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COMPARING THE ACADEMIC ACHIEVEMENTS IN MATH AND CREATIVITY FOR MUSIC STUDENTS AND ORDINARY STUDENTS

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ABSTRACT

The main purpose of this study was to compare the academic achievement in math and creativity for the Music and ordinary high school students. For this purpose, 100 students of regular schools and the conservatory of music in Tehran who were studying during 2011--2012 were selectedvia multistage sampling method. In order to gathering the information, Abedi creativity questionnaire and TIMS test were used to study achievement in mathematics. In this study, according to the studied variables and the type of data collected, in order to describe them, the measure of central tendency, dispersion and distribution were used. At the stage of statistical analysis, to analyze the data, two-way analysis of variance and two-way multivariate analysis of variance (Manova) were used. The results showed that there are significant differences between the mean of students ($P<0.01$). Students of conservatory of music and the ordinary students had a significant difference in the case of creativity scales for the mean of girls and boys, as just for the

innovation and flexibility it was about 0.05. Also a significant difference was observed among the ordinary students and students of conservatory of music in the case of achievements in mathematics. It can be concluded from the mentioned data that students of conservatory of music have higher levels of creativity and educational achievements.

Keywords: Creativity; Achievements in mathematics, ordinary students, conservatory of music

INTRODUCTION

In any society, educational organization has an important role in building a bright future for the community. So investigation of the weaknesses of the organization is of particular importance. One of the weaknesses of this system is the academic failure in mathematics courses of students. That's why researchers are trying to identify the most important factors in academic achievement and creativity to strengthen the education system of the country.Throughout the history of education, one of the important educational purposes was "problem-solving", as one of the demands of the teachers and parents of the students were ability to solve problems. Psychologists and theorists also always stressed the importance of activities related to the problem solving in creating useful and effective learning. Problem-solving leads to gaining skills and new knowledge, as other forms of learning lead to acquiring knowledge and new skills [1].

Another important purpose of education is to train creative talents, such as problem-solving ability [2].Creative people are known as people who are skilled in problem solving, have artistic production, or raise new questions [3]. Investigation of individual differences in particular examining the creativity and academic achievement is one of the most controversial issues in education and psychology [4].

On the other hand, because of the difficulty of music which creates links between the different sensing and moving members of body, it play an active role in development of memory, because it coordinates different members and raises human skills. Playing a song is just like understanding a math problem is the state, the meaning is correlated with the symbols including all necessary information, but the real success of this relationship is depended on the field of education, culture and history [5].

The conducted study shows the role of learning music and its effect on achievements in mathematics and creativity, so taking the researches like this is stated by the

educational authorities for paying attention to learning music as one of the effective factors in improvement of mathematics and creativity as an important component for improvement of students performance. Regarding the mentioned issues present study deal with the comparison of educational achievements in mathematics and music and music learning on the ordinary students and students of conservatory of music.

Theoretical

Santroc (2004) defines creativity as the ability to think about things in new and unusual ways and achieve unique solutions to problems [2]. Gardner (1993) defines creative people as those who are skilled in solving problems [2]. There are different approaches to study of creativity, including the relationship between creativity and intelligence known as the main centre of psychological issues (Guildford, 1954) so that a lot of efforts are paid in the field of study of creative potential [6].

Also many attempts were taken to increase of creative behaviors emphasizing on the correlation of creativity and education. Different viewpoints are also presented about the concept of intelligence with a special case of cognitive processes based on intelligence and creativity. But in the most viewpoints related to the creativity, the relationship between the creativity and intelligence was considered to be important [7]. It seems that among all creative behaviors specified in social levels, motivation has an important role. Academic achievement and its effective factors were always considered important by specialists of educational organizations and so many researches are conducted on them. But at least since 1980 decade, studies have focused on investigation of interaction correlation of motivating and cognitive factors on the student's academic achievements in the form of scientific models [8]. According to the beliefs of the researchers who worked on the correlation of academic achievements and self-organized strategies, motivating factors are so effective in application of these methods and as a result in high cognitive engagement. As an example of the self-efficiency beliefs [9], documents of efforts and self-controls in the success and failure, value of the improvement purposes and the understood efficiency are from the effective motivating factors of application of self-organized strategies [4].Improvement purposes are one of the effective motivating variables on the self-organized strategies focusing on the reasons students take for achieving success. Improvement purposes are defined as the direction of the students, cognitive

representation and reasons of their involvement with the behaviors related to the achievements and norms used for judgment or evaluation of performance [9].Concept of academic engagement refers to the quality of the attempt that students pay for targeted training activities to achieve directed desirable results, including three dimensions of behavioral, cognitive and motivating engagements. Behavioral engagement, involve the observable behaviors of the students in facing the duties and also the attempt, stability and help request from the others components [10].

