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Self-concept and the Gender Differences in Mathematics

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Abstract:

Self and its correlates have always been of prime importance in classrooms. Learners in the classrooms develop and build an image of themselves, which suggest them their ability to perform in a particular academic domain (here in Mathematics). This review paper points towards the importance of study of self-concept and the gender differences in Mathematics, since it is a fundamental core subject in school curricula. The focus of the review is on tracing the findings of several studies and presents a thematic analysis of the related research evidence.

Some of the studies suggest that significant differences exist between boys and girls when self-concept is studied in academic performance, particularly in subject Mathematics. However contradictory results have also been underlined. The main purpose of this review is to map the past studies on self-concept and gender issues in Mathematics. The review also attempts to highlight the research gaps in the relevant knowledge.

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Key words: Self, Self-concept, Mathematics, Gender, Classrooms.

Theoretical Framework

> "Individuals cannot manufacture their self-concepts on their own, but significant others play a critical role in the formation of the self."
> (Shavelson, Hubner and Stanton, 1976)

The Self and the Gender

Gender differences in self-concept development play an important role in research that focuses on self-concept. Morse and Gergen (1970) have argued that since females are accorded lower social status in society, they have internalized this widespread cultural assumption about their inferiority, and thus damage has been done to their self-concept. Bardwick (1971, pp. 154-56) stated this same theme: "In this view both boys and girls are socialized to think of women as less competent, able and praiseworthy. As a consequence of reflected appraisals, girls come to see themselves as inferior- to have lower self-esteem". Rosenberg (1979) believed that females possess a lower level of self-esteem than males.

A review of the studies conducted on this topic has produced mixed results.

Some studies have indicated that boys show higher self-concept than girls. A study conducted on 80 children from first and fifth grade by Carpenter and Busse (1969) indicated that boys obtained significantly higher global self-concept scores than girls. Another study conducted by Rosenberg and Simmons (1975) with a random sample of 2,625 students from the third through the twelfth grades tested sex differences in student self-concept. The results of the study showed that girls were somewhat more likely to have lower self-esteem than boys. In a comparative study of self-esteem of 375 adolescents (between 14 and 16 years of age) among minority groups in

Britain, Louden (1980) reported that there was no significant difference in self-esteem among Asian, West Indian, and English adolescents. However, this study also showed that within each ethnic group, boys had significantly higher self-esteem than girls as measured by the Rosenberg Self-Esteem Scale.

While the studies that were presented earlier showed that boys possessed a higher self-concept than girls, other studies have refuted this conclusion and indicated that girls have a higher self-concept than boys. In a study of 605 fourth and sixth grade children Bledsoe (1961, 1967) found that at both grade levels girls obtained higher scores on general self-concept than did boys. Wendland (1967) used the Tennessee Self-Concept Scale to assess the global self-concept of 685, eighth-grade students: 176 white males, 161 white females, 151 black males, and 197 black females. He found that the black females had higher global self-concept scores than did the black males, and the white females had higher global self-concept scores than did the white males.

Coopersmith (1967) in a sample of 44 boys and 43 girls from fifth and sixth grade students found that boys and girls did not differ significantly in Coopersmith Self-Esteem Inventory. Simon and Bernstein (1971) compared self-concept scores of 61 boys with 68 girls from sixth grade students and reported an insignificant sex differences in the mean score as measured by Coopersmith Self-Esteem Inventory. Reschley and Mittman (1973) administered the Coopersmith Self-Esteem Inventory to 90 seventh grade students. The findings indicated that boys and girls did not differ significantly in their mean scores on the Coppersmith Self-Esteem Inventory.

Brush (1978) in his study of 189 college students found that girls received significantly higher scores than did boys on the Mathematics Anxiety Rating Scale which means that boys were less anxious than girls and boys were more confident than girls on this scale.

Comparing Gender Performance in Mathematics

Sherman (1980) tested sex difference in self-concept of Mathematics on a group of 75 boys and 135 girls. The findings of this study suggested that eighth grade girls and boys did not differ in their confidence and attitude towards Mathematics. However, significant differences were found in eleventh grade where girls perceived themselves as less able in Mathematics than boys.

Meece, Parsons, Kaczala, Goff, and Futterman (1982) reviewed the literature concerning sex differences in self-concept. They reported that few studies have found sex differences in self-concept of Mathematics ability before the junior high school grades, but large and consistent differences have been found after the seventh grade. A large number of studies testing sex differences were carried out using the Self Description Questionnaire (SDQ) by Marsh and co-researchers. The following are some of these studies: Marsh, Relich and Smith (1983) examined sex differences on the SDQ1 for fifth and sixth grades, 655 boys and 498 girls ranging in age from 9 to 13 years, and found that girls had higher self-concept in reading and general school ability and lower self-concept in physical ability, appearance and Mathematics.

