# Gender Differences in Math and Verbal Self-Concept and the Impact on Academic Achievement

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## Abstract

This study examined the relationship between academic domain specific self-concept (specifically mathematical and verbal) and the academic achievement in mathematics and English of young adolescents. Middle school students in grades seven and eight ranging in age from 12 to 15 years completed three subscales of the Self-Description Questionnaire-II (general school, verbal and mathematical self-concept). Results indicated that females displayed lower levels of mathematical self-concept while males displayed lower levels of academic self-concept, verbal self-concept and verbal achievement scores. No significant gender differences were found in mathematics achievement. Educational implications are discussed.

## Introduction

Marsh, Byrne and Shavelson (1988) posited that the sense of self or the self-perception of adolescents is multifaceted and falls into a structured hierarchy with identifiable levels, as opposed to one broad overall view of the self. At the top of the hierarchy, is the youth's Global self-esteem, which encompasses an individual's overall view of him or herself (Rosenberg, Schooler, Schoenback, & Rosenberg, 1995). This level further divides into Social self-concept, Academic self-concept and Physical Appearance self-concept. Academic self-concept in turn subdivides into more domain specific school self-concepts, including Verbal self-concept and Mathematical self-concept. With respect to these (i.e., verbal and mathematical self-

concept), research has shown that a strong positive correlation exists between Verbal self-concept and verbal achievement (as measured by grades in English) and Mathematical self-concept and Mathematics achievement (Skaalvik, 1994).

Furthermore, previous research examining self-concept and academic achievement amongst high school students has found that females tend to have significantly higher verbal self-concept and English grades, while males tend to have significantly higher mathematical self-concept and mathematics grades (Skaalvik 1994). In the elementary grades however, research has shown that females tend to outperform males in both English and mathematics, and tend to have higher overall academic self-concept (Mboya, 1989). This shift in mathematics achievement for females, as well as the low verbal self-concept for males, led to the present study.

The primary focus of this study was to examine the relationship between domain specific self-concept and academic achievement for young adolescents. Specifically, a first purpose was to explore the relationship between mathematical self-concept and mathematics achievement for females between the elementary years (time when they outperform males) and the high school years (time when they score significantly lower than males). A second purpose was to examine verbal self-concept for males during this transition period to determine the effects on English achievement.

While the constructs being examined in this study have been tested in previous research, the age group this study focuses on (early adolescents) is an area

where empirical data is lacking. Despite the recognized vulnerabilities of self-concept for youth aged 11 – 15 and the knowledge that it is at this age when individuals struggle to form their own identity (Erikson, 1968), psychological research is lacking with respect to how these changes impact academic achievement in specific subject areas and gender differences in achievement as a function of domain specific self-concepts.

Method and Data Source

Grade seven and eight students (N = 124) ranging in age from 12 to 15 years participated in the study (63 males & 61 females). Participants completed the General School, Verbal and Mathematical subscales of the *Self-Description Questionnaire-II* (*SDQ-II*) (Marsh, 1990) to measure Academic self-concept, Verbal self-concept and Mathematical self-concept respectively. The *SDQ-II* is designed to measure different elements of self-concept in younger adolescents (i.e., students in grades 7 through 10) and contains 11 self-concept scales. Only the three academic subscales, General School (which is synonymous with overall academic self-concept), Mathematical and Verbal, were used in this study. Scores on the *SDQ-II* subscales were divided into quartiles to indicate high and low self-concepts. The upper quartile of the sample was indicative of high self-concept and the lower quartile was indicative of low self-concept.

Current grades in both English and mathematics were collected as a measure of academic achievement in those areas. All measures were administered on a school day and during class time.

## Results

Chi-square results indicated that while no significant relationship was found between gender and mathematics achievement (Table 1.0), females did have significantly lower levels of mathematical self-concept than males (Table 2.0). Males on the other hand had significantly lower levels of academic self-concept (Table 3.0), verbal self-concept (Table 4.0), and English achievement scores (Table 5.0). Correlational analyses indicated that all examined levels of self-concept were positively correlated with academic achievement in both math and English. However mathematics achievement displayed the strongest correlation with math self-concept and English achievement displayed the strongest correlation with verbal self-concept (Table 6.0).