History of the Research

The purpose of the article of Hejazi and colleagues was to investigate the relationship between intelligence beliefs and academic achievement according to the mediating role of achievement and cognitive engagement. The results generally showed that the purpose of achievement, cognitive engagement and efforts, play a mediating role in the relationship between intelligence beliefs and math achievement. The inherent intelligence believes affect the academic achievements via approach-performance goals, avoidance-performance goals and cognitive levels, indirectly and negatively [11]. Another study was conducted to improve the creativity and academic achievement of the students by investigating the relationship between metacognition and creativity and improvement of academic achievement of the students. The results showed that there is a significant relationship between metacognition and creativity [12]. A study of the relationship between creativity and academic achievement in mathematics is discussed. Correlation analysis of Tai - Kendall done that hypothesis has not been confirmed [13].

A study investigated the relationship between creativity and academic achievement in mathematics. Correlation analysis was taken by Tai-Kendall and shows that study hypothesis has not been confirmed [13]. In a study, parallel structural modeling was used to test theoretical one-dimensional models, to examine two dimensions of levels and mathematical ability simultaneously. There are good evidences for the validity of the concept of mathematical ability including 1) Mathematical ability and 2) Creativity. Each of these two is in a quad hierarchical pyramid.

These findings led to a new approach for understanding the mathematical abilities and created a reliable and valid psychometric instrument. A study was conducted on the relationship between the style of creativity and achievement in primary and secondary

school students including 218 Taiwanese students whose primary language was Chinese and secondary language was English. They were asked to complete the Torrance test and their scores in math and science lessons were investigated showing a high correlation between IQ and mathematical science [14]. In another study the relationship between creative performances of students in different grades was evaluated in the case of their academic achievements in the field of mathematics. Using ANOVA test, the authors found that both creativity and academic achievement in mathematics, at all levels and educational levels are increased by together [15].

The research model and hypotheses

The overall hypothesis of the study is stated as: there are differences between achievement in mathematics and creativity in music of ordinary students and those of conservatory of music. Proposed model can be seen in Figure 1. Sub assumptions are listed below:

1) There are differences between the components of creativity (fluency, elaboration, originality, flexibility) in music conservatory students and ordinary students.

2) There are differences between the components of creativity (fluency, elaboration, initiative, flexibility) in male and female students

3) There are interactions between the type of school and gender for explaining the variance of components of creativity (fluency, elaboration, initiative, flexibility) students

4) There are differences between the TIMSS scores (mathematics achievement) in music conservatory students and ordinary students.

5) There are interactions between the type of school and genders in stating the variance of TIMS scores (math progress)

2) There are correlations between the TIMS test (mathematics achievement), and final math scores (first and last semesters) of music conservatory students and ordinary students

3) There are correlations between TIMS test scores (math progress) and scores of math (first and last semesters) of male and female students.

