Relationship of some psychological variables in predicting problem solving ability of in-service mathematics teachers

M. K. Akinsola

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Abstract
This paper examines some psychological variables in predicting problem solving ability of in-service mathematics teachers. The sample consists of 122 in-service teachers enrolled in degree programme. Five standardized instruments were used to collect the data on teachers' mathematics anxiety, mathematics teaching efficacy belief, locus of control, study habits and problem solving ability. Multiple regression, Chi-square analysis,and Pearson moment correlation coefficient were used to analyze the data. The results show that mathematics anxiety, mathematics teaching efficacy belief, locus of control and study habits all have significant relationships with problem solving ability with mathematics anxiety having the highest and study habits the lowest as stated above. Implications for mathematics teacher education were discussed.

Key Words: Mathematics anxiety; mathematics teaching efficacy belief; locus of control; study habits; problem solving ability; in-service teachers

Introduction

Teachers' beliefs about mathematics have a powerful impact on the practice of teaching (Uusimaki, & Nason, 2004; Charalambos, Philippou & Kyriakides, 2002; Ernest, 2000). It has been suggested that teachers with negative beliefs about mathematics influence a learned helplessness response from students, whereas the students of teachers with positive beliefs about mathematics enjoy successful mathematical experiences that result in them seeing mathematics as a discourse worthwhile of study (Karp, 1991). Thus, what goes on in the mathematics classroom may be directly related to the beliefs teachers hold about mathematics. Hence, it has been argued that teacher beliefs play a major role in their students' achievement and in their formation of beliefs and attitudes towards mathematics (Emenaker, 1996). Addressing the causes of negative beliefs held by pre-service primary teacher education students about mathematics therefore is crucial for improving their teaching skills and the mathematical learning of their students (Uusimaki & Nason, 2004). Reboli, & Holodick (2002) reported that the National Council of Teachers of Mathematics in its 1991 publication Professional Standards for Teaching Mathematics (NCTM, 1991) and the current Mathematics Program Standards for the National Council for Accreditation of Teacher Education (NCATE, 1998) stress the importance of the

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disposition of the classroom teacher towards mathematics. They maintain that if students are to develop a disposition to do mathematics, it is essential that the teacher communicate a positive attitude towards mathematics. Additionally, teachers need to establish a supportive classroom learning environment that fosters the confidence of students to learn mathematics. Unfortunately, research has reported that many pre-service elementary teachers have negative attitudes toward mathematics, are not confident in their own mathematics ability, and claim to have a high level of anxiety towards mathematics (Harper & Daane, 1998; Tooke & Lindstrom, 1998). So it is important for mathematics teacher educator to continually search for more personal factors that could hinder elementary school teachers from adequate delivery of instructions to their pupils.

The issue of mathematics teachers' self-efficacy, study habits, locus of control, anxiety towards the teaching and learning of mathematics as well as their problem solving ability is the concerns of this study.

Problem solving

Problem solving has a special importance in the study of mathematics. A primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematics problems (James W. Wilson, Maria L. Fernandez, and Nelda Hadaway (1993). Stanic and Kilpatrick (1988) traced the role of problem solving in school mathematics and illustrated a rich history of the topic. To many mathematically literate people, mathematics is synonymous with solving problems -- doing word problems, creating patterns, interpreting figures, developing geometric constructions, proving theorems, etc. On the other hand, persons not enthralled with mathematics may describe *any* mathematics activity as problem solving (Wilson, Fernandez, and Hadaway, 1993). Problem solving is an integral part of all mathematics learning. In everyday life and in the workplace, being able to solve problems can lead to great advantages. However, solving problems is not only a goal of learning mathematics but also a major means of doing so. Problem solving means engaging in a task for which the solution is not known in advance. Good problem solvers have a "mathematical disposition"--they analyze situations carefully in mathematical terms and naturally come to pose problems based on situations they see.

Good problems give students the chance to solidify and extend their knowledge and to stimulate new learning. Most mathematical concepts can be introduced through problems based on familiar experiences coming from students' lives or from mathematical contexts. As students try different ideas in solving problems, the teacher can help them to converge their ideas towards the solution of the problem, thus providing a meaningful introduction to a difficult concept.
Students need to develop a range of strategies for solving problems, such as using diagrams, looking for patterns, or trying special values or cases. These strategies need instructional attention if students are to learn them. However, exposure to problem-solving strategies should be embedded across the curriculum. Students also need to learn to monitor and adjust the strategies they are using as they solve a problem.

Teachers play an important role in developing students' problem-solving dispositions. They must choose problems that engage students. They need to create an environment that encourages students to explore, take risks, share failures and successes, and question one another. In such supportive environments, students develop the confidence they need to explore problems and the ability to make adjustments in their problem-solving strategies. (NCTM, 2000).

"The first rule of teaching is to know what you are supposed to teach. The second rule of teaching is to know a little more than what you are supposed to teach. . . . Yet it should not be forgotten that a teacher of mathematics should know some mathematics, and that a teacher wishing to impart the right attitude of mind toward problems to his students should have acquired that attitude himself" Polya (p. 173). It then follows that teacher of mathematics should by themselves be comfortably with problem solving otherwise they might not be able to effectively inculcate the attitude of problem solving to their students.

