Student's psychological factors and science performance: does gender matter for Iranian Students

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Abstract: This study examined whether, self-efficacy, science self-efficacy, general self-concept, science self-concept, self-esteem, anxiety, and science anxiety can be considered as predictors for science performance. Also, this study explored the moderating effects of gender on the link between student's psychological factors with science performance among guidance school students. The participants in the study were 680 guidance school students, (317 male and 363 female, in the age 14 years old) at Tehran and Shahriar City, the province of Tehran, Iran. Five valid and reliable instruments were used to assess Self-concept Attribute Attitude Scale, State-Trait Anxiety Inventory, Coopersmith Self-Esteem Inventory, General Self-Efficacy, and Science Self-Efficacy Questionnaire and students' science performance which measured by the report school test. Descriptive statistics, multiple and hierarchical regression analysis were used to analyses the data. The result demonstrated that science performance be influenced by general self-concept and science self-concept. In addition, the moderating effect of gender on the relationship of general self-concept, science self-concept, self-efficacy, science self-efficacy, self-esteem, anxiety, and science anxiety with science performance was not established.
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1. Introduction

Educational psychologists and theorists have long believed that students who believe in their abilities tend to perform successfully (Bandura, 1993). Literature on *self-efficacy*, which is define as the capabilities to accomplish a given task, seems to be a major predictor of academic achievement among the Western society but may not necessarily so for different cultural background (Shen, 2002). Of related positive psychological factors, self-concept and self-esteem also vary from culture to culture. Self-concept refers to the global understanding a sentient being has of him or herself. It is also more general than self-esteem, which is the purely evaluative element of the self-concept (Fleming & Courtney, 1984). In addition, negative psychological factor such as anxiety may also influence the student performance (Milford, 2011). To date, very limited numbers of research investigate these psychological factors among Iranian students. Therefore, this study aimed to fill the gap and provide empirical data from Iranian perspective on the influence of psychological factors and science performance. Gender is another factor that may have effect the relationship between students' psychological factor and science performance. Previous studies on the relationship of gender and science achievement show that boys in general tend to perform better than girls(Comber & Keeves, 1973). More recent study indicate that find no interaction between grade level and gender (Senler & Sungur, 2009). Therefore, this study also aims to investigate the role of gender in moderating the relationship between students' psychological factor and science performance among 8th grade Iranian students.

Science self-efficacy, science self-concept, science anxiety and gender

Science self-efficacy is the belief in one's own capability to do science, in terms of organizing and executing the skills and knowledge needed to manage science content and processes (Miller, 2006). Science self-concept is a term used to describe one's perception of self in relation to achievement in science (Byrne & Shavelson, 1987) and one's confidence in science (Campbell, 1992). Science anxiety in students is a debilitating fear of learning science—but with the emotion processed on a cognitive level, and lastly, science anxiety manifests itself primarily during examinations, but is distinct from an apprehension towards examinations in general, since students who exhibit science anxiety often react normally in their non-science subjects (Mallow, 1994).

Therefore, Naderi, et al., (2009) indicate that there is no relationship between self-esteem and

academic achievement (Sig=.074, P>0.05). and also, Meanwhile, Milford (2011) at the country level, the relationship was negative between self-concept and academic achievement in science (i.e., countries with higher science self-concept tend to achieve lower on scientific literacy), while science self-efficacy and science self-concept positively influenced science achievement. Mokshein (2002) meanwhile indicates that the effects of self-concept in science and gender are significantly related to achievement. Senler and Sungur (2009) find no interaction between grade level and gender, with F (3,496) = 0.37, P> .05, or significant grade level and gender, with F (3,496) = 76.39, P< .0001, η2 = .32 and F (3,496) = 5.74, P = .001, η2 = .03 respectively. Naderi, et al., (2009) asserts that although self-esteem indicates a strong significant relationship on academic achievement when gender is controlled (Chi-Square =14.173, Sig=.007, P<0.01, there is no relationship between self-esteem and academic achievement (Sig=.074, P>0.05). In other words, a significant difference between gender and self-esteem was observed (Sig=.001, P<0.01). The findings of study's Ghaderi et al., (2009) revealed that anxiety and Stress level of Indian students are significantly higher than those of Iranian students. Furthermore, gender differences are not found significant. Other studies (such as Bacharach, Baumeister, & Furr, 2003; Dimitrov, 1999; Von Secker, 2004) indicate that gender is another factor which influences science achievement in boys to generally perform better than girls in science. There is no significant difference in term of the level of self-esteem between the two genders (Fathi, 2006a). Mirabi(2004) indicates that there are no statistically significant differences in "feelings of self-esteem, nor self-concept" between male and female students. Fathi (2006a) indicates that There is no significant difference in term of the level of self-esteem between the two genders. Whereas, the finding of Baran and Maskan's study (2011) indicate that the male students' academic self-concept total score means and their mean scores in science were equal female students' mean scores (P<.05). There is a statistically significant relationship between gender and a person's self-esteem for his or her physical abilities (Longmire, 2008). The students with low self-esteem score the teachers low, and girls from the groups with high and middle self-esteem have a higher evaluation of the teachers than boys (Qi & Zhang, 2010).

