

## **Relationship between Mathematics Teachers Self Efficacy and Students Academic Achievement at Secondary Level**

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### **Abstract**

Research studies proved that teachers' self-efficacy is directly related to students' academic achievement and overall learning. The current study was conducted to explore relationship of mathematics teachers' self-efficacy with students' academic achievement at secondary level. A sample of 576 respondents with a break up of 96 math teachers (48 male and 48 female) and 480 students (240 male and 240 female) from six districts (Chakwal, Attock, Mianwali, Lahore, Leyyah and Muzaffar Garah) of the Punjab province. Academic score of the Students in the subject of mathematics was collected from relevant (BISE) documents. Pearson correlation was used to determine association between self-efficacy and academic achievement. Math male teachers' self-efficacy and math female teachers' self-efficacy was also compared on t-test assuming two sample having equal variances. No significant difference was found between mean scores of male teachers' self-efficacy and female teachers' self-efficacy. Gender differences in students' mathematics achievement were also determined. Comparison of both male students' academic achievement and female students' academic achievement indicated no significant difference. The findings of the study reflected a strong correlation between mathematics teachers' self-efficacy and their students' academic achievement. Recommendations were made to build higher level efficacy beliefs of teachers during in-service training programs and promotion link training programs.

**Keywords:** Teacher self-efficacy, students academic achievement, gender differences

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## Introduction

Self-efficacy is the judgment of one's proficiencies to shape and implement actions required to produce desired achievements (Bandura, 1997). Individuals' beliefs in their efficacy impact their energetic attempt and determination to achieve anticipated objectives. According to Woolfolk (1998), self-efficacy is defined as one person's beliefs in his perfection of skills in a given context to do successful performance. Teachers' self-efficacy indicates to teachers' confidence on their teaching competencies to teach their students and promote students' learning and academic achievement to desired level. Allinder (1994) found high efficacious teachers motivated to experiment new ideas to teach their students. They steadily continued change in teaching strategies and overwhelmed obstacles. According to Tschannen-Moran and Hoy (2001) Students' performance reflects their teachers' worth. Teachers strong in efficacy beliefs promote desired level learning and achievement. It consequently builds students' thinking and inspiration to learn. HO and Hau (2004) described teachers' effectiveness in terms of addressing students' learning skills deficiencies. Haung , Liu, and Shiomi (2007) commented that teacher efficacy works in two ways. Students' learning approach and teacher efficacy positively control each other. According to Marsh (1986) students' mathematics learning capabilities sprang from their teachers' high efficacy beliefs. It developed students' mathematical verbal learning skill and math achievement at elementary through secondary and higher secondary level. According to Armstrong (1980) higher level efficacy beliefs found to be a strong source for forecasting mathematics learning and achievement. Bufford-Bouchard (1989) certified the facts that higher level self-efficacy beliefs found to be a greater source of mathematics performance and achievement on all grade level. According to Murphy (1992) superior segment of taking responsibility for students learning grounded in teachers' high level efficacy beliefs. Efficacious teachers indicated commitment to bring a desired learning achievement at secondary level. Real change was characterized in terms of eradicating criticism about students' learning errors in secondary classrooms. Conversely, teachers low in self-efficacy beliefs tends to blame their students for poor learning. Ryan and Deci (2000) investigated gender role in terms of teacher self-efficacy and recorded its significant impacts upon students' academic achievement. Abiam and Odok (2006) studied student mathematics achievement factors and differences in students' academic achievement at secondary school level. No significant difference was found gender wise in mathematical skills like numeration, algebraic process and statistics. Some researchers reported that the sex differences for mathematics learning grounded in inherent cultural bias. Different studies indicated that multiple factors caused sex

differences. Research studies analysis conducted by Sprigler and Alsup (2003) supported the claim that females possessed equal abilities in mathematics learning and mathematics achievement as retained by males. Females mathematics thinking talents particularly, confirmed their resoluteness to acquire sound basis mathematics expertise at elementary level. Ding, Song and Richardson (2007) conducted a research study to measure gender inclination towards mathematics. The researchers observed growing equal concern and liking for learning mathematics.

