

FACTORS AFFECTING MATHEMATICAL PROBLEM SOLVING COMPETENCE OF UNDERGRADUATE STUDENTS IN FACING COMPETITIVE EXAMINATIONS

R. Rajkumar¹ & G Hema²

¹Research Scholar, Department of Education, Periyar University, Salem, Tamil Nadu, India

²Assistant Professor, Department of Education, Periyar University, Salem, Tamil Nadu, India

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ABSTRACT

Promoting the ability of mathematics problem-solving is an important task. The Institute for the Promotion of Teaching Science and Technology (IPST 1997) is stated that studying mathematics plays a very important role in developing human thinking to be more creative, reasonable and able to analyze problems and to forecast the future. Examination relies mostly on memorization of knowledge and that results in drawbacks like students' low capability in thinking, analyzing, synthesizing, innovating and problem-solving. Students' competence can be measured by observing their performance in terms of task finalization based on their expertise. Student competence can be predisposed by many factors. These influences can come from teachers as instructors, students as learners and the environment as an enthusiast. In Tamil Nadu, undergraduate students' mathematical problem-solving competence and their achievement in competitive examinations are a critical issue as an enormous number of students, especially undergraduate students studying in arts and science. The authors of this article discuss the factors that impact on students' problem-solving competence and describe a research framework, based on a literature review, which might contribute to improving the students' mathematical problem-solving competence. Ultimately, they decide to focus on some specific factors: attitude towards mathematics, mathematics anxiety and interest in mathematics.

KEYWORDS: *Mathematical Problem Solving, Competence, Attitude, Interest, Anxiety, Mathematics Education*

INTRODUCTION

Mathematics theatres a key role in determining how individual transaction with the various spheres of private, social, and civil life (Anthony &Walshaw, 2009). This rationalizes the impulse of the study of the subject by all students who go complete basic and secondary education in most countries. Mathematics is consequently a core subject at these levels of education. It is unfortunate, therefore, that in contemporary time's many students fight with Mathematics and perform very badly low in their final examinations in most influences. Students' performance in mathematics at the senior high school has not been hopeful of late(Chief Examiner's Report, 2007).

Achievement in mathematics among secondary school students is influenced by a range of factors including interest in mathematics, self-concept, mathematics anxiety, attitude towards mathematics, self-efficacy, parental involvement peers and gender. In this review only focus on mathematical problem-solving competence factors affecting variables such as anxiety

and attitude as related variables, and their interaction with the involvement to influence mathematics achievement. It reflects the impacts of each of mathematics anxiety, attitude towards mathematics and involvement on mathematics achievement, before considering the facilitating influences of gender (Mini Chaman, Kim beswick& Rosemary Callingham,2014).

Mathematical problem-solving competence is defined as the capacity to the ability to solve real-world problems and to transfer problem-solving strategies through metacognition and technology and also ability to solve problems by applying cognitive skills such as reasoning and logical thinking. WHO (1990-2000) also reported that the education process in school has centered on memorizing textbook materials rather than developing self-learning abilities. Examination relies mostly on memorization of knowledge and that results in drawbacks like students' low capability in thinking, analyzing, synthesizing, innovating and problem-solving. In Thailand, there have been some researches in mathematical problem-solving. One was done by using "Newman technology "(Natcha and Satoshi, 2006). The other one done in Mahasarakham (Sakorn, Tayru-akham&Nuangchalerm, 2009) was mainly focused on factors like motivation and self-efficacy, attitude towards mathematics, self-esteem and teachers' teaching behavior. There are no significant studies however which were mainly focused on mathematics anxiety, despite the fact that mathematics anxiety has been identified in the literature as a problem on the mathematical achievement of students. So it is necessary to find out the factors which affect the Mathematical problem-solving competence among undergraduate students for facing competitive examinations.

INFLUENCING GENERAL STUDENTS' FACTORS

Self-Directed Learning

Self-directed learning could be a factor in students' mathematics achievement. There is no faultless, well-structured, deliberate or prescribed system that lets students' reason and acts mathematically. This can be done only students are playing their allocated roles in their learning progress. Self-directed learning has a significant place in successful mathematics learning. Students can revenue the creativity in their learning by recognizing their needs, framing goals, identifying goods for learning, and evaluating or monitoring learning outcomes (Knowles 1975). The teacher's role is to engage students by serving to organize and contribution them as they take the initiative in their own self-directed investigations, instead of directing their learning despotically (Strommen & Lincoln, 1992).