2. Objective

The objective of the present study are to investigate if gender has any moderating effect upon the relationship between the students' psychological factors (general self-concept, science self-concept, science self-efficacy, self-efficacy, self-esteem, science anxiety, and anxiety) on science performance among Iranian 8th grade students.

3. Hypothesis

There is a significant moderating effect of gender on the relationship between students' psychological factors and science performance.

4. Material and Methods

4.1. Sample

The sample for this study is selected from the total population of Eighth Grade students in lower secondary schools from large community schools in Tehran city as urban and Shahriar as suburban and the rural areas of Shahriar, during the academic year of 2010/2011. For the present study, stratified sampling was used, and therefore the sample of this study involves two centrally-located school districts among 21 districts of Tehran with 120 male and 160 female students, and also Shahriar lower secondary schools with 202 male and 198 female students.

4.2. Procedure

Data was collected by means of structured questionnaires and the questionnaires were applied in class. Based on verbal agreements of the training lecturers and participants, the questionnaire forms were distributed to the 680 participants and were asked to complete the questionnaires simultaneously at the start of a core lecture and return them to their lecturer Immediately after completing them. All completed questionnaires were passed on to the researchers.

4.3. Measures

All participants responded to Iranian translation of the instruments in this study which is listed below. They were translated into Persian and then the questionnaires were verified by the panel of lecturers and researchers to check the format, arrangement, appropriateness of the content and the language used in the instruments (Asghar-Nezhad, Karimi Klwadapanahi, & HeydariI, 2004; Fathi-Ashtiani, Ejei, Khodapanahi, & Tarkhorani, 2007; Fathi, 2006b; Hayati & Ostadian, 2008; Khodarahimi, 2010).

4.3.1. Self-concept Attribute Attitude Scale (SaaS);

The SaaS instrument was developed by Campbell (1991). The response format is a five-point Likert scale. The first version of SaaS was developed by factor analyzing the data from 1300 high achieving high school students, with exploratory and confirmatory factor analyses determined for each

sample. These factors were extracted by using the Principal Component Analyses with varimax iterations. The three factors that were produced from the factor analyses are math self-concept, science self-concept, and general self-concept. In the present study, only general self-concept and science self-concept were used which include 6 and 14 items relating to general self-concept, For example, I take a positive attitude toward myself and science self-concept, for example, I have a lot of self-concept in science. A major contribution to the validity of the self-concept scales comes from the extensive factor analyses used in the development of the SaaS. Most items had factor loadings in excess of .60 (Campbell, 1991). Alpha reliability values were calculated for general self-concept of 0.85 and a science self-concept of 0.89 were used, (Carmines & Zeller, 1979). In this study, the reliability coefficient for each subscale ranged between 0.87 for science self-concept and 0.61 for general self-concept.

4.3.2. State-Trait Anxiety Inventory (STAI);

The STAI developed by Spielberger (1970a) contains self-report scales for measuring both state and trait anxiety. The S-Anxiety Scale (STAI Form Y-1) used in this study consists of twenty statements designed to evaluate how a respondent feels at that particular time, for example, I feel calm in science. The T-anxiety (STAI Form Y-2) refers to the relatively stable-individual differences in anxiety proneness, i.e., the tendency of an individual to perceive stressful situations as a threat, and to then respond to these situations with a heightened S-anxiety reaction (O'Neil & Spielberger, 1979) and used in this study consists of twenty statements, for example, I feel pleasant. The S-Anxiety Scale required the respondent to determine how he or she feels at a particular moment in time. Evidence bearing on the construct validity of the state scales was derived from a sample of 977 undergraduate students at Florida State University with a median r of .73 for females and .60 for males (Spielberger, Gorsuch, & Lushene, 1983). Caldwell (1988) obtained an alpha coefficient of 0.94 for the S-Anxiety. T-Anxiety scores (Dreger, 1978; Katkin, 1978). In this study, the reliability coefficient for each subscale ranged between 0.88 for S-Anxiety and 0.85 for T-Anxiety.

