A Study of Students' Self-Efficacy and Academic Achievement in Mathematics at University Level

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Abstract

The focus of the study was to explore students' self-efficacy and their respective academic achievement in the subject of mathematics. Pertaining to this aspect the following hypotheses were tested. That: a) there is no significant difference in the academic achievement of students having high and low self efficacy; and b) there is no significant relationship between academic achievement and the self-efficacy of students in Mathematics. The sample of the study consisted of 450 (302 male and 148 female) MSc students for which random sampling technique was adopted. A self-efficacy scale related to mathematics was used to measure student's self-efficacy level and their respective scores in the subject of Mathematics that appeared in the examination during the year 2011. A comparative analysis indicated that there was significant difference in the academic achievement scores of respondents having high and low mathematics self-efficacy. Students with high level of mathematics self-efficacy show significantly higher scores in academic achievement as compared to those having low self-efficacy. Pearson Correlation Coefficient was applied to check the relationship between mathematics self-efficacy and their relative academic achievement. It was found that a significant relationship exist between students' mathematics self-efficacy and academic achievement. This clarified that math self-efficacy can be accepted as a strong predictor for math achievement.

Keywords*:* A Study of Students' Self-Efficacy and Academic Achievement in Mathematics at University Level

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One's personal belief and confidence also play a pivotal role in excelling any discipline. In education and psychology such inclination of the mind is popularly termed as self-efficacy, and is a distinct area of research. Regarding self-efficacy, the findings of Bandura (1977) are of great importance. He explored the idea of self-efficacy and intimated it to the research community. He concentrated on self-efficacy, explored and evaluated the impact and application of self-efficacy surrounding the theoretical framework of his social cognitive theory. He is of the opinion that human achievements are closely related to the interaction of one's personal behavior, his/her immediate environment and the nature of the social setup surrounding one's personal life and the goals that he/she wish to achieve.

Bandura's belief is supported by other famous researchers like Pajares and Miller (1994) who stated that Self-efficacy is an inward trend among the students who are certain about their capability to gain commands over new skills and assignments of a specific discipline. They also have strong view about self-efficacy as a disciplining force to coordinate the different faculties of minds for achieving the determined objectives. Such type of learners enhances their abilities and invests their efforts for a fruitful outcome.

Most of the researchers believe that self-efficacy increases learner momentum and enthusiasm for learning and further increase their academic excellence (Pajares, 1996; Schunk, 1995). Other thinkers like Mousoulides and Philippou (2005) had discovered in their joint research that there is a direct relationship between self-efficacy and academic achievement. Accordingly students possessing strong sense of self-efficacy have greater potential and courage to face and solve challenging problems as they can work persistently and can show remarkable academic performance as compared to students who are lagging behind and are lacking in confidence level to cope with such challenging job.

Naturally Self-efficacy and academic achievement are reciprocal. This has been amply regarded and proved by the findings of Ellefsen and Beran (2007), Speight (2009), and Fallon and Illinois (2010) who remarked that high and low academic achievement varies due to parental and personal factors gaining force by self-efficacy. Martin and Marsh (2006) and Skaalvik and Skaalvik (2004), in their joint research observed clear relationship between self-efficacy and academic achievement. Thomas (2013) Nasirian et al., (2011) Gold (2010) Henry (2008) Mohsenipour (2005) Liew et al., (2008) Ross (2008) Usher (2009) and Carroll et al. (2009) have consensus on the view that self-efficacy carries direct impact on academic achievement.

The greater value of self-efficacy can result far-reaching changes in the behavior of students and have lasting influence on their future achievements irrespective of their past achievements. The higher the level of self-efficacy, the higher the level of achievements. This reinforcing relationship was revealed by Alldred (2013). A number of other researchers like: Hsuch & Yoshikawa, (2007); Jensen (2009) arrived at the conclusion that self-efficacy is a determining factor for showing greater performance; hence those who are deficient in this regard are liable to show lesser achievement. Students with a high level of self-efficacy show greater sense of participation in academic activities and they are more interested and willing to do hard work and have greater hopes for their successful future to regulate their efforts in positive direction and do the work continuously with

steady tempo (Magno, 2008; Pajares & Urdan, 2006; Schunk, 2009; Zimmerman, 2000; Nasirian et al., 2011; Gold, 2010; Carroll et al., 2009; Henry, 2008; Mohsenipour, 2005; Liew et al., 2008; and Ross, 2008).

