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Gender Differences in Students' Mathematics Self-Concept and Academic Burnout

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Abstract

Background: Mathematics self-concept and academic burnout are one of the most important psychosocial factors in academic achievement.
Objectives: The current study aimed to compare gender differences in mathematics self-concept and academic burnout in the students.
Methods: The sample included 140 male and 90 female first-grade high school students selected via one-stage cluster sampling method. The current descriptive study applied mathematics self-concept scale by Radi in 2011 and also school burnout inventory by Salmela-Aro, Naatanen in 2004. Data were analyzed using independent t-test.
Results: The results showed that the mean of scores in mathematics self-concept and its subscales components (skills and capabilities, mathematics enjoyment and mathematics avoidance) were not significantly different between male and female students ($P > 0.05$), while the mean scores of academic burnout and its components (exhaustion, cynicism, inadequacy) were higher in male students ($P < 0.05$).
Conclusions: Mathematics self-concept and its components were the same between male and female students, but academic burnout and its components were higher in males than females.

Keywords: Mathematics Self-Concept, Academic Burnout, Gender

1. Background

To investigate the term mathematics self-concept, first the word "self" was evaluated. This word is already studied by many scholars. For instance, Kimble defines "self" as the individual's set of feelings and thoughts about himself/herself and his/her unique way to react to the surrounding environment (1). Murphy defines "self" as individual's feelings and understandings that he/she has about his/her existence, which gradually becomes completely abstract; he also believes that all his/her feelings and actions are formed based on social requirements and his/her benefits (2). 'In addition, "self-concept" is the core of Roger theory to form the individual's extensive perspective on himself/herself (3). In other words, "self-concept" is the individual's recognition of his/her characteristics, attributes, deficits, capabilities, values and interactions in terms of his/her identity (4). Self-concept is generally the individual's concept of himself/herself reinforced by others' evaluations (5).

A large number of studies investigated self-concept. Sharifzade et al. found a positive relationship between high levels of self-concept and academic success (6). In the study by Nagy, self-concept in female students was higher than that of male students (7).

Mathematics, as a scientific issue, constitutes an indispensable part of curriculum of educational systems in most countries, from elementary school to university and is one of the most outstanding indexes of academic success to reach a position in higher education. Actually, mathematics is a colander for students who desire to continue a profession in scientific and engineering fields (8). In mathematics training, students do not merely learn concepts such as numbers, equations, series and functions, but how to reason and apply this knowledge in real every day events such as money counting and measuring, as well as learning complicated calculations in future professions (9).

In recent years, mathematics anxiety is a common concern for the educational authorities in many countries, even the developed ones. Scientific and industrial advancements and the employment of computers in academic and professional fields and unpleasant consequences of math anxiety on academic success and attitude toward math which requires mathematics efficiencies to occupy certain kinds of positions, led educational policy makers and aca-

demic planners to effectively cope with this phenomenon (10). Given the fact that mathematics anxiety is the result of students' frustrating performances in mathematics issues, it is not surprising to expect higher levels of mathematics failure in the last high school years for those with experiment of repetitive failures on math in elementary period or the first years of high school. To improve mathematics learning in the second-grade high school students, and eliminate negative attitudes and fears toward mathematics, methods of coping with negative thoughts regarding pervious failures should be trained (11). Therefore, improving mathematics self-concept in such students requires providing them with opportunities to achieve new positive experiences and only in this case achieving logical mathematics advancements can be expected.

Githua and Mawanji reported that mathematics self-concept relates to gender; although this relation depends on organizational structure of schools (e g, single-gender or coed) as well as students' grades (12). The results of their study showed that self-concept did not significantly differ in male and female students in the elementary period; however, it gradually changed in high school period. In addition, they inferred that the relationship between mathematics self-concept and gender depends on the organizational structure of the school; actually, mathematics self-concepts of male and female students was significantly different in coed schools but it just slightly differed in single-gender ones. In other words, female students in coed schools evaluated their mathematics abilities less than those of male students, but it was not the case in single-gender schools.

Based on the reduction of gender differences in mathematics performance, Kiyamanesh concluded that not every kind of gender differences should be attributed to sex differences. These scholars attributed gender differences in mathematics advancement to cultural beliefs, and differential socialization of females and males, and considered that social and cultural issues play an important role in this difference. That is why they put the word "sex" against "gender", since gender refers to social and cultural aspects of differences while sex relates to a biological relatively permanent base (13).

Outcomes of a study on male and female students of three countries including Canada, Norway and the United States showed that mathematics self-concept was a strong predicting factor for mathematics advancement in the three countries (14). Yarmohammadivasel examined predicting factors of mathematics anxiety and their relations with academic failure in guidance school period. It was shown that among various studied variables (e g, mathematics motivation, academic motivation, mathematics self-concept and students' attempts), mathematics self-concept had a negative and inverse relationship with mathematics anxiety (R = -0.67) and was among the main predicting factors of mathematics anxiety (Beta = 0.49) (15).

