استخدام المعلمين لاستراتيجيات التعليم التي تعزز حل المشكلات أن أغلب المعلمين يستعملون هذه الاستراتيجيات بشكل متكرر. كما أوضحت النتائج أن أقل الاستراتيجيات استخداماً في أوساط المعلمين هي استراتيجية تقديم مجموعة من المشاكل والسماح للطلاب باختيار إحداها للعمل عليها حسب رغبة الطالب. كما أوضحت الدراسة أنه ليس هناك فرق في الانطباعات واستخدام الاستراتيجيات يعزى إلى الجنس. بل أظهرت أنه هناك تفاوت كبير في جنسيات المعلمين ومستوى التدريب المهني وسنوات الخبرة وبعض معايير الانطباعات واستخدام الاستراتيجيات. أحد النتائج الرئيسية أن هناك علاقة إيجابية بين الانطباعات واستخدام استراتيجيات التدريس التي تدعم حل المشكلات. كما أشارت الدراسة إلى أنه ثمة علاقة بين الثقة بالنفس والشرح والانطباعات العامة لدى المعلمين والمتغيرات الديمغرافية وهي الجنس، والجنسية، والتدريب المهني، وسنوات الخبرة.

## APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Education in Curriculum and Instruction.



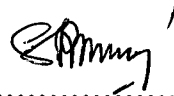
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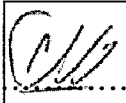


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## DECLARATION

I hereby declare that this dissertation is the results of my own investigation, except where otherwise stated. I also declare that this dissertation has not been previously or concurrently submitted as a whole for any other degree at IIUM or at other institutions.

Lawsha Mohamed

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Date.....18<sup>th</sup> July 2012.....

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Date

*To my loving mother and father,  
Asiyath Ali and Mohamed Anwar*

*To my caring husband,  
Hussain Waheed*

Thank you for believing in me, supporting me and loving me throughout this entire endeavor!

## ACKNOWLEDGEMENTS

Praise be to Allah, the Lord of the Worlds. Allah (Glorified and Exalted be He) has bestowed upon me abundant blessings and by the will of Allah I have accomplished my Thesis; I pray this work of mine would be a benefiting deed for me in this world and here after. I infinitely thank Allah for the blessings.

The successful completion of this work would not have been possible without the expert guidance from my Supervisor Prof. Dr. Rosnani Hashim. Her guidance, insightful suggestions and invaluable advice have been most helpful. I appreciate and express my humble gratitude to her for her thorough analysis of my work, thoughtful suggestions and kind encouragements. At this opportunity I would also like to thank all of my outstanding lecturers I have had the honor of learning from, during my time at International Islamic University Malaysia.

My great thanks and huge appreciation goes to all the people who helped me in the data collection and submission of the work. I would like to express my gratitude to the Ministry of Education of Maldives, the heads of the school in Male' City and supervisors for helping me to conduct the survey in the schools. Furthermore, special thanks to all the secondary mathematics teachers who were willing to participate in this study. I would like to thank my lovely cousins, Minna Rasheed and Zimna Rasheed and adoring sister-in-law, Mariyam Abdullah who had perspired lot of sweat to help me in data collection. I would also like to express my gratitude to a dear friend, Aishath Reesha for all her untiring help during thesis submission.

This educational goal could not have been accomplished without the love and support of my loving family. My grandmother who always supported me with prayers and reminded me that God had great plans for me. My mother, who is the most amazing woman I have ever seen, with unconditional love and faith in me. My Father, who has inspired me to make this commitment and always encouraged me to fulfill my dreams. My husband, Hussain Waheed who has walked with me hand in hand, sharing all the triumphs of my study, never failing to encourage, listening to me and supporting me whenever I needed. My aunt Shahina Ali and uncle Mohamed Nazim, who are like my second parents to whom I can always rely on. My loving sisters, Usha.ath Mohamed, Hamsa Mohamed, Maisa Mohamed and Mariyam Abdullah, who are my true friends, are always more than eager to help me whenever I needed. My adoring brothers, Kinanath Mohamed, Ahsan Mohamed and Abdullah Jinan who has always believed in me and supported me in every step. Thank You for your endless support, love and understanding.



