Journal of Positive School Psychology http://journalppw.com
2022, Vol. 6, No. 12, 2518-2526

Mathematics Self-Efficacy And Belief About Incremental And Entity Intelligence: A Study Of University Students In Gender Context

Dr. Sadaf Naz[1] , Dr. Habib Elahi[2] , Dr. Asaf Niwaz[3]

[1]*Assistant Professor, Department of Education Hazara University Mansehra, Pakistan Corresponding Author Email:sadafhu@yahoo.com*

[2]*Associate Professor, Department of Education Hazara University Mansehra, Pakistan Email: habib.elahi@yahoo.com*

[3]*Associate Professor, Department of Education University of Haripur, Pakistan. Email: dr.ansatti75@gmail.com*

Abstract

This study was designed to investigate the relationship of Mathematics self-efficacy and belief about incremental and entity intelligence among university students in Pakistan. It was a co-relational study having 450 (302 male and 148 female) students selected from seven public sector universities through stratified sampling technique. To achieve the desired objectives two research scales' were used. Students' academic achievement was measured by using their previous examination scores. The collected data was analyzed using t-test, and correlation analysis. The analyses of the study showed a significant positive correlation between students' Mathematics Self-efficacy and belief about Incremental and Entity belief about intelligence. A high level of Mathematics Self-efficacy is associated with Incremental belief and low self-efficacy is associated with Entity belief about intelligence. There was a significant difference in students' self-efficacy and belief about incremental and entity intelligence. This study concluded that male students possess a significantly higher level of self-efficacy in mathematics and hold an incremental belief about their nature of intelligence than their female counterparts. This study has important implications for teachers, curriculum developers, and counselors.

Keywords: Mathematics Self-efficacy, Incremental, Entity, University Students

Introduction and Background of the Study

Educators and Educational Psychologists have searched different environmental and personal factors that have a close relationship with the academic gains of the learners. One such factor is self-efficacy which has attained relatively greater popularity among researchers regarding the educational attainment of learners. It is the capacity and belief of the learners about themselves that they can do. Albert Bandura refers to individuals' beliefs about their capabilities to perform certain tasks. Self-efficacy depends on one's sense of control over his/her cognitive belief and environment that determines whether the behavior can make the necessary changes. For how long one can resist failure and how much effort is necessary? (Mirderikvand, 2016).

The power of self-efficacy is that it develops: a sense of commitment; the ability to face odd circumstances; the capacity to dispel disappointments; trust in hard work; motivation for achieving difficult goals. While in the absence of self-efficacy, usually the learners tend to be

avoiding challenging situations and feel a sense of inability to do certain tasks which further lowers the learners' level of confidence in addressing even routine matters.

Self-efficacy has remained the focus of concern in various disciplines, however, in the discipline of mathematics it has attained tremendous attention as mathematics is supposed to be comparatively more hard and complex work demanding (Ashcraft and Krause 2007). Numerous students struggle academically, display low self-efficacy in arithmetic, and are intimidated by math-related subjects. However, the study of mathematics is crucial for the advancement of science, industry, technology, and society because it is associated with more academic and professional prospects (Agwagah & Usman 2003).

'Self-efficacy in mathematics' is students' belief about their capability to succeed and learn in mathematics. Hackett & Betz, (1989) defined this concept as individuals' strong belief about their capability to accomplish or perform a particular mathematical problem.

The higher the student's level of confidence, the better their level regarding test attempts, material understanding, written assignments, skills acquisition, understanding difficult material, and better academic achievement in math (Liu & Koirala, 2009).

More importantly, students' belief about the nature of intelligence along with self-efficacy plays an important role in academic outcomes. Dweck has developed the idea of two different implicit theories of intelligence: entity and incremental (Dweck et al., 2003). Such theories of intelligence are rooted in students' line of thinking about the structure and function of intelligence. Bandura explained the importance of these two concepts by saying that cognition is the engine of intellectual behavior while self-efficacy beliefs are the fuel.

According to Dweck and Molden, (2005) as cited by Vahalíková (2013) students' set of thinking regarding their ability in terms of intelligence is based on two beliefs: i) Incremental, and ii) Entity beliefs. The former is the notion that intelligence is not a static phenomenon and is flexible changeable and can be improved with hard work (Blackwell, Trzesniewski, & Dweck, 2007). The latter concept of intelligence is considered as a fixed phenomenon that cannot be changed (Ahmavaara & Houston, 2007). These beliefs effect students' motivation and learning behaviors as expounded by Dweck, (1986). Similarly, Krakovsky (2013) explained that students having an Incremental and Entity learners beliefs think differently about "ability". If some students think that they can show off their ability then it is considered for them as fixed and something internal, yet others may think to improve their ability, then it seems to be changeable, malleable, and dynamic.

Students possessing the entity view of intelligence were involved in learning to gain respect from their teachers and parents, they want to get higher grades and avoid punishment. Their main concern is to protect their ego by showing off their appropriate amount of intellectual abilities. Mostly they use learning approaches like copying, guessing, or concentrating only on the expected exam material which they memorize for getting high grades (Abdullah, 2008). On the other side, students holding an incremental view of intelligence involve in learning for gaining better knowledge, understanding, insights and skills. These students are expending their essential efforts to learn something persistent and new in any difficult situation and they are developing new ideas and skills for mastering new things. They are engaging themselves in summarizing, note-taking, paraphrasing, elaborating, and questioning (Stipek & Gralinski, 1996).