Academic burnout was also examined in the current study due to its recognized effects on academic performance (16). Boudreau et al. claimed that academic burnout relates to experiencing frequent stress, long hours of simultaneous working and studying, concern for academic scores, ambiguity of future, low levels of control over situations, lack of satisfaction with the imbalance between personal and professional life, and low levels of perceived support from peers and friends (17).

Initially, burnout was commonly known as job burnout. Schaufeli, Maslach and Marek considered job burnout as a psychological syndrome consisted of emotional exhaustion, depersonalization and decreased personal accomplishment (18). However, in recent years, the burnout meaning is extended and entered into academic context, called academic burnout (19). Several researchers reported negative consequences of academic burnout such as academic failure, depression and negativism (20-22). Most studies on burnout examined this concept in teachers (23, 24), nurses (25, 26), consolers (27) and staff of health services (28).

Based on the theory of job burnout, this concept has three components including emotional exhaustion, cynicism and academic inadequacy. Emotional exhaustion manifests as feeling pressure mainly caused by excessive educational activities; cynicism is shown in negative or neutral attitudes toward school works, lack of interest in works related to education and considering them as meaningless; academic inadequacy may emerge as low level of merit feeling and lack of feeling successful in doing school homework or performance. The concept of academic burnout overlaps with other concepts including sleep problems, concern and mental rumination (29). However, Ahola and Hakanen stated that psychological pressure, anxiety, and depression symptoms are not specific to a special situation; while academic burnout occurs only in a school-related context (30).

Results of the study by Mikaeli on the relationship between self-concept and academic burnout and academic performance of female students in Ardabil with a sample size of over 400 students, after analyzing the data, using Pearson correlation coefficient and MANOVA, showed a significant relationship between mathematics self-concept and academic burnout and its components, exhaustion, cynicism, inadequacy (31).

Given the importance of these two mentioned variables, the present study aimed to find if mathematics self-concept and academic burnout differ significantly be-

tween male and female first-grade high school students.

2. Objectives

The present study aimed to compare gender differences in mathematics self-concept and academic burnout in students of Bostan-Abad, East-Azerbaijan province, Iran.

3. Methods

The current descriptive study included all male and female students of Bostan-Abad County, East-Azerbaijan, Iran, in 2014 - 2015 (n = 522). To form the sample, single-stage sampling method was used. First, among all high schools of Bostan-Abad County four schools were selected and due to the higher number of male students (n = 334) compared to female ones (n = 188), categorical random sampling method was applied. Finally, using the Morgan table, the volume sample was determined 230 students and 20 more students were added due to probable sample reduction; finally 90 female and 140 male students were selected for the statistical analysis.

3.1. Mathematics Self-Concept Scale

The mathematics self-concept scale was first developed by Marsh in 1983 based on the multifaceted hierarchical model of Marsh and Shavelson concept of self to assess mathematics self-concept. This questionnaire was derived by Githua and Mawangi (from Marsh revised mathematics self-concept scale, 1990) using math-related factor analysis with 12 items based on the Likert scale (32). This questionnaire and the short anonymous questionnaire used in trends in international mathematics and science study (TIMSS) tests were combined and items were added up to 25. After the pilot study, five questions were removed and in the final administration of mathematics self-concept scale by Radi (2011), its reliability and validity were tested and confirmed by Dr. Saleh (33). The reliability of the scale was 0.89 and its discriminant validity was significant at lower than 0.01. The criterion validity of the scale was 0.76. The construct validity of the three components were demonstrated; skills and capabilities, mathematics enjoyment, and mathematics avoidance; the Cronbach's alpha was calculated for these subscales as 0.83, 0.84 and 0.51, respectively (33). In the present study, the reliability of mathematics self-concept scale was 0.93, using Cronbach's alpha, and for skills and capabilities, enjoying math and avoiding math components were 0.90, 0.88 and 0.62, respectively.

3.2. School-Burnout Inventory

Salmela-Aro et al. designed school burnout inventory (SBI) based on Burgen burnout scale (34). SBI has fifteen items, among which five items assess emotional exhaustion (1, 4, 7, 10, 13), four items assess cynicism (2, 5, 8, 11) and six items assess inadequacy (3, 6, 9, 12, 14, 15). Students are asked to indicate their agreement with each item on a 7-point Likert scale (Never = 0, Always = 6). In the study by Badri et al., Cronbach's alpha for the whole SBI was computed 0.86 and 0.77, 0.78 and 0.84 for subscales of emotional exhaustion, cynicism and inadequacy, respectively (35). In the current study, Cronbach's alpha was 0.86 for the whole SBI, and 0.71, 0.69 and 0.77 for emotional exhaustion, cynicism and inadequacy subscale, respectively.