Many teachers do recognize that non traditional strategies are necessary to meet the learning needs of their increasingly diverse students. Embracing change can be unsettling, but these teachers venture into new territory, opening a world of discovery for themselves and their students. For they know that a young mind carefully nurtured may be the next big thinker to solve another of the world's mysteries (Jarrett, 2000).

The importance of students' (and teachers') beliefs about mathematics problem solving lies in the assumption of some connection between beliefs and behavior. Thus, it is argued, the beliefs of mathematics students, mathematics teachers, parents, policy makers, and the general public about the roles of problem solving in mathematics become prerequisite or co-requisite to developing problem solving (Wilson, Fernandez, & Hadaway,1993). The question then is: Are the teachers who are suppose to the lay the good foundation for the student's problem solving capacity themselves good problem solvers?

Teacher Efficacy and Academic Achievement

Teacher efficacy has proved to be powerfully related to many meaningful educational outcomes such as teachers' persistence, enthusiasm, commitment and instructional behavior, as well as self-efficacy beliefs (Tschannen-Moran, & Hoy, 2001). A teacher's efficacy belief is a judgment of his or her capabilities to bring about desired outcome of student engagement and learning even among those students who may be difficult or unmotivated (Armor, Corroy-Oseguera, Cox, King, McDonnell, Pascal, Panly & Zellar, 1976) and this judgment may have a powerful effect on students learning. According to Bandura (1977) self-efficacy is mediated by a person's beliefs or expectations about his/her capacity to accomplish certain tasks successfully or demonstrate certain behavior (Hackett, & Betz, 1981). This expectation determines whether or not a certain behavior or performance will be attempted, the amount of effort the individual will contribute to the behavior, and how long the behavior will be sustained when obstacles are encountered. (Brown, 1999). Some researchers belief that greater efficacy enable teachers to be less critical of students when they make errors (Ashton & Webb, 1986), to work longer with a student who is struggling (Gibson,& Dembo, 1984) and be less inclined to refer a difficult student to special education (Soodak & Podell, 1993). Researches have also shown that teachers with a high sense of efficacy exhibit greater enthusiasms for teaching (Allinder, 1994) have greater commitment to teaching (Coladarci, 1992) and are more likely to stay in teaching (Burley, Hall, Villeme, & Brockmeier, 1991). Teacher's sense of efficacy has also been related to student outcome such as achievement (Armor et al, 1976) motivation (Midgley, Feldlanfer, & Ecceles, 1988). In addition teachers' efficacy beliefs also related to their behavior in the classroom. The effort they invested in teaching, the goals they set, and their level of aspirations are products of their efficacy beliefs. Teachers with a strong sense of efficacy tend to exhibit greater level of planning and organization (Allinder, 1994) are more open to new ideas (Guskey, 1988) and are more willing to experiment with new methods to better meet the needs of their students (Stein & Wang,1988).

When individual have low self-efficacy expectations regarding their behavior, they limit the extent to which they participate in the endeavor and are more apt to give up at the first sign of difficulty (Brown, 1999). In order words low efficacy beliefs may serve as barrier to teachers teaching effectiveness and efficacy. When teachers have a low self-efficacy, their teaching may tends to be characterized by authoritative, teacher-centred roles with a less clear understanding of the various development levels of their students. To Rubeck and Enochs (1991) teachers who were week in content knowledge background tended to have significantly lower personal efficacy than did teachers with strong content background. Teachers with a high self efficacy may tend to teach in ways characterized by the use of inquiry approaches more students centred ,beliefs that they can help any students overcome learning and succeed, and are more knowledgeable of their students development levels.

The role of self-efficacy helps to examine why people's performance attainment might differ even when they have similar knowledge and skills (Pajares & Miller, 1995). From the fore going review, it is clear that the way teachers view themselves and their roles in the teaching context is at least partially derived from their self-efficacy beliefs. The issue of pre-service teachers' mathematics efficacy beliefs is therefore very important for them to be able to carry out their primary function of teaching diligently and effectively. In the present study the extent of the relevance of the construct to problem solving ability of in-service mathematics teachers is part of the major concern.