Students are showing different levels of self-efficacy in terms of their respective beliefs. The research findings indicate that implicit theories (belief about the nature of intelligence)

can be able to predict self-efficacy as expounded by Purbaghban et. al (2013). Incremental belief about intelligence is significantly associated with academic self-efficacy. Students with Incremental beliefs about intelligence tend to show a high level of self-efficacy as Purbaghban et. al (2013) think. Students are showing a high level of self-efficacy, and believe that intelligence can be increased. They adopt mastery goals and deep learning strategies to gain high academic achievement. They employ a lot of struggles to achieve their goals. According to Purbaghban et. al (2013) by creating incremental intelligence belief in people, it is unnecessary to increase the area of self-efficiency.

Students with high self-efficacy likely hold an incremental belief (Dweck, 1986). Schunk & Pajares, (2001) are of the view that students with these strong beliefs are engaged in more difficult tasks, can expand greater efforts, and use better quality strategies in comparison to students having a low level of self-efficacy. Moreover, students set of believe affects their level of self-efficacy, motivation and academic achievement as Ilhan & Cetin (2013) believe.

In face of the above discussion, it can safely be concluded that through the incremental or fixed nature of intelligence, self-efficacy is a determining factor in students' learning. However many scholars have carried out investigations related to the impact or difference in this learning acquisition of the students regarding gender.

Gender Differences

According to Mundy, (2012) gender difference remains one of the greatest issues in human society. Gender differences are no exceptions in the academic arena. As a focus of this study, gender differences in terms of self-efficacy among mathematics students were identified by many researchers such as Pajares, (1997) and Louis and Mistele, (2012). Generally, girls show higher self-efficacy in languages, and arts, whereas in mathematics and science boys were reported to have higher self-efficacy (Meece, Glienke, & Burg, 2006). Betz & Gwilliam (2001) have also reported that when comparing the students in terms of beliefs male students poses comparatively high self-efficacy in both math and science subjects. Another researcher, Hendricks, (2012) argued that usually boys possess an incremental theory of intelligence while girls believe in the entity view of intelligence. Todor (2014) found that Girls in most cases believe in the entity theory of intelligence as a result of this tendency they are less efficacious in mathematics in comparison to boys.

Todor (2014) reported a significant relationship between self-efficacy in mathematics on the one hand and the implicit theories of intelligence on the other. According to the findings, students who possess strong self-efficacy beliefs usually believe in the incremental nature of intelligence. According to Alldred (2013), academic attainments and students' beliefs about their mental ability have a reciprocal impact on strengthening self-efficacy. This is worth noticing when students beliefs about the nature of intelligence is studies their self-efficacy needs to be taken into consideration. On the whole, the association of students self-efficacy in mathematics and their' belief about the nature of intelligence has been explored mostly in the Western context. Research is scarce in the Pakistani context in this regard, hence; there is a need to explore these important factors. Therefore, the current study is designed to explore, the relationship between students' self-efficacy in mathematics and their beliefs in intelligence in gender context at university level. The current study was focusing on investigating the association of students' Self-efficacy in Mathematics with their belief in Incremental and Entity Intelligence; and to find out gender differences in self-efficacy and Incremental and Entity beliefs about Intelligence.

The following hypotheses were formulated and duly tested:

Ho1: There is no significant relationship between students' self-efficacy in mathematics and belief about their intelligence.

Ho2: There is no significant gender difference in self-efficacy in mathematics and belief about intelligence.

Research Methodology

A quantitative research design was used in this study. Samples of 450 (both male and female) students were selected. These students were selected from 07 public sector universities through a random sampling technique. Two instruments were used: Mathematics Self-Efficacy Scale (MSES) and the Belief about an Incremental and Entity Intelligence Scale. MSES comprised twenty items where each item was to be ranked by the respondents on a 5-point Likert-type scale ranging from strongly agree to strongly disagree. For measuring students' belief regarding intelligence Dweck's (1999) scale was used and it consisted of 12 items where 7 items were related to incremental intelligence belief and 7 items were associated with entity intelligence belief. Items are ranked on a 5-point Likert scale of 1 to 5 with strongly disagree and strongly agree respectively. Both instruments were validated through expert opinions. After ensuring validity, both scales were pilot-tested and reliability was examined. Also, the required length of time for filling the questionnaire was made appropriate besides, removing/ clarifying the confusing statements. Through SPSS version 16, the items of the questionnaire were analyzed. For the sake of determining the reliability of the instruments, Cronbach's alpha coefficient was calculated for both scales which were found 0.96 and 0.97. Students' academic achievement was measured by using their previous examination scores.

Data collection and Analysis

All the participants were ensured of the confidentiality of their responses. The scales were administered to the selected sample. The data was collected after seeking the consent of students. Analysis of data was carried out through SPSS version 16. Furthermore, through Pearson correlation analysis the relationship between the two aspects of self-efficacy in mathematics and students' belief about the nature of intelligence was investigated. Together with this t-test was used to compare gender differences in both variables.