Arithmetic Ability

Arithmetic ability might also be another forecaster of mathematics achievement. Arithmetic ability comprises skills such as operating mathematical knowledge and concepts in ways that transform their meaning and implications. It allows students to interpret, analyze, synthesize, generalize, or hypothesize the facts and ideas of mathematics (TuncaySaritas and OmurAkdemir, 2009).

Motivation or Concentration

Mathematics education comprises reasoning, making interpretations, solving problems, mathematical issues, and concepts so that student’s demands highly motivated. The challenges of mathematics learning for today’s education is require self-controlled study, concentration, and motivation. To encounter these tasks, learners must be attentive and driven to progress. Reliable with previous studies, they found that for a higher level of mastery, motivation was related to higher mathematics grades (Broussard; Garrison, 2004).

Students’ factors are influential factors, which arise from the students themselves. Students’ self-regulated learning is how students select, arrange or create their own learning environment so that it can be advantageous, and also how they plan and control themselves in the learning process (Martirosyan, Saxon, and Wanjohi, 2014). Students’ successfulness in organizing their own learning activities contributes to their academic achievement (Akinoglu and Tandogan, 2007). Communication becomes an important element for self-development. While communicating with other students or teachers, students will have the opportunity to discuss and share their ideas (Zimmerman, 1990). If the communication is running well, the transfer of information between students and students or students and teachers will be achieved. The third factor is the students’ achievement motivation. Motivation is the most important factor to achieve something (Caprara et.al, 2008). Achievement motivation has an essential role in students’ academic performance (Morreale, Osborn and Pearson, 2000). Students’ academic knowledge and skills can be achieved by improving their motivation to achieve them (Singh, 2011). The last factor is the students’ learning satisfaction. Students who are satisfied with their learning experiences at school have better academic achievement than students who are not and they will have a positive disposition. A positive disposition improves students’ intrinsic motivation, so their performance will also increase (Awan, Noureen and Naz, 2011). These details highlighted the need to bring into attention the present study which is planned to reflect each of the following psychological factors and examine their connotation with academic achievement in mathematics, Self-concept, test anxiety, interest in mathematics, attitude towards mathematics, and motivation since a better accepting of the influences of psychological variables on mathematics achievement would be of substantial help in developing and enhancing a more effective method for teaching mathematics at various levels. This, in turn, will enhance achievement in the subject, which is our ultimate goal (Eduwem Joy Dianabasi, Umoinyang Imo E., Out Bernard Diwa, 2017).

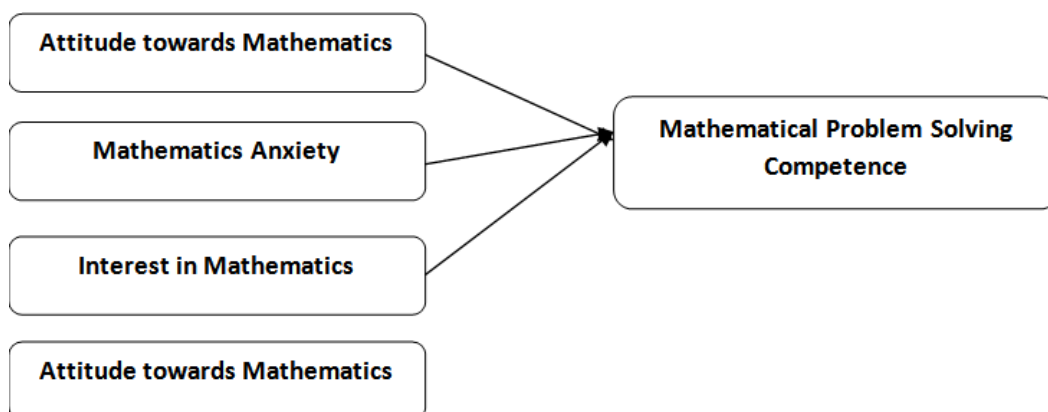


Figure 1

Attitude towards Mathematics and Competitive Examinations

Attitude as perception is troubled with an individual's way of thinking, substitute, and behaving. It has very serious suggestions for the learner, teacher, and immediate social group with which the individual learner transmits, and the entire school system. Attitudes are shaped as a result of approximately kind of learning experiences students go through. This is imitation, which also has a part in production in the teaching and learning situation. In this admiration, the beginner draws from his teachers' nature to form his own attitude, which may probable affect his learning outcomes (Yara,2009).

