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Iranian Journal of Learning and Memory 2018, 1 (3)

The Role of Teacher's Characteristics on Mathematics Performance of Eighth- Grade Students from 2003 to 2015 (Based on International TIMSS Studies)

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Abstract

The purpose of this study was to review the changes in the role of demographic and personality variables of mathematics teachers in predicting the mathematical progress of eighth-grade students in Iran and analyzed the trend of these variables in four international studies. For this purpose, we examined the data from 21434 eighth graders and 877 math teachers who had participated in four TIMSS studies (2003, 2007, 2011 & 2015). Among the educational variables influencing the educational development, ten variables including gender, age, history of teaching, the degree, major, teaching hours, job satisfaction, confidence, interaction with other teachers and teaching method were investigated using statistical methods of Pearson correlation coefficient and multiple regression analysis. The findings related to the demographic variables showed that the students ' mathematical performance changes were almost consonant with the changes of age, history of teaching, and teaching hours in both groups of male and female teachers. This coordination was not similar in the major and academic degrees. The results of multivariate regression showed that the students ' mathematical development was explained by a set of demographic and personality variables. Among these variables, teaching history and self - confidence of the teachers played the most important role in explaining the students ' progress, and the variables of the degree of education and gender did not contribute to the explanation of the students ' math's progress. The findings show the necessity of paying more attention to the history of teaching and examining the reasons why major and teachers ' degree were not that influential in math development is essential.

***Keywords*:** Trend, Demographic and personality variables, Math teachers, TIMSS studies

Introduction

Learning and studying maths in most educational systems has a special importance. Different aspects of mathematics, such as counting, numeracy, computing, problem-solving, and using different strategies are taught to students during the years of study. For years, many theorists and researchers in the field of mathematics have studied and theorized its influential factors. The results of these studies have a great impact on teaching and learning maths (Kelement, 2002). One of the international studies conducted on students' math performance is TIMSS. The international Association for the Evaluation of Educational Achievement (IEA) conducted this study. The IEA is one of the pioneers in the international assessment of academic achievement and has been independent of national research institutes and government agencies since 1995, designing, implementing and managing international studies in various fields such as mathematics, science and reading (Jafari, Kayamensh & Karimi, 1396). TIMSS shows that students' mathematical performance is very different in different countries (Liang & Jia, 2015).

The factors that can affect academic achievement and consequently math performance are divided into two categories: environmental factors and individual factors. One of the most important environmental

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factors is the teacher (Tuyserkani, 1392). He or she should definitely be more than an educator (Harden & Crosby, 2000; quoted from Zlatwouc, Stojilkovic & Djik, 2012). Any scientific and targeted investment for providing a healthy and proper future for the teachers will not only promote Productivity, but also the conditions of a nation's prosperity. Fulfilling the goals of education in all levels of education from pre-school and elementary school to university is in control of every one of the teachers. Hence, the importance and grandeur of the teacher and coach role in societies is to such an extent that the divine prophets have introduced themselves as teachers and on the other hand, it is often seen that history has been made by great teachers (Behpajooh, 1380). The characteristics of a teacher is one of the most effective factors in teaching and its effect on students' progress is undeniable. The researchers have shown that the best teachers are not necessarily the most experienced. The best teachers usually have great passion in teaching, they are sensitive to the progress of each student they have positive relationships with the students, high motivation and commitment (ESRC, 2010). Various investigations including Vakili Harris, Hejazi and Ezhei (2009), Taleh (2008), Qalani, Kadivar, Sarrami and Esfandiari (1391) and Coral, Tauer, Jayy and Cohen (2005) have shown that self-esteem and job satisfaction very effective when it comes to the learners' performance.

People who have high self-esteem, ability to recognize and accept themselves, sympathize with oneself and others, stay fit and timely, restraint and use cognitive and behavioral skills in life challenges are known to be successful teachers. They have unconditional values and beliefs, given the environmental status, but they also know how to respect other's values (Schab, 1393). A teacher's recognition of self as a person who is in touch with students, has a very important role in his or her self-confidence as well because teaching high quality of teaching cannot be established unless there is a connection between the teacher and the learner (Gottwave & Wilhelm, 2014; Patrick, Kaplan & Ryan, 2011; Riz, Bracket, Rivers, White, & Salvo, 2012; Sot Kamp, Kaiser & Muller, 2012). Job Satisfaction is one of the most important factors in success and job motivation it also increases job efficiency and job security. Job satisfaction is the result of interaction between numerous factors including the working environment, the rules of the organization, the relationships of employees in the workplace, the social position of the job, income and cultural factors. Hence, job satisfaction is a psychological feeling that interacts between the psychological, economic, cultural and social achievement (Shafi Abadi, 1396). The level of confidence and job satisfaction are very important factors which affect students' mathematical performance (Liang & Jia, 2015).