Teachers holding high level efficacy beliefs develop a sense of realization in their students that teachers care for students' learning and success. Students and their parents indicated varying perceptions about teachers' caring and help. Romo and Falbo (1996) stated that teachers' effectiveness is a pretty hard task, since people rated the teachers in terms of harder efforts they put in helping low achievers to make them successful high achievers. It demands rigorous routine practices, more time and energy consuming efforts. Researchers claimed that teachers' effectiveness is grounded in teachers' self-efficacy and declared it a strong predictor of mathematics learning and academic achievement. According to Wilkins (2008) experimentation of novel thinking for transmitting knowledge in the classroom reveals teachers' efficacy level. The researchers further explained that teachers with high command over mathematics content area displayed higher level mathematical skills among learners. Goldin, Katz, and Kuziemko (2006) studied the gender trend to join mathematics courses at secondary level. It revealed identical inclination to join mathematics courses. The findings reflected that males and females were likewise interested to study mathematics course.

It may be observed in the findings of related research studies that teachers' self-efficacy and its relationship with students' academic achievement is highly context specific. Since teachers' self-efficacy varies across the countries according to the culture and environment, students' academic achievement particularly in mathematics fluctuates across the countries.

In Pakistani context, researchers conducted numerous studies to investigate the impact of self-efficacy in educational setting. Tayyaba Shahzadi et al. (2011) investigated the impact of demographic aspects like age, gender, educational and professional qualification and classroom teaching experience upon teachers' teaching self-efficacy in the classroom venue. The study findings summarized that female teachers indicated strong efficacy beliefs as compared to males' efficacy beliefs to teach in the classroom context and shaped wished results. Findings of the study indicated that teachers in the urban areas earned more respect as compared to the

teachers teaching in the remote areas. Professional and educational qualification strengthened confidence upon their capabilities. Classroom teaching proficiency indicated as strong source of higher level belief about capabilities. Age factor showed no role in efficacy beliefs. How gender role and teaching experience enhanced belief of teachers for their teaching capabilities Nausha Atta et al, (2012) stated that female teacher's unveiled higher level belief of teaching competencies as compared to male teachers. These researchers claimed that female teachers verified themselves as appropriate characters for teaching vocation in the educational framework of Pakistan. A research study conducted at primary level to investigate the impact of students' mathematics self-efficacy on their mathematics performance and achievement. Shafiq Ahmed et al. (2012) examined the impact of self-efficacy on variables like test anxiety, self-regulated learning, school identification and academic success. Significant correlation was observed between students' self-efficacy and self-regulation for learning. An identifiable positive difference was also marked for academic achievement. Females also endorsed their resoluteness to join the test. Akram and Ghazanfar (2014) conducted a study to find out the correlation between students' self-efficacy and students' performance in the frame of their obtained CGPA on university level. The researchers measured students' efficacy scores for learning and their and academic achievement scores (calculating their CGPAs). They concluded that students with higher level efficacy beliefs indicated better academic performance and achievement. They further recorded gender differences in respect of self-efficacy as male learners reflected high efficacy beliefs as compared to female learners.

### **Objectives of the Study**

The study addressed the following objectives:

1. To find out the relationship between teachers' self-efficacy and students' academic achievement in the subject of mathematics.
2. To determine relationship between teachers' self-efficacy and students' academic achievement gender wise in the subject of mathematics.
3. To compare math teachers' self-efficacy gender wise.
4. To compare students' academic achievement gender wise in the subject of mathematics.

### **Hypotheses of the Study**

The following null hypotheses were tested in this study:

- Ho 1. There is no significant relationship between teachers' self-efficacy and students' academic achievement in the subject of mathematics.
- Ho 2. There is no significant relationship between male teachers' self-efficacy and their male students' academic achievement in the subject of mathematics.
- Ho 3. There is no significant relationship between female teachers' self-efficacy and their female students' academic achievement in the subject of mathematics.

### **Methodology**

The purpose of this study was to measure the self-efficacy beliefs of mathematics teachers at secondary school level and its relationship with students' achievement in mathematics and to determine gender differences in math teaching efficacy and math achievement in the context of Pakistan. Education system in Pakistan provides opportunities to learn mathematics in same-gender based institutions where male teachers teach boys and female teachers teach girls i.e. public sector secondary schools.

### **Population and Sample**

Stratified sampling technique was used in the present study. Since the subgroups male and female were involved, the researcher chose equal sized sample from each of a number of subgroups. The sample of the present study comprised of 576 respondents with a break up of 96 teachers (48 male and 48 female) and 480 students (240 male and 240 female) from six districts (Chakwal, Attock, Mianwali, Lahore, Leyyah and Muzaffar Garh) of the Punjab province.