Mathematics Anxiety and Achievement in Mathematics

According to Tooke (1998) mathematics anxiety has been the topic of more research than any other area in the affective domain and has become very popular research topics for both mathematics educators and educational psychologists. Mathematics anxiety has serious consequences in both daily life and in work, and has its roots in teaching and teachers (Williams, 1988) and has been tied to poor academic performance of students, as well as to the effectiveness of elementary teachers (Bush, 1989; Hembree, 1990). Mathematicians and mathematics educators have great concern that teachers' attitudes toward mathematics may affect more than their students' values and attitudes toward mathematics; these attitudes may affect the effectiveness of the teaching itself (Teague & Austin-Martin,1981). Mathematics anxiety is more than a dislike toward mathematics. Smith (1997) characterized mathematics anxiety in a number of ways, including: (a) uneasiness when asked to perform mathematically, (b) avoidance of math classes until the last possible moment, (c) feelings of physical illness, faintness, dread, or panic, (d) inability to perform on a test, and, (e) utilization of tutoring sessions that provide very little success. Mathematics anxiety has been defined as a state of discomfort which occurs in response to situations involving mathematical tasks which are perceived as threatening to self esteem (Cemen, 1987). In turn, these feelings of anxiety can lead to panic, tension, helplessness, fear, distress, shame, inability to cope, sweaty palms, nervous stomach, difficulty breathing, and loss of ability to concentrate (Cemen, 1987; Posamentier & Stepelman, 1990). Although only a small proportion of persons suffer from a propensity to experience this condition, it is important to recognize how it can lead to a very debilitating state of mind. Those persons with severe cases of mathematics anxiety are limited in college majors and career choices. There is a particular concern in the case of elementary teachers, because it is has been reported that a disproportionately large percentage experience significant levels of mathematics anxiety (Buhlman & Young, 1982; Levine, 1996). This leads to doubts as to their potential effectiveness in teaching mathematics to young children (Trice & Ogden, 1986). NCTM (1989) recognizes math anxiety as a problem and has specifically included in its assessment practices, since a teacher's job is to assess his/her students' mathematical dispositions (Furner, J.M., & Breman, B.T (2004). NCTM (1989) has included the following in its Standards document for teaching mathematics:

"As mathematics teachers it is our job to assess students' mathematical disposition regarding:
-confidence in using math to solve problems, communicate ideas, and reason;
-flexibility in exploring mathematical ideas and trying a variety of methods when solving problems;
-willingness to persevere in mathematical tasks;
-interests, curiosity, and inventiveness in doing math;
-student ability to reflect and monitor their own thinking and performance while doing math;
-focus on value of and appreciation for math in relation to its real-life application, connections to other disciplines, existence in other cultures, use as a tool for learning, and characteristics as a language" (p. 233).

According to Hadfield and McNeil (1994) the causes of mathematics anxiety can be divided into three areas: environmental, intellectual, and personality factors. Environmental factors include negative experiences in the classroom, parental pressure, insensitive teachers, mathematics presented as rigid sets of rules, and non participatory classrooms (Dossel, 1993; Tobias, 1990). Intellectual factors include being taught with mismatched learning styles, student attitude and lack of persistence, self-doubt, lack of confidence in mathematical ability, and lack of perceived usefulness of mathematics (Cemen, 1987; Miller & Mitchell, 1994). Personality factors include reluctance to ask questions due to shyness, low self esteem, and viewing mathematics as a male domain (Cemen, 1987; Gutbezahl, 1995; Levine, 1995; Miller, & Mitchell, 1994).

Many researchers attempt to trace the evolution of mathematics anxiety among high school and college students back to their elementary school classroom experiences. When early school experiences get the blame for mathematics anxiety, the elementary teacher is usually labeled as the responsible party. Mathematically anxious teachers are said to pass their anxieties on to their students (Buhlman & Young, 1982). They are also often doubted as to their effectiveness as teachers of mathematics (Hadfield & McNeil, 1994; Kelly & Tomhave, 1985). According to Brush (1981), mathematically anxious teachers tend to use more traditional teaching methods, such as lecture, and concentrate on teaching basic skills rather than concepts. This is contrary to the current movement toward teaching mathematical concepts and problem solving through cooperative learning and projects (National Council of Teachers of Mathematics, 1989). It is certainly agreed upon by most educators that elementary school teachers are at a disadvantage if they possess mathematics anxiety, and to admit their fears and attempt to overcome them would not only be in their best interest, but also be in the best interest of their students. Amelioration any perceived mathematics anxiety noticed in pre-service teachers during their training may go a long way in reducing these cankerworms and thereby making them a more effective mathematics teacher.

The changes in levels of mathematics anxiety among future teachers in two different mathematics materials and methods classes were investigated by (Vison, Haynes, Sloan, & Gresham, 1997). The changes were a function of using: (a) Bruner's framework of developing conceptual knowledge before procedural knowledge, and (b) manipulative to make mathematics concepts more concrete. The sample included 87 pre-service teachers enrolled in mathematics methods courses. Two strategies were used to gather data both at the beginning and ending of each quarter. First, future teachers completed 98-item, Likert-type questionnaires. Second, some of the factors that influence the levels of mathematics anxiety were determined through the use of questionnaire-guided narrative interviews. Multivariate analysis of variance was employed as the quantitative measure for comparing mathematics anxiety both at the beginning and ending of the quarter. Data revealed a statistically significant reduction of mathematics anxiety levels. Turkey's HSD was used to determine that a significant difference in mathematics anxiety levels occurred between the classes in the fall and winter quarters. Results of the study have implications for teacher education programs concerning the measurement of mathematics anxiety levels among future teachers and the determination of specific contexts in which that anxiety can be interpreted and reduced (Vinson, 2001).