4.3.3. Coopersmith Self-Esteem Inventory (CSEI);

The CSEI measures general self-esteem. Coopersmith's (1967) own inductive work examined CSEI scores as they related to other personality constructs. The present study has used the Adult Form of the CSEI, which is adapted from the School Short Form for children. The CSEI-A is a 58-item questionnaire completed by respondents by way of answering a five-point Likert scale. As Coopersmith (1967) claims, the questionnaire is designed to measure "the evaluation a person makes and customarily maintains with regard to him or herself". The CSEI has been the subject of many validity research studies (Taylor & Reitz, 1968). For example, I spend a lot of time daydreaming. A study by Kokenes (1978) confirmed the construct validity of the subscales used to measure of self-esteem that were proposed by Coopersmith. Test retest reliability for the CSEI was originally reported by Coopersmith to be 0.88 for a sample of 50 children in grade V and 0.70 for a sample of 56 children, 12 years old (Azar & Vasudeva, 2006). In this study, the Cronbach's coefficient alpha for CSEI was 0.86.

4.3.4. General Self-Efficacy (GSE);

General Self-Efficacy (GSE) developed by Sherer et al. (1982) is designed to gauge self-efficacy in clinical, educational, and organizational settings (Chen, Gully, & Eden, 2001). The measure contains items assessing GSE and social self-efficacy, but only GSE items be considered in the present study. As Sherer et al. (1982) claim, these items tap a "general set of expectations that the individual carries into new situations." The GSE Scale contains is 17-items, for example, When I make plans, I am certain I can make them, while the response format is a five-point Likert scale. The sum of item scores reflects general self-efficacy, meaning that the higher the total score, the more self-efficacious the respondent. Convergent validity has been established in studies comparing the general self-efficacy scale and similar clinical measures (Sherer, *et al.*, 1982). Reliability, measured with Chronbach's alpha, was found to be .86 for General Self- Efficacy (Sherer, *et al.*, 1982). In this study, the Cronbach's coefficient alpha for CSE was 0.79.

4.3.5. Science Self-Efficacy Questionnaire (SSEQ);

The SSEQ was developed by Smist (1993) to assess students' self-efficacy in science by measuring beliefs about competence in school science tasks (Smist, 1993). The SSEQ-A is a 27-item questionnaire completed by respondents by way of answering a five-point Likert scale. The SSEQ was developed to assess students' self-efficacy in science by measuring students' own beliefs about their competence to perform or complete science-related tasks. This questionnaire includes physics, chemistry, biology, and laboratory. The researcher has used science totally. In the present study, only science self-efficacy was included which includes nine items related to science, for example, I can use a computer in science class. In this study, the Cronbach's coefficient alpha for SSEQ was 0.70.

5. Results

Data was analyzed by using statistical package for social sciences (SPSS 18.0). Besides, descriptive statistics, multiple regression analysis were also used in this study.

5.1. Descriptive statistics;

A perusal of table 1 reveals that the largest mean scores on self-esteem is 188.77 with the SD of 25.32 and the smallest mean scores on science score is 15.94 with the SD of 3.12.

5.2. Multiple Regression Analysis (MRA);

MRA was computed to assess the strength of relationship between dependent and independent variables. MRA provides an opportunity with little ambiguity to assess the importance of each of the predictors to the overall relationship. The results of regression analysis for the dependent variable (science performance) are presented in table 2. It is clear from the results that the regression analysis accepted the variables (general self-concept, science self-concept, self-efficacy, science self-efficacy, self-esteem, anxiety).

5.3. Hierarchical Multiple Regression (HMR);

Hierarchical Multiple Regression was employed in examining the effects of moderator variable (gender) on the relationships between the independent (general self-concept, science self-concept, self-efficacy, science self-efficacy, self-esteem, and anxiety) and dependent (science performance) variables.

HMR involves two steps. First, it is needed to form two regression equations, one includes the first-order only and a second model includes the first-order effects as well as a product term including the moderator variable (Bennett, 2000). In this research, the product term is gender. The following are the two equations formed that derived from the regression procedure by entering independent variables and product term block by block in order to create two models.