### **Instrument**

Teacher Efficacy Scale (TES) was used to determine self efficacy of the teachers. TES was developed by Tschanned-Moran and Hoy (2001) which was translated in Urdu language. The teacher efficacy scale comprised of twenty four items. Under instrument the items are measuring the dimensions: classroom management, students' engagement in the classroom and instructional strategies. Developed (Urdu version) tool was then pilot tested and consulted with expert committee of three professors.

The finalized tool was, accordingly used to collect the data. Five point rating scale was used to collect teachers' efficacy beliefs about their capabilities to teach mathematics in the secondary classrooms. The calculated reliability of the instrument was 0.93. The classroom management sub factor reliability was 0.84. Sub factor student engagement in the class was 0.82. And instructional strategies sub factor reliability coefficient indicated 0.86.

## Results

Descriptive and inferential statistics were used for analysis. Pearson correlation was used to find out how teachers' self efficacy was correlated with students' academic achievement in mathematics. Further, *t*-test was used to find out gender differences.

**Table 1**

*Correlation between teachers' self-efficacy and students' academic achievement in the subject of mathematics*

Variable	Teacher efficacy score	Student achievement score
Teacher efficacy score	1	
Student achievement score	0.72	1

\* $p < 0.05$

Table 1 shows that there exists a strong correlation (0.72) between teachers' efficacy score and students' academic achievement score in the subject of mathematics. Therefore the null hypothesis revealed non-significant relationship between teachers' self-efficacy and students' academic achievement in the subject of mathematics was rejected.

**Table 2**

*Relationship between male teachers' self-efficacy and male students' academic achievement in the subject of mathematics*

Variable	Teacher efficacy score	Student achievement score
Teacher efficacy score	1	
Student achievement score	0.67	1

\* $p < 0.05$

Table 2 indicates a positive substantial correlation between male math teachers' self-efficacy score and their male students' academic achievement in the subject of mathematics, but this relationship (0.67) was not very strong. This may be due to the less interaction between male teachers and their male students during teaching and learning session.

**Table 3**

*Relationship between female teachers' self-efficacy and female students' academic achievement in the subject of mathematics*

	Teacher efficacy score	Student achievement score
Teacher efficacy score	1	
Student achievement score	0.75	1

\* $p < 0.05$

Table 3 indicates (0.75) high relationship between self-efficacy of female teachers and academic achievement of female students in mathematics. This high correlation (0.75) was more than male which is (0.67), this may be due to the reason that naturally a strong interaction exists between female teachers and their female students.

**Table 4**

*Comparison of Male Teachers efficacy score and Female Teachers efficacy score*

*t*-test: Two-Sample Assuming Equal Variances

	Female Teacher efficacy score	Male Teacher efficacy score
Mean	93.5	98.43
Variance	159.02	131.06
Observations	48	48
Pooled Variance	145.04	
Hypothesized Mean Difference	0	
<i>df</i>	94	
<i>t</i> Stat	-2.01	
P(T<=t) one-tail	0.02	
t Critical one-tail	1.66	
P(T<=t) two-tail	0.05	
t Critical two-tail	1.99	

\* $p < 0.05$

It can be seen from above table that male teachers' average efficacy score is greater than female teachers' average efficacy score the difference between the score is significant at 0.05 level of significance. It shows significant difference between mean scores of male and female teachers on self-efficacy.

**Table 5**

*Comparison of Male students' achievement score and Female students' achievement score  
Two-Sample Assuming Equal Variances*

*t*-test: Two-Sample Assuming Equal Variances

	<i>Female students achievements</i>	<i>Male students achievement</i>
Mean	221.39	233.58
Variance	1332.41	1201.35
Observations	48	48
Pooled Variance	1266.88	
Hypothesized Mean Difference	0	
<i>df</i>	94	
<i>t</i> Stat	-1.68	
P(T<=t) one-tail	0.05	
<i>t</i> Critical one-tail	1.66	
P(T<=t) two-tail	0.096	
<i>t</i> Critical two-tail	1.99	

\* $p < 0.05$

In table 5 average score of five students of each teacher is taken in to account. It is evident from the above table that there exists no significant difference between male students' academic achievement score and female students' academic achievement score, though both the groups have high academic achievement score.