Trujillo (1999) through administration of the Revised Mathematics Anxiety Rating Scale (R-MARS) to 50 pre-service elementary teachers identified the five most mathematically anxious teachers. Each of the five identified participants was interviewed with regard to her mathematics experiences in elementary school, high school, college, and family setting. Their perceptions as to the causes of their specific anxieties about mathematics were expressed. Their future plans to deal with their anxieties about teaching mathematics when they join the teaching profession were also voiced. Negative school experiences, lack of family support, and general test anxiety were trends found within the backgrounds of the participants. Despite their current apprehensions regarding the study and teaching of mathematics Trujillo(1999) found out that most of the subjects were very confident and optimistic as to the possibility of setting aside their fears in order to develop into effective teachers of mathematics themselves.

All of the prospective elementary teachers in this study had environmental, cognitive, and personality factors that contributed to their levels of mathematics anxiety. They all had negative classroom experiences and minimal family support, they all suffered from mathematics test anxiety, and they all had fears in regard to teaching mathematics themselves. He also found out that they all are aware of their negative feelings toward mathematics, and they are all determined to prevent the passage of their negative feelings on to their own students.

Haper and Daane (1998) analyzed math-anxiety levels among elementary pre-service teachers before and after a mathematics methods course, noting factors that promoted math anxiety. Interviews and surveys indicated significant reductions in math anxiety at the end of the course. Anxiety stemmed from rigid and structured classroom instructional practices. The main factors causing math anxiety were word problems and problem solving. Poole (2001) says many prospective and current elementary teachers admit, although reluctantly, that their weakest subject area is math. This weakness is compounded by their lack of confidence and poor attitudes toward the subject. He also says many of these teachers attribute unhappy, negative experiences in the "early grades" as sources of their weakness. Whatever the reasons, educators should not foster 'negative feelings' about math. They should implement programs that enhance learning about, and improve attitudes toward, the subject of mathematics, particularly for prospective elementary teachers.

Teacher attitudes have been a major focus of many research studies involving mathematics anxiety. Teague and Austin-Martin (1981) investigated teachers' mathematics anxiety and its relationship on teaching performance. The results indicated a correlation between the two variables. In addition, mathematics methods courses were found to reduce anxiety towards mathematics, but not significantly change attitudes towards mathematics. Similarly, Olson and Gillingham (1980) concluded from their study that attitude toward mathematics and mathematics anxieties were not significantly related. On the other hand, Arem (1993) structured a popular self-help book, on the premise that a positive attitude toward self and mathematics serves as a solid foundation for overcoming math anxiety.

Teacher variables have been studied to determine effects upon student achievement and mathematics anxiety. Van de Walle (1973) investigated third- and sixth-grade teachers' formal (mathematical emphasis on rote memory) and informal (probing and trial-and-error) perceptions of mathematics. Findings indicated a positive effect on students' mathematical comprehension when teachers exhibited informal perceptions and evidence of positive attitudes, such as low mathematics anxiety. Furoto and Lang (1982) studied teaching strategies designed to foster students' positive self-concepts and their subsequent effects on attitudes, anxieties, and achievement in mathematics. The study revealed a positive relationship between students' achievement and teacher attitudes, as well as, a reduction in mathematics anxiety levels as a result of positive self-concepts.

From an academic standpoint, Post (1992) warned that negative attitudes toward mathematics can produce negative results in mathematics due to the reduction of effort expended toward the math activity, the limited persistence one exerts when presented with an unsolved problem, the low independence levels one is willing to endure, and whether or not a certain kind of activity will even be attempted. Cruikshank and Sheffield (1992) wrote that they were unconvinced that elementary school children suffer from mathematics anxiety. Instead, they argued that teachers, who fail to implement seven important measures, cause their students to learn math-anxious behaviors. These measures include teachers who: (a) show that they like mathematics; (b) make mathematics enjoyable; (c) show the use of mathematics in careers and everyday life; (d) adapt instruction to students' interests; (e) establish short-term, attainable goals; (f) provide successful activities; and (g) use meaningful methods of teaching so that math makes sense. Martinez (1987) has noted that, "Math-anxious teachers can result in math-anxious students" p.117. Sovchik (1996) offered the relationship between mathematics anxiety and future students as one that is passed from teachers to students. Teachers, Sovchik warned, must first examine the symptoms of math anxiety to see if they themselves exhibit any. In addition to that, teachers were encouraged to incorporate strategies in the classroom to alleviate mathematics anxiety altogether. In a study conducted by Scholfield (1981), teacher attitudes were directly linked to student performance in and student attitudes toward mathematics. Results indicated that high-achieving teachers produced high-achieving students with least-favorable attitudes toward mathematics. Those teachers who were classified middle- or low-achieving in their abilities to teach mathematics had students whose attitudes were the most-favorable, yet maintained the lowest achievement scores. Akinsola (2002) study mathematics anxiety and its relationship to in-service teacher's attitude to the studying and teaching of mathematics and found significant relationships between teachers' mathematics anxiety and their attitudes towards the studying and teaching of mathematics. Teachers with high mathematics anxiety tend to avoid studying and teaching of mathematics. This study will like to see what relationship exist between mathematics anxiety and problem solving ability of the subject.

Locus of Control and Academic Achievement.

It has often been said that obtaining a good education is the key to being successful in the world. But what determine been successful while in school? While many factors may contribute to school achievement, one variable that is oven overlooked is locus of control (Grantz, 2006).