Table 3 shows that for model 1, R = .139, R2 Model 2 incorporates the product term into the prediction equation. As shown in table 3, the addition of the product term resulted in an R2 change of .005, F change (7,664) = .485, 'Sig. F' change = .846 with a P >.05. This result does support presence of a moderating effect. In other words, the moderating effect of gender explains .9% of variance in science performance above and beyond the variance explained by general self-concept, science self-concept, self-efficacy, science self-efficacy, self-esteem, anxiety. The result suggests that the gender is not important moderating the relationships of general self-concept, science self-concept, self-efficacy, science self-efficacy, self-esteem, anxiety with science performance.

6. Discussion

The results of the study found students' psychological factors were significantly in science self-concept and self-concept, only, there are not correlated with the other variables. This study also supports that gender is not significant moderate for the relationship between students' psychological factors with science performance.

This finding is in line with (Campbell, 1991; Coopersmith, 1970; Sherer, 1982; Smist, 1993; Spielberger, Gorsuch, & Lushene, 1970b), Also between students' psychological factors and science scores, the finding of this study provides evidence to the claims of the previous researchers (Bacharach, et al., 2003; Beaton, et al., 1996; Chang, 2008; Dimitrov, 1999; Erickson & Farkas, 1991; Fathi-Ashtiani, et al., 2007; Fathi, 2006a; Kabiri & Gharbi, 2009; Kiamanesh, 2004; Martin, et al., 2000; Mettas, Karmiotis, & Christoforou, 2006; Preckel, Goetz, Pekrun, & Kleine, 2008; Rasi, 2002; Senler & Sungur, 2009; Von Secker, 2004).

7. Conclusion

The results of the present study indicated that the independent variables of science self-concept and self-concept have positive correlation with the science score so that these variables (science self-concept and self-concept) together have determined 32 percent of the variance of science scores. Consequently, the role of these variables and concerning them gains so much importance in the instruction of the science. The investigation of semi partial correlation coefficients achieved from the analysis, which is the indicator of the allocated ratio of each variable, shows that the variable of science self-concept has determined 5% of explained variance (33%) and self-concept has determined 10% of explained variance that shows that the self-concept is more important than science self-concept. As a result, it can be stated that 17% of the explained variance is due to the impact of both variables together. According to the relationship between science self-concept and self-concept, it seems that totally self-concept variable has more important role in the instruction of the science and practitioners of the education should have a close eye to this variable.

In addition, the investigation of the moderating role of gender in the relation between dependent variable of science score and independent variables indicated that at least in the cultural structure of Iran, gender has no moderating role. Of course, as the literature indicated, gender doesn't have the

moderating role. So, it can be mentioned that the existence of the moderating role for gender follows the cultural structure and is not necessarily consistent everywhere.

Table 1. Descriptive Statistics of the Independent & Dependent Variables

	N	Maximum	Minimum	Mean	Std. Deviation
Science score	680	6.00	20.00	15.94	3.12
Science self-concept	680	14.00	70.00	47.97	10.81
Self-concept	680	6.00	30.00	20.73	4.43
Science Anxiety	680	20.00	80.00	44.02	11.25
Anxiety	680	20.00	80.00	45.43	10.54
Self-esteem	680	94.00	274.00	188.77	25.32
Self-efficacy	680	17.00	85.00	58.61	10.11
Science Self-efficacy	680	9.00	45.00	28.42	6.67

Table 2. Result of Multiple Regression Analysis

Variables	Summary of Regression	Un-Std Coefficient B	Un-Std Coefficient Std. Error	Std. Coefficient Beta	t	Sig. Value
(constant)		7.161	5.520		1.297	.199
Science self-concept		.093	.043	.328	2.158	.035*
Self-concept		.257	.085	.403	3.015	.004*
Science Anxiety		.001	.042	.003	.019	.985
Anxiety		.015	.047	.059	.325	.746
Self-esteem		-.026	.022	-.241	-1.167	.248
Self-efficacy		.019	.043	.064	.431	.668
Science Self-efficacy		.062	.072	.117	.869	.388
Multiple R	.572					
R Square	.328					
Adjusted R Square	.25					
F-Statistics	4.245*					

Note. Predictor: students' psychological factors. Dependent Variable: Total science performance, * p < .05.

Table 3. Result of HMR Analysis for the Moderated Effect of Gender on the Relationship between gender and students' psychological factors

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.139	.019	.007	3.11648	.019	1.641	8	671	.110
2	.155	.024	.002	3.12488	.005	.485	7	664	.846

Note. Predictors step 1: students' psychological factors; step 2: students' psychological factors, Students Gender, * p < .05.

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