The most important aspect is that students gain self-trust in their efficacy and are optimistic about their performance in math test and feel quite satisfied to get deeper knowledge of the most difficult problems of math text. They approach the math assignments with enhanced confidence and a psychological satisfaction in mastery of skills during math classes. They

achieve better position of gaining high scores in the subject of mathematics (Liu & Koirala 2009).

Performance and achievements of the students in the subject of mathematics are dependent on the opportunities which they find for learning. It is also a known fact that mathematics cannot be restricted to a selected group of students, as it is a universal subject and every student is required to think mathematically and learn all its requirements for mental discipline and coordination of the faculty of mind (Kilpatrick, Swafford, & Findell, 2001). However the acquisition of efficacy in mathematics is not easy as the students have to encounter a number of problems for learning mathematics particularly during their school years. The basic requirement at this stage is the motivation of the students for learning the subject with interest. In this regard the potential factors are the confidence of the students in the subject and their emotional relationship for learning mathematics with commitment and concentration. Such an emotional environment effects the student decision in the selection of course and various pedagogical approaches and ultimately their career choices (Stigler & Hiebert, 2004).

The findings of Niolaou & Philippou (2007) reinforce the belief that higher achievements in mathematics require a far more confidence in the efficacy and accuracy of belief in mathematics. They even assert that selfefficacy in math is a deciding factor to predict the future performance in

mathematics (Niolaou & Philippou 2007). Klassen (2004) also summed up in his findings that there was a powerful interrelation between mathematics self-efficacy and mathematics achievement. The same fact was scientifically studied and subsequently supported by researchers like Ayotola and Adedji (2009) Chen (2003) & Zimmerman (2007) Goodwin. Ostrom & scott. (2009) O'Brien et al. (1999) Özyürek, (2010) Pajares & Miller, (1994) Schnulz, (2005) Usher, (2009) and Waller, (2006).

The general belief in mathematic self-efficacy is about the ability of a student to achieve well in school mathematics. Naturally the students selfefficacy in math is believe to be a predictor for students' interest in mathematics and their whole hearted participation in the learning process for greater academic pursuit. Ultimately this attitude enhances their mathematics achievement (Lapan et al., 1996; Fast et al., 2010; Olsen, LaMire, & Baker, 2011; Sakiz, Pape, & Woolfolk_Hoy, 2012). Self-efficacy in math and its related achievement is also explored by Liu & Koirala (2009).

The research findings of the above referred researches proved the strong cultural impact of the society. In Pakistan context, very little research has been conducted in this regard and there is a need to explore the students' belief about mathematics self-efficacy and its relationship with their academic achievement. Due to lack of research focused on these factors in Pakistan, the researcher made an attempt to investigate the relationship of university

students' mathematics self-efficacy and academic achievement. The hypotheses of the study were: a) there is no significant difference in the academic achievement of students having high and low self efficacy; and b) there is no significant relationship between academic achievement and the self-efficacy of students in Mathematics.

Research Methodology:

The study was carried out by employing descriptive correlation design and it is delimited to MSc Mathematics program offered by different Public sector universities in the province of Khyber Pukhtunkhwa. In the province of Khyber Pakhtunkhwa only seven public universities were offering MSc mathematics program at the time of data collection. The data was collected through random sampling technique. The sample consisted of 450 students (both male and female) studying at MSc level in Mathematics program in the said institutions.