Insert Tables 1.0 to 6.0 here

## Discussion and Educational Importance

The findings did not support the hypothesis that males would reach higher levels of mathematical achievement than females. Instead it was discovered that males and females did not significantly differ in their mathematical achievement

level. This contradicts the social stereotype that males have superior mathematical abilities (Halpern, 1992) and may be linked to the recent push for females to enter non-gender scripted occupations (i.e., engineering and science). Research has demonstrated that performance in math drops for females once they reach high school. It could be argued that the lower levels of mathematical self-concept for females during early adolescence, which is a vulnerable period of time, may result in a decline in math scores in later grades. Furthermore, adolescent girls may simply be buying into the stereotype that males are superior in mathematical abilities, and may thus have less confidence in their ability to perform well, despite having equal mathematics achievement levels as males. Because this study examined students at the junior high/middle school level, it is possible that the grade decline for females had not yet begun. Middle school educators should focus on enhancing mathematical self-concept especially for females so that grades remain strong throughout the formal education years and into post-secondary.

Social stereotypes were supported in the relationship between gender and English achievement. That is, females were more likely to achieve grades in English that fell above the class average. This phenomenon may exist due to biological differences. Research has demonstrated that females are superior at tasks that require linguistic skills (Halpren, 1992). Females also displayed higher levels of verbal self-concept than males. This was not surprising given the strong correlation between English achievement and verbal self-concept. If males were encouraged and

supported in the verbal domain, their verbal self-concept could perhaps be increased, which in turn could result in higher English scores.

Males were also more apt to have lower levels of academic self-concept. One reason for this may be that males tend to receive more negative attention in the school systems. Research studies have demonstrated that males consistently get in trouble more often than females, and are rated less positively by teachers (Berk, 2000). As a result, males may regard school more negatively and as a result have less confidence in their abilities. Previous research has virtually ignored this correlation; therefore this finding contributes significantly to the literature and could guide further research into this relationship.

To conclude, educators should focus on developing students skills and study strategies in order to improve their scholastic confidence, which in turn can impact achievement in higher grades. Educators should also continue to encourage females in mathematics in an effort to make them feel good about their mathematical abilities, and encourage males in English in an effort to increase verbal self-concept. This is essential given that both math and verbal self-concept impact academic self-concept, which in turn affects overall school performance. Our goal as educators is to maximize performance and encourage students to feel good about themselves and their potential. Much of this will involve dispelling gender stereotypes with respect to subject specific achievement and career goals.

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Table 1.0 Math Achievement Scores by Gender

| | Female | Male |
|---|---|---|
| Below Average (< 75%) | 23 (37.7%) | 20 (31.7%) |
| Above Average | 38 (62.3%) | 43 (68.3%) |
| Total | 61 | 63 |

$\chi^2 = .49(1), p = .486$

Table 2.0 Mathematical Self-Concept Level by Gender

| | Female | Male |
|---|---|---|
| Low Mathematical Self-Concept | 19 (65.5%) | 11 (35.5%) |
| High Mathematical Self-Concept | 10 (34.5%) | 20 (64.5%) |
| Total | 29 | 31 |

$\chi^2 = 5.41(1)$, $p = .02$

Table 3.0 Academic Self-Concept Level by Gender

| | Female | Male |
|---|---|---|
| Low Academic Self-Concept | 10 (33.3%) | 21 (65.6%) |
| High Academic Self-Concept | 20 (66.7%) | 11 (34.4%) |
| Total | 30 | 32 |

$\chi^2 = 6.45(1)$, $p = .01$

Table 4.0 Verbal Self-Concept Level by Gender

| | Female | Male |
|---|---|---|
| Low Verbal Self-Concept | 9 (31.0%) | 22 (68.8%) |
| High Verbal Self-Concept | 20 (69.0%) | 10 (31.3%) |
| Total | 29 | 32 |

$\chi^2 = 8.66(1), p = .003$

Table 5.0 Verbal Achievement Scores by Gender

| | Female | Male |
|---|---|---|
| Below Average (< 75%) | 11 (18.0%) | 27 (42.9%) |
| Above Average | 50 (82.0%) | 36 (57.1%) |
| Total | 61 | 63 |

$\chi^2 = 8.99(1), p = .003$

Table 6.0 Correlation Coefficients

| | Academic self-concept | Verbal self-concept | Mathematics self-concept | English achievement | Mathematics achievement |
|---|---|---|---|---|---|
| Academic self-concept | 1.0 | .89** | .68** | .77** | .55** |
| Verbal self-concept | | 1.0 | .32 | .80** | .38** |
| Mathematics self-concept | | | 1.0 | .29* | .68** |
| English achievement | | | | 1.0 | .39** |
| Mathematics achievement | | | | | 1.0 |

* $p \leq .0$, ** $p \leq .01$