4. Results

Descriptive findings of the whole sample were as follows.

According to Table 1, the mean of scores in mathematics self-concept and its components is slightly higher in female students.

Table 2 shows that the mean scores of academic burnout and its components were significantly higher in male students.

Independent T- test was performed to examine the difference between male and female students in terms of mathematics self-concept and academic burnout.

According to Table 3, the independent T-test was conducted to compare the scores of mathematics self-concept and its subscales among female and male students. For mathematics self-concept variable, no significant difference was observed between the scores of males (m= 50.84, SD = 12.57) and those of females (m = 52.46, SD = 12.22), P = 0.277, t (228) = -1.09. Also, for the components of mathematics self-concept (skills and capabilities, mathematics enjoyment, and mathematics avoidance) the difference between the scores of males and females was not significant (P > 0.05). Hence, it can be concluded that mathematics self-concept and its components were equal among males and females.

According to Table 3, the independent T-test was conducted to compare the scores of academic burnout and its components among females and males. For academic burnout variable, the scores of males (m = 42.50, SD = 15.89) were significantly higher than those of females (m =33.08, SD = 11.04), P = 0.001, t (228) = 4.90. Also, for the components of academic burnout (exhaustion, cynicism and inadequacy) the difference between the scores of females and males was significant (P < 0.05). Hence, it can be concluded that academic burnout and its components were higher among males compared to females.

Table 1. Descriptive Characteristics of Academic Self-Concept and its Components Based on Gender

Variable	Male			Female		
	N	M	SD	N	M	SD
Mathematics self-concept	140	50.84	12.57	90	52.66	12.22
Skills and capabilities	140	27.69	3.89	90	28.81	3.98
Math enjoyment	140	15.09	3.35	90	15.70	2.97
Math avoidance	140	7.29	2.34	90	7.32	2.20

Table 2. Descriptive Characteristics of Academic Burnout and its Components Based on Gender

Variable	Male			Female		
	N	M	SD	N	M	SD
Academic burnout	140	42.50	15.89	90	33.08	11.04
Emotional exhaustion	140	14.01	6.06	90	10.06	4.00
Cynicism	140	7.64	3.78	90	5.46	3.12
Inadequacy	140	18.32	7.86	90	15.61	6.46

Table 3. Results of T-test to Compare Mathematics Self-Concept and Academic Burnout in Male and Female Students

Variable	T	Df	Sig.	Partial Eta Squared
Math self-concept	-1.09	228	0.277	0.005
Skills and capabilities	-1.54	228	0.065	0.010
Math enjoyment	-1.45	228	0.148	0.009
Math avoidance	-0.10	228	0.924	0.000

Table 4. Result of T-test to Compare Academic Burnout and its Components in Male and Female Students

Variable	T	Df	Sig.	Partial Eta Squared
Academic burnout	4.90	228	0.001	0.095
Emotional exhaustion	5.47	228	0.001	0.116
Cynicism	4.57	228	0.001	0.083
Inadequacy	2.72	228	0.001	0.031

5. Discussion

The current study aimed to compare gender differences in mathematics self-concept and academic burnout in high school students. The results revealed no significant difference between the two genders in terms of mathematics self-concept, which was consistent with the findings of Kiyamanesh et al. (13), but in contrast to that of Githua and Mawangi (12). To explain this finding, Tapia and Marsh expressed that although females feel social and cultural pressures at all ages which help them to form their attitudes toward math as an studied issue or a component of future profession, a good feeling about mathematics relates to the individual and his/her personal experiences rather than gender (10). According to the reported findings it can be assumed that difference in mathematics self-concept between male and female students is obvious at lower ages, but it somehow disappears after the age 13.

Additionally, the current study found that academic burnout was higher in male students, while Schoon and Silbereisen reported higher levels of academic burnout in female students (36). Salmela-Aro et al. also concluded that academic burnout and its components were increasing among male college students (37). Bruce in his study

on recognizing stress sources and prevention of burnout inferred that various factors including deficit in social support, excessive stress and personality characteristics could bring about burnout (38). Usually, those who experience academic burnout show signs of reluctance to educational materials and do not attend classes continuously, are suspicious of the application of courses, lack eagerness to complete assigned homework and feel unable to learn materials.

Since the current study was performed on the first grade high school students of Bostan-Abad County, its findings cannot be generalized to the students of other grades or academic students. It is recommended to perform similar researches on mathematics self-concept and academic burnout in various grades in other provinces of Iran. Outcomes of the present study revealed the necessity to provide students with an opportunity to receive education counselling to reduce the risk of negative mathematics self-concept, and in turn, their academic burnout.

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