## Discussion

The main objective of the study was to determine the direction and extent of relationship between mathematics teachers' efficacy and their students' academic achievement and to determine gender differences in math achievement at secondary level. Teachers' efficacy score was correlated with students' academic achievement score. Overall a high correlation (0.72) found between teachers' efficacy and students' academic achievement. In the context of Pakistan, this high correlation confirmed math teachers' capabilities to deliver content in understandable way, their expertise of knowledge and commitment to promote their students' higher order mathematics learning and achievement. We may rightly expect these teachers to translate the policy objective of mathematics teaching into reality at secondary level in the context of Pakistan. The correlation result of the present research supported the research findings of Pajares (1992). The researchers concluded that a useful research study reflects exact measurement of correlation between teachers' belief of their capabilities and students' academic achievement. Thus the findings established the relationship between the two variables and supported such other studies on the theme. The result also maintained the research findings of Tschannen-Moran and Hoy (2001) that teachers' effectiveness is directly related to students' academic achievement.



Substantial positive correlation (0.67) was observed between math male teachers' self-efficacy and their male students' academic achievement. This correlation was not very strong as stated earlier; it may be due to less interaction between math male teachers and their male students. In the context of Pakistan less interaction between male teachers and their male students may be due to weak friendly classroom climate. Substantial positive correlation (0.67) may support male math teachers' effectiveness; however it indicated a trend of weak democratic behavior during teaching and learning session.

The result also exposed a high correlation (0.75) between female math teachers' efficacy score and their female students' academic achievement score. Female math group indicated high correlation as compared to male math group correlation (0.67); it proved female math teachers' effectiveness to teach mathematics better to male math group in the context of Pakistan. It evidenced that there exist no gender differences in mathematics teaching-learning and achievement in the context of Pakistan. The present findings supported the research findings of Guiso et al., (2008) which revealed that gender math related differences were grounded in gender biased classroom culture. Countries that facilitated gender even learning opportunities, succeeded to control mathematics gender differences. It may rightly be claimed that in the context of Pakistan in public sector secondary level mathematics, gender differences were diminished or controlled. A global awareness for learning mathematics developed parental thinking trend to educate daughters with advanced mathematics learning that support females to empower them and promote their interest in math related careers like engineering, physics and technological sciences.

Comparison of efficacy score of male math teachers with their female counterparts revealed that there exists a significant difference at (0.05) level of significance between male teachers' efficacy score and female teachers' efficacy score. More confidence was observed in favor of male math teachers. Female math teachers are more careful to claim their potential of performance. It indicated that female math teachers still feel hesitation to express exact level of confidence upon their capabilities to teach mathematics. It is due to cultural bias that female teachers cannot perform better compared to male math teachers. This negative thinking trend may be eliminated among female math teachers by celebrating the recognition of their mathematics achievement in public under the supervision of relevant authorities.

Comparison of female math students' performance to male math students' performance revealed no significant difference at (0.05) level of significance. It indicated a positive change in female math learning and achievement in the context of Pakistan. It evidenced that female math students have equal potential to learn as that of male students in mathematics. It supported the research findings of Guiso, Monte,

Sapienza and zingales (2008). These researchers summarized that girls indicated keen interest in learning mathematics. They explained that gender differences diminished since female put harder efforts and invested more time to learn mathematics.

### **Recommendations**

Following recommendations were made:

Teacher self-efficacy proved an essential factor for effective math teaching. It is therefore, recommended that in-service math teachers' training may be imparted to update their content knowledge that inculcate their self-efficacy after every three years.

Workshops/seminars/conferences in mathematics teaching and learning may be held to share highly expert math teachers' knowledge and skills in the area of mathematics. It may strengthen math teachers' efficacy beliefs.

Female math subject specialist teachers may be given opportunity to deliver their knowledge and skills at math conferences. Sharing their expertise may strengthen their efficacy beliefs for mathematics effective teaching.

Female math teachers' high performance may be appreciated by the relevant competent authorities. It may promote female math teachers' belief upon their math teaching capabilities that consequently build their math teaching confidence in public schools in the context of Pakistan. In order to promote awareness about the importance of learning mathematics among female students, effective strategies and exemplary information related to mathematics may be furnished to young girls to enhance their interest in learning advanced mathematics.

Parents may be guided to facilitate their daughters to learn mathematics, as in the context of Pakistan it may not possible for girls to join engineering and the science disciplines, and math related other fields of technologies without proper support of their parents.

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