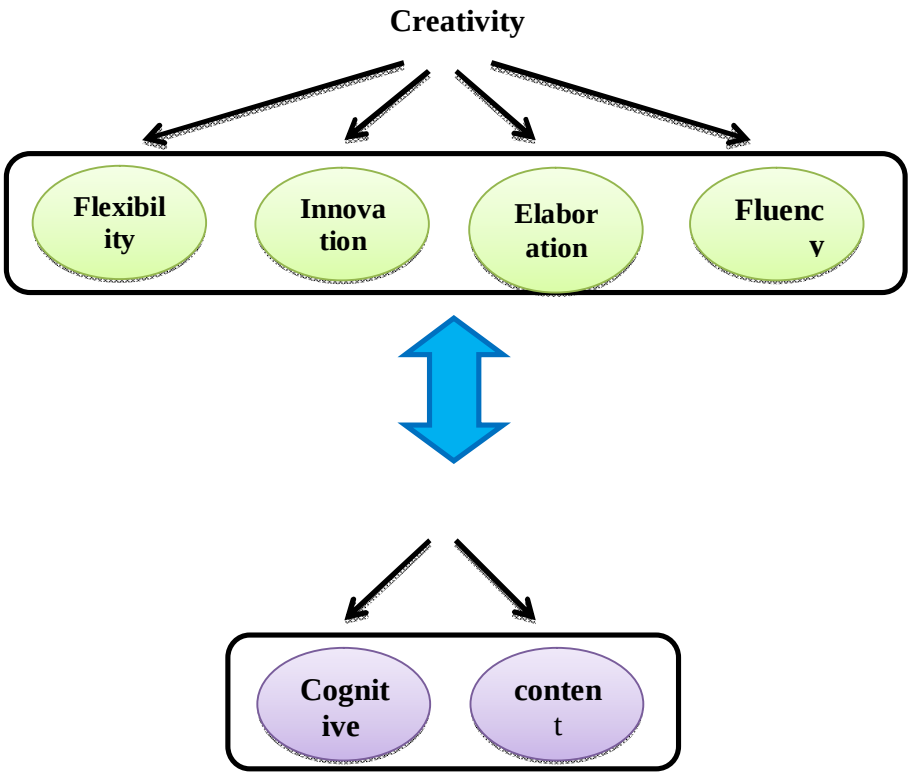

Fig.1. Proposed model for academic achievements in mathematics and creativity

RESEARCH METHODOLOGY

This research is based on non-experimental research case of causal-comparative hypothesis. The multi-stage sampling method is used. First a list of schools of Tehran Music Conservatory was prepared. Then within two male and female conservatories at the third grade school, a third grade class was randomly selected from each school as the required sample was picked among them. The multistage random sampling methodin the ordinary schools was defined as among all regions, the region 8 was selected randomly and among the ordinary schools, two secondary schools of third grade were selected and the desired student sample was picked among them.

The population of this research study consists of students in ordinary schools and conservatory of music in Tehran in 2011-2012. Using the sample size defining formula based on the theoretical standard deviation andreal mean difference of the population and the sample mean,it was estimated and calculated with the error of 5%. According to the calculated volume of the sample and the possible loss of testers, 100 students in the third grade were selected. In this research following tools are used to gather information: 1. Abedi creativity

questionnaire, 2. TIMS test for academic achievement in mathematics and 3. Mathematical averages.

Abedi Creativity Test

The test which was provided based on the theory of creativity Torrance in 1984 by Abedi (1993) in Tehran, was performed on a group of 650 people of third grade students of Tehran's schools. The test has 60 three options questions of four subscales of fluency, elaboration, innovation and flexibility. Options reflected the creativity levels of low, medium and high, where low creativity has the score 1, medium creativity has the score 2, and high creativity has the score 3. The total score achieved in each sub-test shows the examined score in that section and the total test numbers in four sub-tests chows the overall creativity score. The domain of total creativity number in each test lay between 60 and180.

TIMS test

Templates of TIMS mathematics 2007 was completely designed based on the TIMS assessment template. TIMS test is evaluated according to the 4-options questions, to study the diversity of performance and weakness and powerful points students in mathematics and science. In the case of answer making questions possessing the 1,2 and 3 score spectrum, the statistical index included difficulty coefficient and coefficient of determination of each score. In order to estimate the reliability and validity of the TIMS test, in the study for each answer is rated as correct (1 single score) and false (zero point score) were scored. Also for increasing the reliability level of the TIMS test of students, the mathematical average was calculated.

Data analysis methods

After collecting the completed questionnaires: (a) firstly the descriptive statistics such as mean, standard deviation and adjusted charts were calculated. (B) In the descriptive statistics section, by use of statistical methods, two-way analysis of variance (ANOVA) and multivariate variance analysis (MANOVA) were used.

Describing the data

In this section the results of measurements of different variables by using appropriate methods are described based on the descriptive statistics such as mean, standard deviation, distribution parameters. According to the distribution results, the scores of students (in both musical and ordinary) in creativity test (the fluency, elaboration, innovation and flexibility component), TIMS scores and scores of mathematics, different descriptive parameters such as mean, standard deviation, indicators of skewness

and kurtosis and results of normality Kolmogorov- Smirnov tests (except the component of senior math score in the group of students of Conservatory of Music (P<0.5) shows that the distribution of the scores of a sample of measured variables is inclined to the normal distribution inclined.