In a study of 901 Australian high school students (grades 7-12), Marsh, Parker, and Barnes (1985) found statistically significant sex differences in English and Mathematics self-concept, independent of grade level. The girls had higher English self- concept scores, whereas the boys had higher Mathematics self-concept scores.

Marsh, Smith and Barnes (1985) investigated sex differences in multiple areas of self-concept for 559 fifth grade students. The finding of this study revealed that boys had significantly higher self-concept of physical ability, appearance and Mathematics, whereas girls had significantly higher self-concept in reading. Furthermore, boys did not significantly

differ from girls in the self-concepts of peer and parent relations, general school ability and general self-concept.

Stevenson and Newman (1986) in their study of 255 tenth grade students found that boys had more positive self-attitude towards Mathematics than girls and the girls had more positive self-attitude towards reading than boys. Marsh, Byrne and Shavelson (1988) studied sex differences in the 12th grades: 516 boys and 475 girls, with 3 different academic self-concept instruments including the academic scale from SDQ III. For each of the 3 instruments, boys had a significantly higher self-concept of Mathematics than girls. On the other hand, girls had a significantly higher verbal self-concept than boys.

In a comparative study by Kauchana (2002), gender differences in Mathematics self-concept of Indian and American undergraduate college students was investigated. The sample consisted of 196 American students (63 male and 133 female) and 150 Indian students (45 male and 105 female) from Chennai, India. A self-concept description questionnaire intended for use by adolescents and young adults 16 to 25 years was used. For the Indian sample, the mean score for males and females were 4.82 and 4.18 respectively, and the results indicated that male college students has a significant higher Mathematics self-concept ($t = .17$, $p < 0.01$) than female college students. However, difference in Mathematics self-concept between Indian students (mean = 4.38) and American students (mean = 4.51) did not reach statistical significance. In his view, it is indeed a challenge to the Indian culture, to enhance the self-concept of all students, while retaining the sense of belongingness of both the sexes. The findings in the above mentioned studies appear to support the notion that boys have higher Mathematics self-concept than girls; however, some studies have reported contradictory findings.

Skaalvik and Skaalvik (2004), explored whether there are still differences in general Mathematics and verbal self-concepts in 6th, 9th and 11th grades Norwegian students and in

adult students enrolled in senior high school. The participants were 907 students in 6th grades (n= 277:129 boys and 148 girls), 9th grade (n = 239:115 boys and 124 girls), 11th grade (n= 264:128 boys and 124 girls) and adult students enrolled in 1st year of senior high school (n= 127:48 male and 79 female). The results indicated that in all samples male students had significantly higher Mathematics self-concept than female students. The t-values were 6th grade (t = -2.46), 9th grade (t = -3.36), 11th grade (t = -4.66) and adult students (t = -2.66) at 0.05 level of significance.

In an international study, Wilkins (2004) reported, on average, a difference in Mathematics self-concept between male and female students that was statistically significant and favours males (Gamma = 0.08), $p < 0.001$). However, he noted that although, globally, males tended to have higher self-concept than females in Mathematics, there were some countries in which the gap was minimal or even slightly reversed.

In a study by Russilo and Arias (2004), they examined gender differences in various cognitive motivational variables (causal attributions, goals, self-concept and use of learning strategies) and in performance attained in Mathematics and language arts. The sample of the study was 521 secondary students (285 female and 236 male) in Spain. The result indicated no statistically significant gender differences in Mathematics self-concept ($t = 1.14$, $p < 0.05$). In another study, Marsh, Trantwein, Ludtke, Koller and Baumert (2005) investigated the effects of prior self-concept on a variety of academic outcomes (i.e. interest, school grades and standardized scores) and also gender differences in the constructs. The study was based on a longitudinal data from two nationally representative samples of 7th grade students (study 1: N = 5649; study 2: N = 2264) in Germany. The results indicated that there were stereotypic gender differences in the mean-level of Mathematics self-concept. However, they

observed that, patterns of relations among Mathematics self-concept, interest in Mathematics, Mathematics test scores and Mathematics school grades were similar for both boys and girls.

Mathematics: For Boys or Girls?

Research on gender differences in self-concept has produced an inconsistent pattern of finding, with some studies showing that boys have higher self-concepts and others finding no differences. According to Skaalvik and Skaalvik (2004), observed gender differences in Mathematics and verbal self-concepts are most frequently explained in terms of gender stereotypes and differential role socialization patterns. In their view, when it is gender types, Mathematics is viewed as male domain (whereas language arts are viewed as female domains). Furthermore, they argued that gender stereotypes may lead to differences in socialization patterns that may fail to reinforce positive attitudes, motivation and self-concept in Mathematics for girls (language arts for boys).