There is some evidence that prove improving teaching capabilities through collaborative professionnal growth programs improves students' learning. According to the results of various researches (Goddard, Goddard & Moran, 2007; Liu, Tease & Hun, 2015; Mortazie Mehrabani & Goya, 1393), teachers' interaction with other teachers provides a good place for their professional development with a collaborative approach that also helps improve students' learning.

The teaching method is also one of the factors influencing the performance of students. Students' understanding of math, their ability to solve problems, self-esteem, and even their attitude toward math, are formed through the teaching that they face at school. Hence, it can be said that improving math education requires effective mathematical teaching. For effective mathematical teaching, one also needs to know what pupils know and what they need to learn, so that he or she can support and challenge them in a better learning environment. (National Council of Teachers of Mathematics, 2000). In many studies, the effect of different teaching methods in comparison with the traditional methods on the performance of students has been investigated, including the participatory learning method (Kaper & Tarim, 2015; Soleimani, Sepahrian Azar & Ghaderi, 1395; Zakaria, Sulfatiri, Davood & Abedin, 2013), Using games (DarTAJJ, 1392, Ebrahimi, Saber, & Sharifzadeh 1393), Construction Methodology (Mortazavi, Mashrani, Ahmadi & Bazal-el-Zadeh 1390), and the problem-solving teaching method (Hu, Zing, & Tu, 2018) have been confirmed as effective teaching methods for increasing student's math performance.

In various studies, there is also a positive relationship between the amount of teaching experience, the length of teaching, the gender, the field and teacher's degree, and the student's mathematical progress (Abedi, Karmudost, Rahiminejad, & Hejazi, 2009; Eikhani, 2014; Fang et al., 2017; Liang & Jia, 2015; Sarmadi, Saif, Talebi, & Abedi, 2010; Soleimani, 2011).

The results of TIMSS tests in different years have shown that students' math performance, in addition to individual characteristics are affected by many environmental factors such as teachers, schools, parents, and so on. Explaining what factors are leading to different student performance are somewhat complicated (Liang and Jia, 2015). Identifying factors affecting the performance of students in this field and

determining the impact of these factors on improving the students' success in Mathematics are particularly important (Khazari Azar, 2010). Since education has been noticed more than it used to in the present century, human resource training has become a special place in the development process of societies. So, people today have realized that in order to achieve sustainable development and to respond to scientific, economic and social issues in the education system, is an inevitable issue. Given the role of teachers in the education system, first any transformation must begin in education from the selection and training of the teacher, and the key to progress of the educational institution should be sought in teachers' mental health and growth (Nabavi, 2011). However, little research has been conducted in this regard. That is the reason why the purpose of this study has been to investigate the trend and the role of changes in personality traits and demographics of mathematical teachers on the mathematical development of students in the eighth-grade in four different studies of TIMSS (2003, 2007, 2011, and 2015).

Method

The present research is a non-experimental and correlational research aimed at identifying demographic changes characteristics (age, gender, teaching history, level of education, the field of study and teaching hours Math's Weekly, and Mathematical Teaching Methods) of eighth grade Mathematics Teachers participating in TIMSS studies from 2003 to 2015 on the criterion variable, the mathematics' performance of students in the eighth-grade. In addition, this study is a surveying type of study. In this type of research, numerical descriptive of trends, attitudes, or ideas come from a sample of society.

Cross-sectional and longitudinal studies are different kinds of surveying studies that can be used to collect data using a questionnaire or structured interview with the aim of generalizing the sample to the community (Johnson & Kristensen, 1396, Kiamanesh et al). For analyzing changes in variables over time (retrospective) the research methodology has been used. Considering the nature of the research, the correlation coefficients and multiple regression analysis have been used to achieve the research objectives.