Locus of control refers to an individual's generalized expectations concerning where control over subsequent events resides (WikEd, 2005). In the context of education, locus of control refers to the types of attributions we make for our success and for/or failures in school tasks (Grantz, 2006). Locus of control is grounded in expectancy-value theory, which describes human behavior as determined by the perceived likelihood of an event or outcome occurring contingent upon the behavior in question, and the value placed on that event or outcome. More specifically, expectancy-value theory states that if (a) someone values a particular outcome and (b0 that persons believes that taking a particular outcome action will produce that outcome, then (c) they are more likely to take that particular action (WikEd, 2006). Locus of control is the perceived source of control over our behavior. It influence the way we view ourselves and our opportunities (Gershaw, 1989). Rotter (1966) classified locus of control into a bipolar dimension from internal to external. Internal control is the term used to describe the belief that control of future outcomes resides primarily in oneself. In other words, people with internal locus of control believe they control their own destiny (Gershaw, 1989). External control refers to the expectancy that control is outside oneself, either is in the hand of other powerful people or due to fate/chance or luck.

Research has shown that having an internal locus of control is related to higher academic achievement (Findley & Cooper. 1983) , students with internal locus of control earn better grades and work harder(Grantz,1999) and include spending more time on home work as well as studying longer for test. These make sense because if you believe working hard pay off then you are likely to do so (Grantz, 1999).

External locus of control may be caused by continued failure in spite of continued attempts at school tasks (Bender,1995) and a high external locus of control, in turn, leads to a lack of motivation for study and school in general (Grantz,1999). If one has an external locus of control, he may feel that working hard is futile because their efforts have only brought disappointment. Ultimately, they may perceive failure as being their destiny (Grantz, 1999). In other words, students with an external locus of control are more likely to respond to failure by giving up hope and not trying harder (Anderman & Midgley, 1997). Out of the 36 studies reviewed by Bar-Tal and Bar-Zohar (1997) on locus of control and academic achievement 31 of the studies indicated a significant relationship with internals having higher achievement than external.

Becker (1987) comparing student teachers' with internal locus of control and external locus of control during the student teaching experience found that student teachers with internal locus of control expressed more confidence in themselves than student teachers with external locus of control. Also student teachers with internal control attempted to check for their students' understanding of concept more frequently than student teachers with external control. The result of this study underlying the importance of the locus of control construct as factor that could affect the pattern of instructional delivery by teachers.

Weiner asserts that people attribute their successes and failures to internal or external reinforces. An "internal person" attributes successes and failures to her ability or to her effort. An "internal person" attributes her performance to causes for which she assumes personal responsibility. An "external person" attributes her performance to factors for which she has no responsibility and over which she has no control. If she fails, the "external person" assumes that the task was too difficult or that she was unlucky (or both). If the "external person" succeeds, she attributes her success to the easiness of the task or to luck. (Weiner, 1986)

Bandura's theory of observational learning concerns learning from models (Bandura, 1969). He asserts that much behavior is acquired through observing and imitating other people. He contends that new patterns of behavior are learned through observing behavior without the observer overtly responding or receiving any reinforcements in the exposure setting. He writes, "Modeling influences . . . can create generative and innovative behavior." (Bandura, 1977: 40-41) He argues that observers watch models performing responses, which embody a certain principle. Later the observers behave in a way stylistically similar to the model's behavior, even though the observer is not mimicking the model's specific responses, because the observer has applied what she has learned from the model to a new, but related, situation. (Bandura, 1977).

Bandura and Walters assert that teachers as role models may have three types of effects on students (Howard, 1996). The first is the "modeling effect," which involves the student's direct imitation of the model's behavior. The second is the "disinhibitory effect," which involves the student's observing the consequences of the model's actions and consequently choosing behavior in opposition, if the model's observed consequences were undesirable. For example, when female faculty members are regarded with low esteem by school administrators and are not treated as equals, the effect may be to inhibit female students' aspirations toward the teaching profession. The third modeling effect is the "eliciting effect," which involves the increased susceptibility in a student to the influence of the role model. For example, a female teacher who holds high expectations for female students' achievement may have an increased probability of influencing the female students' performance through cues which elicit a positive response in the students. (Bandura & Walters, 1969). Teachers are visibly in a position to be imitated by their students and having an internal locus of control or external locus of control can affect the directions of student learning.

This study will like to determine if there is a relationship between locus of control and problem solving ability of in-service teachers.

Study habits and Academic Achievement

There are many factors responsible for underachievement like, motivation, study habits, attitude towards teacher, attitude towards education, school and home background, concentration, mental conflicts, level of aspiration, self-confidence, examination fear, etc.(Sirohi,2004). Poor habits of study not only retard school progress but develop frustration, destroy initiative and confidence and make prominent the feeling of worthlessness towards himself and the subject of study whereas effective methods ensure success, happiness and sense of accomplishment (Smith & Littlefield, 1948). All too often, students perform poorly in school simply because they lack good study habits. In many cases, students don't know where to begin, don't fully understand the material, are not motivated by it, or feel that there was too much work given to them with too little time to complete or study it. If their studying skills do not improve, these students will continue to test poorly and not perform to their fullest potential

In a study of underachievement in relation to study habits and attitudes by Sirohi (2004) the most significant factor contributing to underachievement is poor study habit which has been indicated by 100% underachievers in their study.