## TABLE OF CONTENTS

Abstract .....	ii
Abstract (Arabic) .....	iii
Approval Page .....	iv
Declaration Page .....	v
Copyright Page .....	vi
Dedication .....	vii
Acknowledgements .....	viii
List of Tables .....	xi
<b>CHAPTER ONE: INTRODUCTION</b> .....	1
1.1 Background of The Study .....	1
1.2 Statement of The Problem.....	3
1.3 Objective of The Study .....	5
1.4 Research Questions .....	5
1.5 Significance of The Study.....	6
1.6 Limitations of The Study .....	8
1.7 Definitions of Terms .....	8
<b>CHAPTER TWO: LITERATURE REVIEW</b> .....	11
2.1 Introduction .....	11
2.2 Definition of Problem Solving .....	13
2.3 Mathematical Problem Solving.....	15
2.3.1 Models of Problem Solving.....	16
2.4 Teaching Mathematical Problem Solving.....	19
2.4.1 Teaching Approaches To Problem Solving.....	20
2.4.2 Problem Solving Instruction In Classroom .....	22
2.5 Instructional Strategies That Promote Problem Solving.....	25
2.5.1 Using Various Strategies To Promote Problem Solving In Classroom.....	28
2.6 Role of “Problems” In Enhancing Instructional Practice of Mathematics.....	34
2.6.1 Types of Problems .....	34
2.6.2 Selecting Appropriate Problems .....	38
2.7 Teachers’ Beliefs About Teaching Problem Solving In Mathematics...	40
2.7.1 Defining Beliefs.....	40
2.7.2 Studies on Beliefs About Strategies That Promote Problem Solving.....	41

2.8 Studies on Effect of Demographic Factors on Teachers' Beliefs And Use of Instructional Strategies .....	46
2.9 Relationship Between Beliefs And Use of Instructional Strategies.....	52
2.10 Conclusion.....	58
<b>CHAPTER THREE: METHODOLOGY.....</b>	<b>59</b>
3.1 Introduction.....	59
3.2 Research Design.....	59
3.3 Population And Participants.....	60
3.4 Instrumentation .....	62
3.5 Validity And Reliability of The Instruments .....	65
3.6 Data Collection.....	66
3.7 Method of Analysis .....	67
<b>CHAPTER FOUR: RESULTS AND DISCUSSON.....</b>	<b>70</b>
4.1 Introduction.....	70
4.2 Teachers' Demographic Background.....	70
4.3 Teachers' Beliefs About Instructional Strategies That Promote Problem Solving .....	72
4.4 Teachers' Use of Instructional Strategies That Promote Problem Solving .....	79
4.5 Difference Between Teachers' Beliefs And Use of Instructional Strategies That Promote Problem Solving and Different Variables From Demographic Background .....	88
4.6 Relationship Between Beliefs And Use of Instructional Strategies That Promote Problem Solving .....	98
4.7 Summary of Findings.....	100
<b>CHAPTER FIVE: SUMMARY, RECOMMENDATION, IMPLICATION, AND CONCLUSION .....</b>	<b>102</b>
5.1 Summary .....	102
5.2 Recommendation.....	106
5.3 Implications For Future Research .....	110
5.4 Conclusion.....	111
<b>BIBLIOGRAPHY .....</b>	<b>113</b>
<b>APPENDIX .....</b>	<b>121</b>

## LIST OF TABLES

<u>Table No.</u>		<u>Page No.</u>
3.1	Total number of secondary teachers in Maldives	60
3.2	Total number of secondary teachers in Male'	61
3.3	Number of teachers participating in the study	62
3.4	Items associated with beliefs about problem solving	63
3.5	Items associated with use of instructional strategies	64
3.6	Reliability of the items for subscales and overall scales	66
3.7	Types of statistical analysis used in the study	69
4.1	Demographic characteristics of teachers according to gender	71
4.2	Demographic characteristics of teachers according to Nationality	71
4.3	Professional training of the teachers	72
4.4	Teaching experience of the teachers	72
4.5	Teachers' beliefs about instructional strategies that promote problem Solving	74
4.6	Teachers' beliefs about using technology to promote problem solving	75
4.7	Teachers' self efficacy beliefs about teaching problem solving	76
4.8	Teachers' beliefs about importance of problem solving approach	77
4.9	Level of agreement on beliefs based on mean score	78
4.10	Mean and standard deviation of subscales and overall beliefs	78
4.11	Teachers' use of instructional strategy – Explaining	80
4.12	Teachers' use of instructional strategy – Sharing	81
4.13	Teachers' use of instructional strategy – Exploring	82
4.14	Teachers' use of instructional strategy – Coaching	84