The distribution of the scores of students (in both musical and ordinary groups) in creativity test (quad components), TIMS scores and scores of mathematics, different descriptive parameters such as mean, standard deviation, skewness and Kurtosis parameters and results normality test of Kolmogorov-Smirnov (except of the mathematical component in the first semester p<0.05) indicates that the distribution of the scores of the sample group in the measured variables is inclined to the normal distribution.

Data analysis

Multivariate analysis of variance (MANOVA)

According to the research hypothesis, the number of dependent variables and type of data were obtained from measurement by the method of two-way ANOVA and multivariate analysis of variance (MANOVA).

Table 1.Summery of tests ofequality of Variances of lion error

Significance level	Df2	Df1	F	Variables
0.976	91	3	0.070	Fluency
0.278	91	3	1.303	Elaboration
0.493	91	3	0.807	Innovation
0.370	91	3	1.060	Fleibility

Regarding the obtained F-values and their significance possibility in 4 hypothesized variables, equality of variances was confirmed.

Table 2: Summary of the multivariate test

chi-It	P	Error degree of freedom	degree of freedom	F	values	tests	Groups
0.224	0.000	88	4	6.333	0.776	Wilks lambda	Conservatory
0.098	0.057	88	4	2.386	0.902	Wilks lambda	Gender
0.063	0.212	88	4	1.492	0.937	Wilks lambda	* Conservatory gender

According to values of Wilks lambda test and calculated F-values with degrees of freedom 88 and 4 only the nullhypothesis of the music conservatory students can be reject (p<0.01). In other words, the only the difference between the scores of fluency, elaboration, innovation and flexibility of the ordinary students and students of the Conservatory of

Music is significant at the same time, and these students can be specified based on fluency, elaboration, innovation and flexibility. Measure of the effect size difference, according to the chi-It (0.224) is in a rather "average'. In general, chi-It value (224/0) represents a relatively" strong' correlation between the type of school and the quad components of creativity.

Table 3.Summery of tests of effects among the triables

chi-It	F	MS	2df	1df	SS	Dependent variables	Sources
0.116	**11.894	364.335	91	1	364.335	Fluency	School
0.128	**13.320	183.812	91	1	183.812	Elaboration	
0.109	**11.175	281.685	91	1	281.685	Innovation	
0.085	**8.455	156.621	91	1	156.621	Flexibility	
0.007	0.615	18.848	91	1	18.848	Fluency	Gender
0.004	0.338	4.659	91	1	4.659	Elaboration	
0.057	*5.467	137.798	91	1	137.798	Innovation	
0.052	*4.980	92.245	91	1	92.245	Flexibility	
0.003	0.300	9.191	91	1	9.119	Fluency	gender * school
0.034	3.177	43.841	91	1	43.841	Elaboration	
0.029	2.698	68.00	91	1	68.00	Innovation	
0.001	0.086	1.591	91	1	1.591	Flexibility	

****significant at level of 0.01*significant at level of 0.05**

According to the results of the test subjects and indices, the following interpretation can be offered: F values calculated by the degree of freedom (91 and 1) show that there is a significant difference between the mean of music conservatory students and ordinary students 4 variable of fluidity, expansion, innovation and flexibility ((p<0.01).chi-It value (0.116, 0.128, 0.109 and 0.085, respectively represent relatively "poor to relatively poor correlation between the type of school and all four components of creativity. Thus, sufficient evidence exists to adopt the first hypothesis.

Calculated F-values by the degree of freedom (91 and 1) show that between mean of male and female students in the case of 4 variables of fluency, elaboration, innovation and flexibility, just two variables of innovation and flexibility (p<0.05) are significantly different.

The Chi-It (0.057 and 0.052, respectively) shows the weak correlation between the gender and two components of innovation and flexibility. Therefore, there are enough evidences for two variables of innovation and flexibility to accept the second hypothesis. The calculated F-value with degree of freedom of (1 and 91) show that interaction of school type and gender in defining the variances of four variables of fluency, elaboration, innovation and flexibility was

not significant. So, there are not enough evidences to accept the third hypothesis.

Table 4.Summery of tests ofequality of Variances of lion error

Significance level	Df2	Df1	F	Variables
0.599	91	3	0.627	TIMS

Regarding the obtained F-values and its significant probability in TIMS scores, the hypothesis of equality of variances is confirmed.