Good work habits and skills are not acquired theoretically or in vacuum, it is proper habit of work and insistence on them in every detail and over a long period of time that create right attitudes and values (Secondary Education Commission, 1952).

Since learning is not a team sport but an activity that involves solely the student and the knowledge, it behooves on individual students to set a good work or study habits rather than been vagarious. Since certain skills need to be acquired at an early age—particularly mathematics and reading, writing, and thinking in one's native language—it is important that the idea of self-teaching be inculcated in the earlier years so that learning these essential skills will automatically lead to the development of good study habits.

There is a general need of teaching students the use of general study habits and each subject teacher, as he teaches specific subject skills, should call attention to this general habits. The question is: Are the elementary school teachers themselves have good study habits for them to be able to impact it to their students? What is the relationship of teachers' study habits to their problem solving ability?

Research questions

(1) How much did mathematics teaching efficacy belief, locus of control, study habits and mathematics anxiety (when taken together) contribute to the prediction of problem solving ability of in-service teachers?

(2) What is the relative contribution of each of the variables to the prediction of problem solving ability among the subjects?

(3) Is there is a significant relationship between:

(a) in-service teachers with high and low mathematics teaching efficacy belief and problem solving ability.

(b) in-service teachers with high and low mathematics anxiety and problem solving ability

(c) in-service teachers with internal and external locus of control and problem solving ability.

Method

Design

The design employed in this study was an ex-post facto type. In such a research, the investigation does not have a direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable. What the researcher did in present study was to examine the four psychological variables(independent variables-mathematics teaching efficacy belief, locus of control, study habits and mathematics anxiety) and problem solving ability(dependent variable) as it occurred rather than creating these manifestations.

Participants

Data for this study were collected from a total of 122 in-service mathematics teachers enrolled in the B.Ed primary education programme in the Department of Primary Education, University of Botswana. The sample included 92 females and 30 males. The mean age of the participants was 37years. Their ages range from 29 to 50 years while their working experience ranged from 6 to 25 years.

Instrumentations

(1) **Mathematics Teaching Efficacy Belief Instrument (MATEBI**)

The MATEBI consists of 25 items in a four-point Likert type scales ranging from strongly agree, agree, disagree and strongly disagree. The MATEBI was adopted from Enochs and Riggs (1990).Though the Enochs and Riggs scale is a five-point Likert scale the present study contains four because the investigator want all participant to have an opinion on all items. So the undecided portion was removed. The internal consistency of the MATEBI score was measure by Cronback's coefficient of alpha. The coefficient alpha is the function of the extent to which items in a test have commonality and is the lower limit of the reliability of a set of test scores (Cortinal, 1993). The reliability of scale scores will naturally be influenced not only by the instrument used but also by the sample composition and variability (Davis, 1987). It is therefore important to report reliabilities coefficient for the actual data collected (Vacha-Haase, Kogan, & Thompson, 2000), Isaac, Friedman, & Efret, 2002). The MATEBI was subjected to Cronback alpha reliability coefficient. It was found to be 0.91.

(2) **Locus of Control Scale**
The locus of control behavior scale based on Rotter (1966) was used as measuring instrument. It consists of 13 paired items. The instrument has a coefficient alpha of 0.82.

(3) **Mathematics Anxiety Rating Scale**
The mathematics anxiety rating scale by Richardson & Suinn, 1972 modified by Akinsola (2002) was used to measure the teachers' mathematics anxiety. It consisted of 30 items on a five-point Likert scale. The instrument yielded a reliability index of 0.79.

(4) **Problem Solving Ability Inventory**.
This was assessed with the aid of Rodman, Dean and Rosati (1986) instrument which was modified by Yokomoto, Buchanan, & Ware (1995) to reflect a shift in emphasis toward problem solving. The inventory is divided into two parts, with the first set (items 1-11) assessing student beliefs and attitudes towards problem solving in learning and testing process whilst the second set (items 12-16) assessed student appreciation for mathematics , algebra word problems, and puzzles, and it also assessed student self-perception of their competencies as problem solvers. Students could select "strongly agree," agree," "disagree," or "strongly disagree" as their response on each item. To ensure the suitability of the instrument for the current study however, it was subjected to test-retest reliability analysis. The obtained reliability coefficient was 0.77

(5) **Study Habits Scale**
The study habits questionnaire was a 35 items (3-point scale) adapted from Nneji (2002) study habits questionnaire. It is a 3 point Likert Scale featuring Mostly, Occasionally and Only. A test-retest reliability coefficient of 0.79 was obtained when given to fifty in-service secondary school teachers to score.

Procedure

Data Analysis Procedure
The stepwise multiple regression procedure(backward solution) was used to examine the joint and separate contribution of mathematics self-efficacy, locus of control, study and mathematics anxiety to the prediction of problem solving ability while chi-square analysis and Pearson moment correlation coefficient were used to determine significant relationship between the various aspects of the independent variables on the dependent variable.