4.15	Teachers' use of instructional strategy – Questioning	85
4.16	Teachers' use of instructional strategy – Differentiation	86
4.17	Level of usage of instructional strategies based on mean score	88
4.18	Mean and standard deviation of subscales and overall use of Instructional Strategies	88
4.19	Skewness and Kurtosis of the data	90
4.20	Result of two-tailed t-test of scales of beliefs and use of instructional Strategies that promote problem solving and gender	91
4.21	Result of two-tailed t-test of scales of beliefs and use of instructional Strategies that promote problem solving and nationality	92
4.22	One way ANOVA test between scales and level of professional Training	94
4.23	One way ANOVA test between scales and years of experience	96
4.24	Summary of Multiple Regression Analysis	98
4.25	Correlation matrix for teachers' beliefs and use of Instructional Strategies that promote problem solving	99
4.26	Correlation matrix for scales on teachers' beliefs and use of Instructional strategies that promote problem solving	99

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 BACKGROUND OF THE STUDY**

Maldives is an archipelago in the Indian Ocean towards south west of India. It contains 1,192 coral islands which stretch over an area of 820 kilometres north to south and 120 kilometres east to west. It has a total land area of 298 square kilometres and approximate sea area of 41,500 square kilometres. The islands are formed around a ring shaped coral reef called atoll which provides natural protection to the islands. There are 26 naturally occurring atolls which are divided into seven provinces for administrative purposes. The capital of Maldives is Male' City, where one third of Maldivian population resides (Maldivesele, 2010).

In 2009, Maldives has a total population of 309,430 with a Gross National Income (GNI) per capita of \$3,970 (The World Bank, 2011). According to Human Development Index (HDI) – 2010 rankings, Maldives has been promoted from low human development country to medium human development country (UNDP, 2010). With these developments the education area also has gained a rapid improvement.

According to Census 2006, overall percentage of literates in Maldives is 98.21%. The student's enrolment from all parts of Maldives in 2009 is 89,841. There are three types of schools or institutions in Maldives which include government, private and community school. All these schools are English medium schools where main medium of instruction is through English (Statistical year book Maldives, 2011). Schooling in Maldives is structured under 5-2-3-2 cycle with five years of primary, 2 years of middle school, 3 years of lower secondary and 2 years of higher secondary.

The national curriculum of Maldives covers only the primary and middle school content (Abdul Muhsin & Maryam Azra, 1999). The lower secondary curriculum content is designed around the O'level examination offered by Cambridge international examinations and higher secondary curriculum is based on EDEXCEL A-level syllabuses. Due to this the teachers has to be specifically trained to teach these curriculums.

In the years of 80's and 90's teacher training in Maldives was carried out by Institute for Teacher Education of Ministry of Education. They prepared primary school teachers and subject-specialist teachers in a limited number of subject areas for middle and secondary levels (UNESCO, 1996). However, the government was more dependent on out-of-country teacher training until Maldives College of Higher Education (MCHE) was established in 1998. MCHE offered teacher training courses of certificate level, diploma and bachelors degree level (The Maldives National University, 2011). In 2009, a total of 7,807 teachers worked in the schools of Maldives out of which 31% of teachers are expatriate teachers. Most of the expatriate teachers (about 2,384) are from India, a neighboring country (Statistical year book Maldives, 2011).

Even with expatriate teachers, the quality of teaching in Maldives has not been particularly good (UNESCO, 1996). One of the notable reasons for low quality education is that 20% of both expatriate and local teachers serving in Maldivian schools are untrained teachers (Statistical year book Maldives, 2011). These teachers do not have specific teaching qualifications since they are specialized in particular subjects and its content, not the teaching pedagogies. Another reason for the low performance of students is due to the mode of pedagogy in Maldivian classrooms. It heavily relies on the transmission of knowledge model and usually uses chalk-and-talk

method. This is true especially for mathematics teachers who opt to provide students with the necessary skills by simply working out problems similar to those that are in text books and that are likely to appear in examinations (Adam, 2004).

Throughout these years O'level mathematics results of Maldivian students have been alarmingly low. Mathematics percentage of passes is 27.8% in 2007, 33.2% in 2008 and 40% in 2009 which is comparatively low when compared to results of other subjects (Statistical year book Maldives, 2011). This is alarming because the knowledge of mathematics is an essential tool in society. It is a tool that can be used in our daily life in shopping, banking, professional careers etc. It also aims to help the students construct desirable ways of understanding, ways of thinking and promoting problem solving ability (Harel, 2008).