Participants

The statistical population of this research was all teachers of the eighth-grade of mathematics in Iran. The study was conducted in the periodic studies of TIMSS (2003- 2015). In this research, the data collected by the National Center for These Studies have been used in four TIMSS studies in four years (2003, 2007, 2011, and 2015). The number of students and math teachers participating in these four courses, the two-stage cluster sampling method was 21082 and 877, respectively. Therefore, for the purpose of this study, all students and math teachers participating in four periods of TIMSS were studied. The TIMSS samples are based on the number of participants and the average score of the students in each period. The breakdown of the implementation years is presented in Table 1. The average performance of the mathematics student is significantly lower than the international average (500). The numbers in parentheses which is placed next to the average performance shows the standard error for each quantity.

Table *1*.
Exams data from 2003 to 2015 for math's teachers and performance of the eighth-grade students

Class grade	TIMSS	Average of students performance	The number of Teachers participating	The number of students participating
Eight	2003	453(2.4)	181	4942
	2007	459(3.7)	208	3981
	2011	474(4.0)	238	6029
	2015	456(4.0)	250	6130

Instruments

TIMSS studies consist of two parts: the implementation of the test of academic achievement and previous questionnaires. Backgrounds questionnaires include a student questionnaire, a high school student questionnaire, a science secretary questionnaire, and a school principal questionnaire for the eighth-grade. The tools used in this study are student math progress tests and parts of the questionnaire of the eighth-grade mathematics teacher that has been used in the TIMSS studies of 2003, 2007, 2011, and 2015. In this study, 10 variables have been studied. TIMSS Mathematics questions are developed by experts in mathematics, measurement, as well as specialized committees

composed of leading specialists in the world of education. Required data for research was extracted from WWW.IEA.NL site. Subscribing to the site, the data source section 1 was searched for the type of study (TIMSS), the base and year of the study (2003, 2007, 2011, and 2015) in IEA data respiratory. After specifying these criterions, students' questionnaires and Iranian teachers' questionnaires were selected among the studied countries, and then by specifying the data format (SPSS) the data was downloaded.

Mathematics Achievement Test

The framework for mathematical assessment involves two dimensions of content and cognition. Content areas of mathematics at the eighth-grade Include numbers, algebra, geometry, data, and luck. Cognitive domains are common on both bases and include knowing, apply in, closure and reasoning. TIMSS academic achievement scale of the students examines the performance of the students in the test with a mean of 500 and a standard deviation of 100. The test includes multiple choice questions, short answer and extensive ones. The number of math test questions in each course is presented in Table 2:

Table 2.
Number of math test questions in TIMSS studies

TIMSS	Number of questions in the eighth grade
2003	194
2007	215
2011	217
2015	212

Plausible value is being used for marking. Plausible value consists of three theoretical concepts: Item-Response Theory (IRT), Bayes' theorem and estimates in the society. According to IRT, students' ability can be evaluated and compared based on their answers to different questions. According to Bayes' theorem the information on students' performance and their background is combined. On top of that in major tests like TIMSS studies gaining community attitudes is of great importance. Therefore, using plausible values, both demographics and characteristics features of the individuals and their performance, are calculated more accurately. That way Community features and error rates are more precise and unbiased estimates. TIMSS Studies allocate five scores to progress that is used as a dependent variable.

Teacher backgrounds questionnaire

This questionnaire includes information on the level of education, age, gender, teaching history, being update, and features, evaluation activities, and implementation of the program. In the eighth-grade, there is a separate questionnaire for Mathematics and science teachers. In this study, part of the questionnaire is for teachers of the eighth-grade related to the teachers Mathematics (including demographic characteristics of teachers) age, gender, teaching record, level of education, and field of study (Along with personality traits (job satisfaction, self-esteem, interaction with other teachers and teaching method). Therefore, each section of the questionnaire is followed by questions. Each question also has several parts. Questions about teachers' specifications include the following 5 questions:

1) What is your gender? (Only mark a circle).
Woman ◯ man ◯
2) How old are you? (Mark only one circle).
A) 30 years old or less.....
B) More than 30 years .....
3) By the end of the current school year, in general, how many years of professional experience of teaching do you have ?
A) 10 years or less .....
B) 10 to 20 years .....
C) More than 30 years .....
4) What is the highest level of formal education you completed? (Only mark one circle).
A. (Completion of high school) Diploma (or completion of a degree in technical or professional disciplines or theoretical courses).
B. Bachelor or master degree.....
5) What was your main field of study in high school education? (In each row, mark a circle).
B. Mathematics teaching .....
C) Other fields .....
6) How much time do you spend teaching maths in a week?
A) 3 hours or less .....
B) More than 3 hours .....