Results
The research question was interested in knowing the joint contribution of the independent variables (mathematics teaching efficacy belief, locus of control, study habits and mathematics

anxiety) and dependent variable (problem solving ability). The results of multiple regression analysis are presented in Table 1 below:

Table 1: Multiple regression analysis on problem solving data

Multiple R	= 0.79251				
R-Square (R^2)	= 0.62807				
Adjusted R-Square	= 0.62431				
Standard Error (SE)	= 5.38421				
Analysis of Variance					
Source	Df	SS	MS	F-Ratio	P
Regression	4	10,025.36120	2506.34030	83.60652	<0.05
Residual	117	3507.40326	29.97781		

The above table shows that the predictor variables contributed 62.81% of the variable in problem solving ability. The table further reveals that the analysis of variance of the multiple regression data yields an F-ratio of 83.60652 which is significant at 0.05.

The results presented in table 2 below show the contribution of each of the variable to the prediction of problem solving ability. The table contains the standardized regression weight for each of the variables which from 3.1963 to 7.32625 and standard error of estimate which ranged from 0.09043 to 0.41162. The t-observed for each variable ranged from 4.11965 to 13.61185 which are all significant at 0.05 levels.

Table 2: Testing the significance of regression weight.

Variable	B	SEB	Beta	T obs.	Signif. T
Math Anxiety	-5.60291	0.41162	0.732635	-13.61185	.000
Math Self-Efficacy	4.26312	0.33617	0.42007	12.68144	.000
Locus of Control	-0.58233	0.09224	0.36241	-6.31320	.001
Study Habits	0.37254	0.09043	0.31963	4.11965	.001
Constant	68.42371	4.27311			.000

The data were also analyzed using chi-square test. The chi-square result shows that there is no significant relationship between internal locus of control and problem solving ability while significant relationship was found between external locus of control and problem solving ability. In-service teachers with internal locus of control had a higher problem solving ability and those with external locus of control had a lower problem solving ability. Also with chi-square test, no significant relationship was found between in-service teachers with low mathematics anxiety and problem solving ability whilst significant relationship was found between in-service teachers with high mathematics anxiety and problem solving ability. However, the result shows that in-service teachers with low mathematics anxiety had a higher problem solving ability whilst in-service teachers with high mathematics had a low problem solving ability. Similarly, in-service teachers with high mathematics teaching efficacy had high problem ability while those with low mathematics teaching efficacy had low problem solving ability.

Discussion of finding

The result of this study as evident from Table 1 has shown that the four construct of mathematics anxiety, mathematics teaching efficacy belief, locus of control and study habits contributed 62.81% of the variance of problem solving ability in that order. The multiple R value of 0.79251 signified a high correlation between the predictor and the predicted variables. The result indicated that the predictor variables are potent contributors to the problem solving ability of the in-service mathematics teachers. This was further corroborated by the F-value of 83.60652 which was significant at 0.05 levels. The result thus shows that these variables without exceptions have high predictive value in relation to problem solving ability.

The result revealed that mathematics anxiety contributed mostly to problem solving ability in mathematics thus imply that the more the mathematics anxiety of in-service teachers the weaker their problem solving ability. The image and fear of mathematics is molded and shaped by past experiences and that it is very difficult to teach something you don't possess yourself. These tensions and pressures in the teacher towards problem solving may inhibit sustainable confidence in the delivery of mathematics instruction thereby making them slothful and less effective. Mathematics anxiety is a very real fear for millions of people but the problems becomes acute when the person most afraid of problem solving is standing in front of the classroom trying to teach the subject. The National Council of Teachers of Mathematics in its 1991 publication, Professional Standards for Teachers of Mathematics (NCTM, 1991) and the Mathematics Programme Standards for Accreditation of Teacher Education (NCATE, 1998) stress the importance of the disposition of the classroom teacher towards mathematics. It was their view that if students are to develop a disposition to do mathematics, it is essential that their teacher communicates positive attitude towards mathematics, so the prospective teacher of mathematics has to be kind in words and deeds to them. To break the cycle of poor attitudes generating poor attitudes and provide students with positive experience in learning mathematics taking fears into account can help the teacher approach the subject with attitude that students can learn these subjects, and be sensitive to students who fail due to a lack of confidence. Teachers may also want to take extra care to teach these subjects well and to encourage questions. These presuppose that the teacher himself/herself is not fearful of the subject.

Mathematics teaching efficacy beliefs represents a person's evaluation of his or her ability or competency to reach or overcome a mathematics tasks or obstacles. Low self –efficacy has been linked to increase cheating, lack of concentration, low motivation, lack of persistence, and depression (Finn & Frone, 2004). Conversely, high self-efficacy has been associated with pursuit and achievement goals, problem solving and persistence (Vrugt, Langeries, & Hoogstrate, (1997).Consequently these factors are related to the problem solving effort of student. In other words mathematics self- efficacy may influence how successful students are ready to engage in problem solving activities. Students with high mathematics self-efficacy may be ready to confront and solve any problem that comes there way whereas students with low mathematics self-efficacy may distance themselves from engaging in solving problems they might have perceived as difficult thereby leading to poor achievement in mathematics. Students with high mathematics self-efficacy are likely to persist in solving any kind of mathematics problems while those with low mathematics self-efficacy easily abandoning solving mathematics problems they considered too tasking. High mathematics self-efficacy students are likely to increase personal accomplishment, more absorbed in their mathematics and set and maintain more challenging mathematics goals.