## **1.2 STATEMENT OF THE PROBLEM**

To be able to solve problems is one of the most important skills students need to learn in order to be successful in school life and workplace. In a sense, mathematics will be useful because problem solving is its most important component. Mathematics requires the students to solve problems in all its topics and some are related to their real life experience. Although in real life all the problems are not mathematical, mathematics teaches students to understand, plan, apply certain knowledge to new situation. These principles can be transferred to real life situations. Thus knowledge and skills learned from mathematical problem solving can be transferred to general problem solving (De Corte, Verschaffel & Masui, 2004). Hence it will be important for students to have a strong background of mathematical problem solving in order to face the challenges in life and to compete in the hectic workforce after their studies. This necessitates the need to teach these skills to the students in order to prepare them

for higher studies, employment and for survival in life.

To prepare students for the adventures and challenges of real life, incorporating thinking and problem solving skills into classroom teaching is being much emphasised by many researchers (Anderson, 1998). Many researches conducted on the effect of problem solving method in teaching mathematics on student's achievement showed that problem solving is an effective method for teaching mathematics (Ali, Hukamdad, Akhter & Khan, 2010). Since the teachers play a vital role in conveying knowledge and skills in the classroom, teachers are one of the major factors which determine the achievement of the students. As the actions of teachers purely determine the atmosphere in the classroom, maximum attention should be given to the teacher's role in problem solving (Lester, 1994).

Studies conducted on teachers' role in problem solving show that teacher's beliefs, practices and content knowledge have an effect on the student's problem solving practices and behavior (Ford, 1994; Petterson & Fennema, Carpenter & Leof, 1989). It is found that teachers have diverse beliefs regarding problem solving and how to teach problem solving in classroom. Research also shows that reported beliefs of the teachers regarding problem solving influences reported practices of teachers (Xenofontos and Andrews, 2008; Prescott & Cavanagh, 2006; Rosnani & Suhailah, 2003; McClain, 2002; Aguirre and Speer, 2000; Raymond, 1997; Schoenfeld, 1992; Thompson, 1992, 1984). Due to this instructional approaches used by the teachers vary vastly among the teachers. Teachers are still not sure about the ways in which problem solving can be taught in classroom (Lester, 1994). However most teachers agree that problem solving is one of the most important skills that needs to be taught in mathematics classroom.

So the teacher's beliefs and use of instructional strategies that promotes



problem solving ability of students is a very crucial area to be studied.

### **1.3 OBJECTIVE OF THE STUDY**

This study intended to find out secondary mathematics teachers' belief about strategies that promote problem solving. It will also attempt to find out the strategies that teachers claim to use to promote problem solving skills of the students.

### **1.4 RESEARCH QUESTIONS**

Specifically, the study attempts to answer the following questions:

1. What beliefs do the Maldivian mathematics teachers have about mathematical problem solving?
2. What instructional strategies do the Maldivian mathematics teachers actually use in their classrooms?
3. Is there any significant difference between Maldivian mathematics teachers' beliefs about instructional strategies that promote problem solving and
  - a. the gender of the participants?
  - b. the nationality of the participants?
  - c. the professional training of the teachers?
  - d. years of teaching experience?
4. Is there any significant difference between the Maldivian mathematics teachers' use of instructional strategies that promote problem solving and
  - a. the gender of the participants?
  - b. the nationality of the participants?
  - c. the professional training of the teachers?

- d. years of teaching experience?
5. Is there any relationship between beliefs about instructional strategies that promote problem solving skills and actual practice among teachers of Male' City?