Attitude is a psychological tendency (Eagly&Chaiken, 1993). It is a tendency or a predisposition to reply positively or negatively towards a firm idea, object, person, or condition or an attitude object. Attitude influences a personality's choice of action, responses to challenges, motivations, and rewards (Business Dictionary). Zelle Marianne and Elaine (2005) suggest that attitudes are generally positive or negative views about a person, place, thing or event which are frequently referred to as the attitude object. Assumed in the various definitions is that attitude is a psychological direction developed as a result of one's knowledge, which influences how a person views situations, objects or students, and how students suitably responds to them. The response may be positive or negative, favorable or unfavorable, and neutral or ambivalent (Arul, 1995).

Attitude towards mathematics by revenue of just alike or dislike for mathematics subject, although others range the meaning to hold beliefs, aptitude, and usefulness of mathematics. Attitude towards mathematics is fair a positive or negative emotional nature towards mathematics (Zan and Martino, 2007). It beliefs about mathematics and how she/he performs towards mathematics". Attitude towards mathematics contains the tendency to be fearful of and nervous about mathematics.

Attitude towards mathematics has cognitive, affective and behavioral apparatuses and like extra kind of attitude, it can be formed ended any of the three processes labeled earlier. A student can develop positive attitude towards mathematics because learning is to subordinate positive experiences or events with it. Also, positive strengthening creates for the formation of a positive attitude for mathematics.

Maria de Lourdes Mata, Vera Monteiro, and Francisco Peixoto (2012) sought to characterize attitudes towards mathematics in students from 5th to 12th grade and to analyze the effects of gender, cycle, and math performance on these attitudes. In general, students had positive attitudes towards mathematics, although scores were low and distributed mostly around the midpoint. In spite of this overall positive attitude towards mathematics the setup changes and effects are significant and mean that during schooling, attitudes towards mathematics become less positive. Shamila Dewi Davadas & Yoon Fah Lay (2017) studied that perceived parental influences, teacher affective support and classroom instruction are significant predictors of attitude toward mathematics. The research model was able to predict the inter-relationships of the constructs on a moderate level. However, the modest forecasting relevance and effect size implied that attitude towards mathematics is multi-faceted with a probability of other causal factors such as students' socio-economic status and past achievements.

Factors in Mathematics Anxiety

Mathematics anxiety consists of cognitive factors, psychological factors, physical factors, and environmental factors. Mathematics performance is in terms of knowledge skills, comprehension skills, application skills, analysis skills, synthesis skills, and evaluation skills. This study results showed that the factors that most influenced in performance in mathematics are physical factors. This is followed by environmental factors and psychological factors. The least influenced factors on performance in mathematics are cognitive factors (Shamim Nisar Shaikh, 2013).

Spatial thinking is categorized as a high-level cognitive process in problem-solving. Problem-solving helps humans find useful and original solutions in order to achieve specified goals when they have not faced any similar problem in the past. Problem-solving is divided into two sub-categories, analytic and interactive problem-solving; analytic problems provide a single choice and have all the information disclosed at the outset; while interactive problems provide multiple choices thus solvers must uncover some of the information needed (Fischer et.al, 2015).

Problem-solving is accomplished in two phases, problem representation and problem solution (Mayer, 2012). Spatial thinking substantially donate to both phases because it is representation phase, someone should create a mental representation of the problem to fully understand it and solution phase, someone could spatially represent in the problem's answer using graphs. (Christos Charcharos; Margarita Kokla; Eleni Tomai, 2016) a study describes a framework for designing an experiment that will give insights to the relation between problem-solving and spatial thinking. Participants fill in questionnaires that assess spatial thinking and problem-solving in a holistic way and then statistical analysis will be achieved on the results. A significant outcome from this research is the establishment of a link between these skills. If the results authorize the being of such a relative another outcome will be the comparative influence of each factor to problem-solving skills.