Table 5: Summery of multivariate tests

chi-It	P	F	Mean of squares	Degree of freedom	Sum of Squares	Variation sources
0.212	0.000	24.532	3837.009	1	3837.009	School
0.037	0.063	3.539	553.471	1	553.471	Gender
0.019	0.187	1.770	276.821	1	553.471	*Schhol Gender
			156.409	91	14233.240	Error
				95	1806369.00	Sum

Regarding the amount calculated F-value by the degree of freedom of 91 and 1 just in the case of school variable, the null hypothesis can be rejected ($p<0.01$). In other words, there is a significant difference between the average scores of TIMS test and simultaneously between the students of ordinary schools and conservative students these students can be separated based on test scores TIMS test. Effect of size difference, according to the chi-It (212/0) is rather "average'. In general, chi-It (0.212) represents relatively moderate relationship between the type of school and TIMS scores. Therefore, there is sufficient evidence for accepting the fourth hypothesis. F-values calculated for the main effect of gender and type of school and sex showed no statistically significant interactions. Therefore, there is not sufficient evidence to accept the hypothesis of the fifth and sixth.

Table 6.summary of the results of the Pearson correlation between variables (95 = N)

TIMS Score	variables
**0.540	Mathematical scores of semester1
**0.648	Mathematical scores of semester2

p<0.01**

Table above shows the correlation coefficients among the considered variables in all subjected tests. Results show that the variable of the mathematics scores of the first and the last semesters have a positive and significant correlation with the TIMS score ($p<0.01$). Therefore there are sufficient evidences to accept the 7^{th} and 8^{th} hypotheses.

CONCLUSION

According to the results obtained in the first hypothesis, it suggests that the difference between the average score of fluency, elaboration, innovation and flexibility is significant at the same time for the music conservatory students and ordinary students meaning and they can be separated based on a fluency, elaboration, innovation and flexibility. Therefore, the evidence is sufficient to accept the first hypothesis. The results of domestic investigations conducted by SobhaniNejad and colleagues (2006), Kurvand (2009), Rahnama (2010), show that there is a significant relationship between creativity and student achievements. Also, these results are relatively compatible with that of an external study taken by Jensen (1973), Lyon et al. (2006), Bahar et al. (2011). So, it can be said that the creativity donates a high performance powerto the individual to have the maximum usage of the existing facilities. In the similar condition, people owing such capability have a better performance in comparison with people without such capabilities. All four components stated in this research make the possibility to have more productivity from existing resources and increase their level of learning and performing to achieve higher academic levels.

Results of the second hypothesis have shown that there is a significant difference between the mean of male and female students in the case of four variables of fluency, elaboration, innovation and flexibility and male and female students can be separated by these factors. Therefore there are enough evidences for accepting the second hypothesis. These results are in agreement with those of Kurvand (2008), GolestanJahromi et al. (2009), Rahnama et al., (2009) where have shown that there is a significant relationship among the creative components (fluency, elaboration, innovation and flexibility) and students gender. Also it is relatively compatible with results of foreign studies conducted by Jensen (1973).

Guilford (1987) concluded that three characteristics of fluency, flexibility and innovation are the most important, because the fluency of ideas refers to the quantity of individual's taught while flexibility considers the diversity and Non-counterfeit of answers. According to his opinion, those answer a question or offer more solutions in the presence of a question are more likely to be divergent, so we can say that girls and boys can be successful in some aspects of creativity. For example, boys may be creative in solving mathematical problems while girls act creatively in solving verbal problems and

be expertise or have divergence thinking style [16].

Results of the third hypothesis show that there is not a meaningful interaction between the mean of type of school and gender in defining the variance of four variables of fluency, elaboration, flexibility and innovation. Therefore, evidences are not enough to accept the third hypothesis. These obtained results are in agreement with achievements of the domestic researches conducted by GolShokuh et al., (2009), Sobhani Nejad et al., (2006) indicating that there is a meaningful correlation between the type of school and gender in specifying the creativity components (fluency, elaboration, innovation and flexibility)and also there is a relative agreement between the foreign results obtained by Jensen (1973) and Gibson, Fuli and park (2008). Although the rich and motivating environment can improve the creativity, it is not essentially true. Most of the creative people along the history (man or woman) did not live in enrich environments, but they have created innovations which are still effective in our daily life. Therefore, gender and school environment cannot essentially predict or define the student's creativity and talented and genius students can be identified in any environment and school environment is just responsible to train their various cognitive dimensions.