Results

Table 1 Analysis of Students' Self-efficacy in Mathematics and belief about their Incremental and Entity Intelligence

Variables	N	Pearson Correlations (r)	P value
MSE and Incremental and Entity beliefs	394	0.816**	0.00

P<0.05

Table 1 shows the relationship between students' self-efficacy in mathematics and their belief in incremental and entity intelligence. The results reveal a significant relationship (0.816 and $p<0.05$) between students' self-efficacy in mathematics and their belief in incremental and entity intelligence. This shows that students who have an incremental belief in intelligence possess high self-efficacy in mathematics.

Table 2 Gender-based Comparison of Respondents in Self-efficacy in Mathematics

S. No.	Gender	N	M	SD	t	p
1.	Male	272	70.58	19.50	2.67	0.008*
2.	Female	122	64.79	20.64		

P<0.05

Table 2 shows a gender difference in Mathematics Self-efficacy. The value of p is 0.008* which is greater than 0.05 reveals that there is a significant difference based on gender in MSE. The mean value of male students is (70.58), which is greater than the female students' mean value (64.79) which shows that the male Mathematics Self efficacy is greater than their female counterparts. Such difference is indicative of the fact that there exists a significant gender difference between the respondents in terms of self-efficacy in mathematics. This reveals that male respondents possess a higher level of self-efficacy in mathematics in comparison to female respondents.

Table 3 Gender-based Comparison of Respondents in terms of Belief about their Intelligence

S. No.	Gender	N	M	SD	t	p
1.	Male	272	40.50	12.62	2.40	0.017*
2.	Female	122	37.14	13.35		

P < 0.05

Table 3 reveals the gender-wise difference regarding beliefs about intelligence. The calculated value of p (0.017* < 0.05) indicates a significant difference between male and female respondents. The mean value of male students is (40.50), which is greater than the female students' mean value (37.14) shows a significant gender difference in belief about the nature of intelligence. Hence male respondents hold incremental belief while female respondents possess entity belief about the nature of intelligence.

Discussion

The major objective of the study was, to explore the relationship between university students' self-efficacy in mathematics and belief about the nature of intelligence regarding gender differences. In this context Bandura's (1977) theory of self-efficacy and Carol Dweck's (1999) 'Self-theory on Intelligence' served as the foundation of the present study. Two hypotheses were framed and duly tested to check the decided objectives. These hypotheses were tested as per the decided objectives. The first objective was designed to examine the association between students' self-efficacy in mathematics and their beliefs in incremental and entity intelligence. The related hypothesis was, H1, "there is a significant

relationship between students' self-efficacy in mathematics and belief about their nature of intelligence". As about this hypothesis the findings supported the hypothesis as there is a significant difference between students' self-efficacy in mathematics and belief about the nature of intelligence with statistical values being r=0.81 and p>0.05. Hence, this hypothesis was liable to acceptance. Such finding matches the investigations of many researchers such as Pajares and Kranzler, (1995); Zimmerman, Bandura, and Martinez-Pons, (1992), who also found that students with a strong belief in incremental ability are stronger in self-efficacy.

The second objective was set to explore the gender-based difference in students' self-efficacy in mathematics and belief about the nature of intelligence. For this objective the related hypothesis was, H2, 'there is a significant gender difference in self-efficacy in mathematics and belief about the nature of intelligence. The analysis of data revealed a significant difference in self-efficacy in Mathematics and belief about the nature of intelligence of both types of respondents. The level of self-efficacy among male respondents was higher than that of their female counterparts. Male respondents held strong beliefs about the nature of intelligence (incremental belief). Thus, the hypothesis was accepted. This finding is supported by many explorations carried out by researchers around the world (Skaalvik & Rankin, 1994); (Bandura, et al., 2001); (Adrian & Buchanan, 2005) and (Neumann et al. 2010). These scholars reported significant gender differences in their respective studies. They also concluded that compared to female, male students have a higher level of self-efficacy in mathematics and have a strong belief in Incremental ability.

Conclusions and implications

Based on the above discussion, it is concluded that there exists a significant relationship between students' self-efficacy in mathematics and their belief in intelligence. Students having a strong and high level of self-efficacy in mathematics tend to hold an incremental belief about their nature of intelligence. It was further concluded that male students have significantly higher levels of self-efficacy in mathematics and hold an incremental belief about their nature of intelligence than their female counterparts. Females possess an 'entity' theory of intelligence; hence they are less efficacious and competent in the subject of mathematics.

The current study will add to the body of knowledge because there is a gap in the literature especially, in the context of KP, Pakistan at the university level. This study will assist university teachers in understanding the concept of mathematics self-efficacy and their belief about the nature of intelligence to academically perform better. The results of this study will also assist policymakers and curriculum developers in understanding the significance of these ideas in fostering students' self-confidence. The current study will further help the students in academic settings in using some effective strategies to address stressful situations such as presentations, exams, etc. the study is helpful for researchers who intend to carry out studies in this arena.

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