Interest in Mathematics

Interest is a state of alarm or curiosity. It is to cause to become involved in something. To show interest in a thing is to be actively involved with that thing; to show concern for or have an interest in that thing. To be interested in mathematics involves showing sufficient concern for and curiosity in the subject by being movement involved in all activities related to the subject (UduogieIvowi, 2001). Interest is a significant cognitive and affective motivational factor managerial attention and assisting learning in different situations (Renninger&Hidi, 2011). Interest is at least circuitously related to learning and achievement outcomes even when controlling for earlier ability and it typically accounts for approximately 10 % of the variance of performance (Ainley, Hidi&Berndorff, 2002a; Schiefele, Krapp, &Winteler, 1992; Van Yperen,2003). Ainley and colleagues (2002a) showed that the method of the influence is relatively complex, with interest being related to affective response, the affective response to persistence, and the persistence to learning outcomes. Interest may be a particularly important factor when trying to understand mathematics performance and possible gender differences in it as students tend to continue a dislike towards mathematics (Ma & Kishor,1997; Gomez-Chacon, 2000) while remaining largely unaware of how deeply mathematics is embedded in the world around them (Hannula, 2012).

The development of positive mathematical interest is linked to the direct involvement of students in activities that involve both quality mathematics with significant others within a clearly defined community such as a classroom (van Oers, 1996). In the mathematics classroom, mathematics teachers are confronted with critical moments of making a decision that reflect their personal idea and self-belief about mathematics and how it should be taught (Shroyer, 1978). Relaxing confidence and structure students interest of the mathematics teacher is a dangerous component in the building of an environment that in-dorses problem-solving and kinds students feel happy to talk around their mathematics (Yackel et al., 1990). Student interest in mathematics has been found to correlate strongly with their mathematics teacher clarity, (i.e. how careful the teacher uses vocabulary during a discussion of both the why and how in problem solving) and ability to generate a sense of permanence between the mathematics topics in the curriculum (Campbell and Schoen, 1977). Bikner-Ahsbahs (2002; 2004; 2015) studied how interest in mathematics emerges in circumstances where there is collaboration between teacher and students on a collective level. (Radford, 2008) the observable fact referred to as an interest-dense position captures how students get involved in an activity and become a part of a dynamic and epistemic process. Situations including these processes are of such a nature that cooperative interest emerges (Bikner-Ahsbahs, 2004); the students reach deeper mathematical meanings together.

CONCLUSIONS

The results from the above studies indicate that there is more to the solution process than comprehending the problem text because giving problems or reading them aloud does not guarantee solution accuracy (Debbie Bautista; Michael Mitchellmore & Joanne Mulligan, 2009). An understanding of the problem's mathematical structure is also necessary for success in solving word mathematical problems. As Adetula (1990) argues, 'word problems are reasonable to children, only when the structure of the language in which the problems are presented is understood by the students' and only then can the mathematical structure of the problem be grasped? The low performance is alarming given that the students consisted mostly who are already expected to solve basic addition and subtraction word problems. Even without showing a competent understanding of these initial concepts, they are expected to solve problems involving multiplication, division, and rational numbers by the end of the school year. The implications of not being able to solve simple word problems are huge.

Finally, it would be desirable to look at the factors influencing improvement in these domains over a wider range of ability in these domains. Would the same factors influence or fail to influence improvement in numeracy children who were initially performing at average and above-average levels, as in these children, who were selected for weaknesses in arithmetic? Would the finding that, for example, initial numeracy score predicted improvement in Comprehension but not vice versa be replicated in a group who were better at Comprehension than numeracy to start with? Would such predictive relationships differentiate between the student with specific difficulties in literacy or numeracy and those who are performing poorly in all academic domains? (Ann Dowker, 2016). Generally, these three factors will become a very helpful indicator in discussing the important element of students' beliefs about mathematics and problem-solving competence (Siti Fairus Mokhtar, Zahayu Md Yusof & Masnita Misiran, 2012). This also provides in-depth understanding to the fundamental problem in learning mathematics and subsequently will improve mathematics performance and achievement in the near future, not only for problem-solving competence, and also for students in higher institutions in general.

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