Results obtained in the fourth hypothesis show that there is significant difference between the mean of TIMS test scores simultaneously in the knowledge of students of conservatory of music and ordinary students and they can be separated according to the TIMS scores. Therefore, there are sufficient evidences for acceptance of the fourth hypothesis which is relatively in agreement with results obtained by domestic researches conducted by Ghasem Tabar et al., (2008) and SobhaniNejad(2006) showing that there is a significant difference between the TIMS scores of conservatory students and ordinary students and also with results obtained by foreign studies of Gardner (1997 quoted by Armstrong 2004), Haris (2007) and Sobhi (2002).

But it is not in agreement with Lion's study (2006) indicating that creativity cannot predict the academic ability or mathematic ability. Therefore it can be said that musical intelligence is considered as one of the main factors of the intelligence showing the importance of music in training and education and generally in human life.

Music training can efficiently affect the improvement of counting and calculating skills, researches have shown that there is a

correlation between the learning strategies and motivation of educational improvement with educational performance, music training can facilitate the learning and becomes a motivation for academic achievements. Generally, it can be said that effect of music in learning of mathematical skills can be denied.

Results obtained at the fifth step have shown that there is not a significant difference between the means of TIMS tests of male and female students and they cannot be separated based on the TIMS test scores. Therefore there are not sufficient evidences for acceptance of the fifth hypothesis as the domestic and foreign results did report on the gender differences. It can be claimed that regarding the obtained results, girls and boys have the same expectations to be successful in mathematics with the possible same performance.

In general, gender stereotypes representing that mathematics is a masculine lesson has been changed and there is no difference between the mathematics problem resolving, tendency and desire to mathematics among the two genders and both of them show the same tendency toward the improvement in mathematics.

Results obtained at the 6thhypothesis have shown that there is not a significant difference between the means obtained by type of school and gender in defining the variance of TIMS test scores and type of school or gender cannot predict the educational achievements in mathematics. Therefore, there are not sufficient evidences for accepting the 6th hypothesis, as results obtained by the domestic studies conducted by Golestan et al. (2009) have shown that gender and school have no significant effect on the academic achievements of mathematics. Also it is relatively in agreement with results of foreign studies conducted by Lion et al (2006), but it is not I agreement with domestic studies of Rahnama et al., (2009) and foreign studies of Jensen (1973) and Ling (2009). Therefore it can be concluded that age and gender are as the quantitative predictors of the academic achievements in mathematics at school and university. Even some correlations among the creativity scales of the mathematical creativity, numerical creativity talent, mathematics academic achievements, creativity and problem solving at university and results have shown that even mathematics ability and creative thinking can predict the creativity in both genders. Type of school cannot specify the academic achievements in mathematics, because academic achievement is almost depended on

the student's motivation and quality of teachers teaching style [17].

Results obtained at the 7th hypothesis have shown that there is a positive and meaningful correlation among the mean of mathematics scores of the first and last semester with TIMS score which are in agreement with that of foreign studies conducted by Bahar et al. (2011) and Naderi (2010), showing that having mathematics motivation has a correlation with achievements in mathematics.

But past evidences about the acceptance of the 7th hypothesis are not available sufficiently. Therefore it could be said that the self-concept mathematics variable is an important factor for prediction of academic achievements of mathematics. Both the creativity and academic achievements of mathematics are increased simultaneously in all levels and all educational degrees. But not much studies are conducted in this case and lots of the available ones did more consider the demographic variables as the normalizing factor.

Results obtained at the 8th hypothesis have shown that there is a significant correlation between the mean of mathematics scores of the first and the last semesters and the TIMS scores of the girls and boys. Therefore, there are enough evidences to accept the 8th hypothesis which are in agreement with obtained results of domestic Islamic researches (2010) and Rahnama (2009) showing that having mathematical motivation I related to the academic achievements of boys and girls besides foreign studies of Jensen (1973) and Naderi (2010), but disagreed the results of Kurvand's (2008) studies.

As mentioned before, there I no gender difference in the case of tendency toward mathematics. Also in the case of improvement in mathematics there is no difference between girls and boys. Based on their scores in the first and the last semesters, the academic achievements can be seen both in girls and boys.

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