Thus the way a teacher judge his/her capability to organize and execute the course of action required to attain designated types of performance in mathematics like problem solving may likely affect the way they approach the task. So, attempting problem solving tasks in mathematics by in-service teachers depends on their level of mathematics self-efficacy as revealed from this study. In other words a teacher with a high level of mathematics self-efficacy will be willing to expend energy, effort and time in solving problem and encouraging his student in the act of problem solving. On the other hand, a teacher with a low mathematics self-efficacy may not be willing in exerting energy, effort and time on mathematics problem solving. Such a teacher will hardly encourage his/her students to persist on solving mathematical problems they might have considered too tough to handle. It may be concluded that teachers with high mathematics self-efficacy are likely to be more apt in fostering and encouraging their students to tackle mathematics problems of all colour-ation whilst teacher with low mathematics self-efficacy may not be enthusiastic and committed in encouraging their students to embark on problem solving in mathematics since they themselves are not kin at problem solving as teachers model the behaviour they wish their students to exhibit.

In this study locus of control was find to correlate with problem solving ability of the in-service teachers. Further investigation by chi-square revealed significant difference between in-service teachers with external locus of control and mathematics problem solving ability. Locus of control which is the tendency to ascribe achievements and failures to either internal factors that they can control(effort, ability, motivation) or external factors that are beyond control (chance, luck, others' actions) is an important factor that could affect the ways a teacher performs his teaching role. It could be ascertain that teachers who believe that effort and ability are essential in the learning of mathematics are likely to motivate and encourage their students to tackle and solve problems in mathematics whereas those who believe that luck, fate, chance or powerful others might not be favourably disposed towards encouraging their students in engaging in strenuous mathematics problem solving because they themselves attached their successes to luck, chance or fate.

Study habits have been shown to contribute to students' failure in mathematics (Mangaliman, 2007). Study habits correlated least with problem solving ability in this study. Nonetheless, there is a significant relationship between study habits and problem solving ability of in-service teachers. For teachers to encourage good study habits in their students they themselves have to be an epitome of good study habits.

Conclusion

Attitude cannot be easily separated from learning because they are acquired through the process of learning which involves interactions of several variables. As illustrated by the definition of learning by Farrant (1994) that "learning is a process of acquiring and retaining attitudes, knowledge, understanding, skills and capabilities" p 107. According to Farrant's definition, learners are not born with attitudes but instead they acquire them when they get in contact with the new world. This position is supported by Olaitan (1994) that "attitude can be learned and teachers should strive hard to develop the right attitudes in their pupils particularly towards acquiring manipulation skills" p27. Attitudes differ according to how learners perceive what they are taught and whoever is teaching them. This position is supported by Jonassen (1996) who defined attitudes as "how people perceived the situation in which they find themselves" p485. He then asserted that if learners are not assisted or encouraged to perceive positively most of the things they learn, their performance in class will be affected. Thus the crucial roles of teachers as facilitator of positive attitudes of students.

Most mathematics teachers are obtuse to student problems in mathematics thereby failing to educe the best from them. Mathematics teachers with lack of understanding and acceptance often provide a psychological climate which may precipitate negative attitude and avoidance to mathematics by students. This should no be so. As mathematics teachers we should always seek for avenue by which we will be making our students elated at the end of our interaction with them in the classroom. Methods which are perdurable should be employed always to sustain student continuous interest in learning mathematics. This is the only way by which we may be able to gear and stir them up and change their negative perception towards the learning of mathematics. This presupposes that mathematics teachers themselves are positively oriented towards the learning and teaching of the subject.

Our teacher training programme must be evaluated on their ability to prepare mathematics teachers for students that have or may have develop discomfort for mathematics and who may end up teaching the elementary/junior schools where these feelings have been found to begin. By studying the pre-service and in-service teachers, we cannot only ascertain what future and present teachers are feeling but we can work with them towards alleviating their own discomfort with mathematics as well as prepare them for students they may encounter with similar feelings. The power of process resides in the key pathways through which mathematics teachers learn, grow, and improve their practices. A high mathematics teaching efficacy, a low mathematics anxiety, and internal locus of control and a good study habits are essential factors for would be mathematics teacher to be able to perform his teaching tasks creditably and optimally.

A teacher's competence, a teacher's identity, a teacher's 'self' is woven into the fabric of everyday events in a way which means that they have little choice but to be committed to outcomes of events that involve, at one and the same time, both the pupils' and the teachers' careers in the school (Denscombe, 1995). It is therefore necessary for mathematics teachers to be percipient of students' mood and by so doing they may be able to reduce student often nasty experiences in mathematics classroom.

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