## **1.5 SIGNIFICANCE OF THE STUDY**

The recent draft of Maldivian national curriculum highlighted the need for teaching through problem solving in Mathematics classrooms. At the same time Maldivian student's performance in O'level mathematics exams has been very low throughout with a pass percentage of 28.4% in 2007, 33.2% in 2008 and 40% in 2009 (Ministry of Education, 2011) According to former Education minister of Maldives, Dr. Musthafa Luthufee, this low performance of the students should be considered as a very serious issue by all Maldivians especially the educators and policy makers (Shifleen, 2010). But unfortunately there is no research conducted on this field finding either the students problem solving behaviour or with regard to teacher's practice of teaching problem solving in mathematics classrooms. Research has proven that teachers' practice of problem solving in classrooms improves the student's problem solving behaviour and improves the student's academic achievement (Ali, Hukamdad, Akhter & Khan, 2010). And also there is evidence that teachers beliefs shape teachers reported practice (McClain, 2002; Raymond, 1997; Schoenfeld, 1992; Thompson, 1992) specifically with regard to teaching thinking skills (Rosnani & suhailah, 2003). Hence it is very crucial to study about the teacher's beliefs and practice of problem solving in classroom in order to understand this complex relationship and hence find ways to improve the achievement of the students.

The empirical evidence generated by this study will be significant for four

main purposes. Firstly, Maldivian government and the policy makers need these research findings to formulate policies to strengthen the training of in-service and pre-service teachers. The courses conducted to train teachers might be renewed to include or emphasize problem solving component in them in order to produce teachers who are well prepared and with a better strategies to promote problem solving behaviour of the students. Secondly, these results and data could be used by the teachers themselves to improve their attitude and usage of problem solving strategies in classrooms. Thirdly, the principals and school management can use this as an evidence to improve and monitor their teachers teaching strategies. All these will lead to produce citizens who are well prepared to solve problems that they face throughout their life.

Finally, this study is also significant since it has potential to contribute to the mathematics education field in increasing research knowledge with regard to teacher's beliefs about problem solving and their practice of problem solving and how these variables are related. Most current researches focused on finding if the teacher's beliefs have an effect on the use of instructional strategies that promote problem solving, shows that there is a complex relationship between them (Xenofontos & Andrews, 2008; Anderson, Sullivan & White, 2004, 1998; Thompson, 1985). This suggests that more research should be done to examine the complex relationship between teacher's beliefs and use of teaching methods that promote problem solving. And also existing research seemed to indicate that many teachers were not comfortable with problem solving activities, however not much about the specifics of this discomfort. Hence this study will also try to improve knowledge on these areas.

## 1.6 LIMITATIONS OF THE STUDY

It is also important to note that this study is limited in the following areas considering the availability of time and cost. First, research site is confined to only secondary schools in capital city of Maldives. Therefore, it limits the ability to generalize the results to all the other parts of the Maldives. Second, participants are selected only from the lower secondary schools, so the finding reported will be regarding only lower secondary mathematics teachers. Third, as this study is limited to only capital city the sample size is thus limited.

## 1.7 DEFINITIONS OF TERMS

This study uses the following definitions

**Teachers' beliefs:** Most of the definitions of beliefs given by the researchers vary according to the need of researcher. In this study the belief will be defined as “an individual’s understandings and feelings that shape the ways the individual conceptualize and engage in mathematical behaviour” (Schoenfeld, 1992). Educational beliefs constructs used in research are very wide and consists of but not restricted to beliefs about teacher efficacy, nature of knowledge, causes of teachers’ or students’ performance, perceptions of self, self efficacy and beliefs about specific subjects (Pajares, 1992). Teachers’ beliefs measured in this survey will be teachers’ beliefs about using instructional strategies that promote problem solving, role of technology in problem solving, teachers’ self efficacy to promote problem solving and usefulness of problem solving approach.

**Instructional Strategies:** An instructional strategy is defined as something teacher arranges that is designed to establish interaction between the teacher, the students and the subject matter or any combination of these dimensions (Vijayalakshmi, 2004).

They are the methods, techniques and approaches used by the teacher to achieve the objectives of the lesson. No single strategy is applicable for all classroom teaching and evaluations. Due to this instructional strategies suggested by different researchers vary accordingly. Mathematical didactic strategies proposed by Andrews (2007) give a very comprehensive view about common strategies that has to be used in mathematics classrooms. He has highlighted ten strategies that are proposed to be used in mathematics classrooms. This study uses five of these strategies which are explaining, sharing, exploring, coaching and differentiation (Andrews, 2007) and questioning.

- Explaining: Explaining here refers to teacher explaining an idea or a solution. This could be done by demonstrating, modeling or orally telling.
- Sharing: The sharing involves students getting involved in a sharing their ideas to solve a problem. It can be done within the group, between the groups or whole class discussion.
- Exploring: involves the students getting involved in a task which involves problem solving and leads to new mathematical ideas. Here the teacher acts as just a facilitator.
- Coaching: The teacher gives hints and prompts to facilitate students understanding or to make students identify their mistakes and misunderstandings.
- Questioning: the teacher asking questions to check the students understanding and to guide them think about how they have solved a problem. Questions also are asked to challenge the students' existing knowledge and make them think about it.