According to Liu (2009), boys and girls show similar interest in Mathematics during the elementary school. However, during secondary school, boys tend to be more interested in learning Mathematics than girls and in her view; this difference tends to enlarge by adolescence. Furthermore, Ahmed and Bruinsma (2006) suggested a positive relation between academic self-concept and interest in academic tasks, which would explain any avoidance of Mathematics by boys or girls.

In a comparative study between USA and China, Liu (2009) investigated gender differences in affective factors (self-concept inclusive), and how these variables affect Mathematics achievement of 5 year olds. The participants were 5465 students (50.10 % males) in the USA and 4478 (49.60 % males) in Hongkong. The results indicated that in the USA, male students reported significantly higher self-concept in their

general Mathematics ability than female students ($z = 8.98$, $p < 0.01$). A similar pattern was found with Hongkong students, where male students reported significantly higher Mathematics self-concept of ability ($z = 8.44$, $p < 0.01$).

Concluding Thoughts

In all, from the cited studies, gender differences continue to provide contrasting findings. It is not clear whether gender differences in Mathematics self-concept are diminishing or not. Many researchers believe that self-concept is a very important personality variable for the prediction of academic achievement. Therefore, self-concept literature reveals a plethora of studies which examine the relationship between self-concept and Mathematical outcomes but the results of these studies have been diverse. While some researchers (Coopersmith, 1959; Kunce et al., 1972; Leonardson, 1986) reported significant relationship between self-concept and academic measures, others (Hall, 1972; Albott and Haney, 1972; Marx and Winne, 1975; and Keith et al. 1986) reported a non-significant relationship between the two constructs.

Studies reporting high correlations (Zarb, 1981; Jordan, 1981; Byrne, 1986; Mboya, 1986; Pottebaum, Keith and Ehly, 1986) have generally measured academic self-concept rather than global self-concept, which has been found to have low correlation to academic achievement. Moreover, it is especially important to note that the highest correlations reported are between academic achievement in specific subject areas and these subject-specific self-concepts (as opposed to academic self-concept). For example, Marsh, Relich and Smith (1983) found the highest correlation for Mathematics achievement with Mathematics self-concept ($r = 0.55$), while Mathematics achievement was less correlated with self-concepts in other academic areas ($r = 0.21$ with self-concept of reading) and was uncorrelated with regard to non-academic self-concepts.

Studies concerning gender differences in self-concept also produced mixed results. Some studies (Louden, 1980; Olowu, 1985) have indicated that boys show higher self-concept than girls. Other studies have shown that girls have higher self-concepts than boys (Schroeder, 1973 and Chapman et al., 1984). In addition to these, studies of Zuckerman, 1980; Meece et al., 1982; Calhoun and Sethi, 1987 have not found any significant differences in self-concept with respect to gender.

The authors here have made attempt, to illuminate various inconsistent findings obtained by previous researchers. This is done by using an adequate review which is based on a clear definition of self-concept given by Shavelson, Hubner and Stanton, 1976. In all, on the basis of cited studies, the review concludes with the argument that gender differences continue to provide contrasting findings. It is not clear whether gender differences in Mathematics self-concept are diminishing or not. Hence, gender difference in Mathematics self-concept requires further study, especially with reference to the learner's culture, Mathematics performance and the classroom environment.

Implications and Suggestions

Research specialists in Mathematics teaching-learning, those who prepare learners, teachers and develop curricula, must search for new and better ways for teaching their subject and to develop the self in Mathematics. If learning experiences are positive, self-concept is enhanced but when they are negative, it suffers. Academic self-concept is also important to teachers because it strongly interacts with school performance. As children enter school, they expect to learn and do well, but as they progress, actual accomplishments lead them to alter this expectation. Hence, a teacher should make an effort to increase the 'I can do' approach in students. As part of their normal classroom teaching, Mathematics teachers should encourage

positive students' self-concepts over and above the development of learner's knowledge and skills.

Wilkins (2004) suggested that a person's self-belief in his ability to do well in a given subject is related positively to respective achievement in the same area. This view is supported by Huitt (2009) and Pajares and Schunk (2001) who posited that when domain-specific self-concept is compared with achievement in the same area (e.g. self-concept and achievement in Mathematics), the relationship is positive. Therefore, our schools and classrooms must provide an opportunity to both the learners (male and female) to build a belief on them for doing better in Mathematics. Similarly, parental self-concept and the role of peer-groups may also bring some positive changes in the attitude of learners towards Mathematics and other subjects, thus raising the academic performance level of the individual.

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