In 2011 and 2015 studies, in addition to demographic characteristics, job satisfaction variables, self-esteem, interaction with teachers and the method of teaching mathematics, the scale made by TIMSS to examine these variables have been used. In each TIMSS era, due to changes that may occur in different educational conditions in different countries, the questions are altered. In this research, in order to examine the process, we needed the same questions (reference), so similar questions were chosen from all

the questions raised for various scales that TIMSS used for variables such as job satisfaction, self-esteem, interaction with other teachers and the method of teaching mathematics were chosen and studied.

TIMSS has designed a scale to measure job satisfaction, self-confidence, interaction with other math teachers and teaching methods of the eighth-grade. The questions of these scales in two stages of implementation of the TIMSS in 2011 and 2015, are different to some extent. In this study, to examine the process of change, similar questions in two periods were used as reference.

Job Satisfaction Scale

The questions of this scale are as followed:
Score them as:

1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 4 = strongly disagreeable
How much do you agree with each of the following phrases?
1) I am satisfied with my work as a teacher (reverse scoring).
2) I am happy to be a teacher at this school (reverse scoring).
3) Since I began to teach, my passion has increased (reverse scoring).
4) I do an important job as a teacher (reverse scoring).
5) I decide to continue to reciprocate as long as I can continue to teach.
6) I feel disappointed as a teacher.

Cronbach's alpha for the job satisfaction level of the mathematics teaching was calculated to be 0.43 and 0.83 for the years 2011 and 2015 respectively.

Teachers' Self-confidence Scale

Questions of this scale are as followed:
Rate them as:

1 = Very certain; 2 = to some extent certain; 3 = not very certain
How much do you feel comfortable and motivated in teaching class on any of the following?
1) Provide and display various problem-solving strategies for students (reverse scoring).
2) Determining harder math tasks for better students (reverse scoring).
3) Changing the way of teaching to engage and attract students (reverse scoring).
4) Helping students understand the value of math learning (reverse scoring).

Cronbach's alpha for the confidence level of mathematics teachers in the two periods of 2011 and 2015 was calculated to be 0. 68 and 0.78 respectively

The Scale of Teacher Interaction with Other Teachers

The questions of this scale are as followed:
Rate them as:

1 = every day or almost every day; 2 = once to 3 times a week; 3 = twice or
Up to 3 times a month; 4 = never or rarely
How often do you have the following interactions with other teachers?
1) Talk about how to teach a subject (reverse scoring).
2) Collaborate in the design or planning of materials (reverse scoring).
3) Understanding what is learned from teaching experiences (reverse scoring).
4) Observe other classes to learn more about teaching (reverse scoring).
5) Work together to run and test new ideas (reverse scoring).

The Cronbach's alpha for the interactions of mathematics teachers with each other in 2011 and 2015 were0.76 and 0.86 respectively.

Mathematics Teaching Methodology Scale

The questions of this scale are as followed:
Rate them as:

1 = each session or almost every session; 2 = about half of the sessions; 3 = some meetings; 4 = never or rarely
In teaching of math to students in this class, how often do you want them to do the following.
1) Listen to my description of how to solve problems (reverse scorecard).
2) Maintain the rules, basics and concepts (reverse scoring).
3) Work on issues (individually or in a group) with my advice. (Reverse scoring).
4) Work together on the issues in the whole class with my direct guidance (reverse scoring).
5) Work on issues (individually or in a group) when I'm busy with other tasks. (Reverse scoring).
6) Participate in exams or written quizzes (reverse scoring).

Cronbach's alpha for the eighth-grade mathematics teaching method was calculated to be 49. 0 and 0.64 in 2011 and 2015, respectively.

Findings

To analyze the data, descriptive statistics (frequency, mean and standard deviation), and inferential statistics (correlation coefficient and multiple regression analysis) are used for IDB (international database) and SPSS (statistical package for social science) software have been used.