The data was collected by self-constructed mathematical efficacy scale containing thirty items followed by 5 point likert scale ranging from strongly disagree (1) to strongly agree (5). The face validity was checked by a panel of experts and feedback was provided to the experts. To establish reliability of the scale Corn Bach's Alpha coefficient was calculated as 0.96. This scale was administered to the sample after addressing Codal formalities regarding heads of the departments and the students. The student's results were recorded

relating to the year 2011. The scores of the students were equated by using percentage of the marks obtained. The analysis of Pearson correlation was used to arrive at the relationships between students' selfefficacy and academic achievements in mathematics. Comparison of achievements of students was carried out by using T-test having high and low mathematical self-efficacy.

Results

The results are as under:

Table 1: Comparison of Mathematics achievement of students having high and low mathematics self-efficacy

Self-efficacy	N	M	SD	SE Mean	*t*	*P*
High MSE	91	78.34	5.61	0.59	17.70	0.000
Low MSE	94	59.70	8.39	0.87		

P>0.05

Table 1 indicates the work out value of *t* is 17.70 being greater than tabulated value (1.96) at 0.05, level. This shows a remarkable difference in the scores of students having high and low mathematics self-efficacy. The achievement score is high of those students with high mathematics self-efficacy as compared to students of low mathematics self-efficay.

Table 2: Correlation (r) between students' Mathematics Self efficacy and academic achievement in mathematics

Variable	Correlation *(r)*	*P*

Mathematics efficacy Achievement	Self and	0.835**	0.00
*significant p<0.05		at	0.05

Table 2 shows positive and significant correlation (r= .835, p < 0.05) between respondents mathematics self-efficacy and achievement in mathematics. The coefficient of correlation recorded the higher the mathematics self-efficacy in respondents; the greater the student's achievements.

Discussion and conclusion

The primary focus of the study has been to compare the academic gains of the students having greater or lower level of mathematics selfefficacy, data analysis (t is 17.70 greater than tabulated value (1.96) at 0.05, level) signifies a marked distinction in the academic acquisition of students with high or low mathematics self-efficacy. Hence the hypothesis "there is no significant difference in the academic acquisition of scholars having high or low level of mathematics self-efficacy" was rejected. The results emanating from this research are similar with the former findings such as by Pajares (1996), and Pintrich, Schunk (2002), Bong and Skaalvik (2003) and Carroll et al., (2009). The research work of the researchers has revealed that the students with higher

level of self-efficacy are able to achieve higher acquisition level as compared to their counterpart with lower level of selfefficacy.

The second main purpose of the research was about analyzing the relationship between students' self-efficacy and their corresponding academic achievements in the subject. The detailed analysis of the data reflected greater importance of the relationship between mathematics self-efficacy and academic achievements showing $r= 0.83$ and $p<0.05$. Making the base of this finding the second hypothesis "there is no marked relationship between academic achievement and the self-efficacy of the students in mathematics" was rejected. The research study showed that scholars with greater degree of mathematics self-efficacy showed more capability in the subject of mathematics. The findings of the present study are quite in line with the past research work that approved the mathematics self-efficacy and mathematics achievement were reciprocal and mutually related as put forward by: Pietsch, Walker, & Chapman, (2003); and Stevens, Olivarez, Lan, & Tallent- Runnels, (2004). Consequently it was decided that students with higher mathematics achievement were showing greater self-efficacy in the subject (Stevens, Olivarez, & Hamman 2006 and Zarch & Kadivar 2006).

In the light of the fore going research study and the analysis of data, it is concluded that male respondent exhibited higher self-efficacy than did female respondent in mathematics.

Moreover male respondent academic achievement scores were significantly higher than those of female respondents. The other important result of this research was that mathematics self-efficacy is an important positive predictor for judging the mathematics achievement. The findings of the study bear significant implications for mathematics teachers especially as well as for educational and counseling psychologists in general. The teacher will know beforehand that the academic achievements of the students is directly influenced by several other factors and among these; mathematics selfefficacy is the most cogent part to empower the teacher to determine students believes about their mathematics potentials. There can be more intellectual ventures intended to predict how much mathematics self-efficacy affect relative academic achievement. In future the research will be extended in the same direction and improving the research measures by incorporating greater number of students to collect samples in divergent social and cultural context to achieve more objective results of the research.

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