- **Differentiation:** The teacher trying to consider individual differences in terms of kinds of tasks given, materials provided or extra guidance provided.

**Problem Solving:** A process of confronting a novel situation, formulating connections between given facts and identifying goals and exploring possible strategies for reaching the goal (Szetela & Nicool, 1992). Whenever a person cannot go from a desired situation to a given situation it forces the person to think to devise some action which may mediate between the existing and desired situations (Robertson, 2001). It involves a complex set of cognitive actions requiring many connections to cognitive structure and to the context of the situation (Nesher, Hershkovitz, & Novotna, 2003). Hence from all the definitions it could be understood that problem solving involves encountering a perplexing situation which needs to be solved by thinking and devising a plan.

**Problem solving strategies:** Certain approaches, methods, techniques used by the people to solve problems. When people encounter problems, different people tackle problems based on their previous experiences and by using the strategies that they are aware of. Some of the problem solving strategies involve working backwards, finding a pattern, adopting a different view point, solving a simpler analogous problem, considering extreme cases, making drawings, intelligent guessing, logical reasoning etc. (Posamentier, Smith & Stepelman, 2010).

**Teachers' Self efficacy:** Self efficacy is the beliefs that a person has about his/her capabilities to attain a desired outcome (Bandura, 1997). Teachers' self efficacy is the beliefs that teachers have regarding their capability to engage students in learning process (Henson, 2001). It is a judgement by the teacher about the skills and knowledge possessed by the teacher to enhance maximum learning in the classroom.

According to Gibson & Dembo (1984) efficacy beliefs is made up of two dimensions. One is General teaching efficacy which is the general beliefs about teaching possessed by the teacher and second is personal teaching efficacy which is the teacher's personal beliefs, competence, skills and convictions regarding his/her own teaching (Tschannen-Moran, Woolfolk Hoy & Hoy, 1998). The dimension used in this research will be personal teaching efficacy.

**Teacher professional training:** Training is defined here as an activity that will lead to a skilled behaviour. Teacher professional training is the training of teachers through formal course work and practice of teaching. Apart from the content knowledge, these courses offer pedagogical training and necessary skills as a teacher. In Maldives, these courses mainly at three levels, that is, Certificate level in teaching, Diploma in teaching (Secondary & primary), Bachelors of Education (primary) or Bachelor of teaching (Secondary).

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

Problem solving has been a survival skill for individuals from the time of cave dwellers to the present. Whenever a problem is approached, a problem space must be created or retrieved from the memory to formulate a solution using the available information (Newell & Simon, 1972). Failure to solve important problems

successfully has meant death, extinction, war, prejudice and poverty. Being unable to respond immediately to the problems in life has led to most catastrophic ends during the life time. Hence it is very crucial for individuals to be able to think and solve problems in order to survive in real life.

Mathematics evolved in response to the need of people to solve problems. Even though mathematics consists of axioms, theorems, proofs, definitions, formulas and methods, they are not the most essential part of the subject. To a mathematician, doing mathematics means solving problems or satisfying their intellectual curiosity. Hence what mathematics really consists of is problems and solutions (Schoenfeld, 1992). Due to this, problems have been at the heart of school mathematics curriculum. Mathematics books and classrooms are often loaded with problem solving exercises.

One of the main goals of mathematics education has been to enable people to comprehend and analyse real world problems and to respond to those problems in an appropriate way. Mathematics classrooms and courses aim to train students to develop their problem solving ability to help them to achieve their desired goals and activities. It includes goals such as handling business, making profits, or just to improve intellectually to weigh alternatives and make proper judgments. Hence, to achieve these goals it is crucial to make students engage in real life problem solving.

Teaching problem solving skills in mathematics teaching has been emphasised by many educators and researchers, which led to a wide range of curriculum change to incorporate it. However, problem solving is the most written about, but least understood area, of the mathematics curriculum (Lester, 1994). Many researches have been conducted to find the effect of problem solving method in teaching mathematics on student's achievement which showed that problem solving is an effective method for teaching mathematics (Ali, Hukamdad, Akhter & Khan, 2010).