Descriptive statistics: Using data from collected data from a set of related questions related to gender, age, teaching experience, degree and field of study, and duration of the mathematics weekly teaching of eighth grade in TIMSS studies of four periods of 2003, 2007, 2011 and 2015. Trend information on changes of each of the variables and the average of students' progress by gender specification are presented in tables 3 to 7 and Figures 1 to 5.

Table 3.
Descriptive information about the age of math teachers and the mean of math progress of students in the eighth-grade

TIMSS	Gender	Age to year				number	total
		Less than 30 years	Average of mathematic progress	30 years or more	Average of mathematic progress		
2003	Female	16	414.67	44	422.02	60	168
	Male	17	396.90	91	413.49	108	
2007	Female	17	385.18	59	429.97	76	187
	Male	19	386.44	92	418.04	111	
2011	Female	11	378.40	81	424.86	92	209
	Male	18	389.09	89	431.91	117	
2015	Female	13	415.37	109	446.27	122	248
	Male	13	400.71	113	445.73	126	

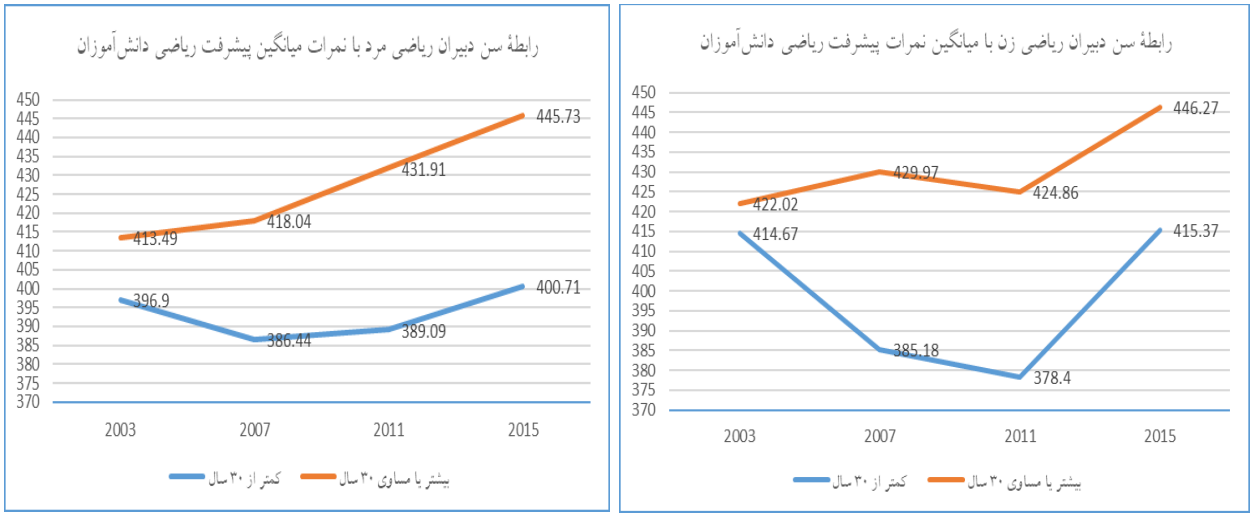

Figure 1.
The process of changing the age of male and female math teachers and the mean of math progress of the eighth-grade students

According to Table 3, in each of the four periods of 2003 to 2015, eighth-grade math teachers in both men and women groups who are more than 30 years old have the most numbers. Also, in all four periods of 2003-2015 students, Eighth-grade math teachers in both male and female groups who were 30 years old or more had more progress compared to the ones who were less than 30 years of age. According to Figure 1, the performance of the students who had a female teacher of 30 years of age or more was increasing in all periods except for 2011. While the performance of students in the group which had a male teacher in the same age group was increasing from 2003 to 2015. In 30 year old and less age group of female teachers,

students' performance was decreasing from 2003 to 2011 but it up surged in 2015. The same trend can be seen in the groups with a male teacher.

Table 4.
Descriptive information about teaching history of math teachers and the average of students' progress

TIMSS	gender	Age to year							
		Less than 10 years	Average of mathematic progress	20 year Or more	Average of mathematic progress	10 T0 20	Average of mathematic progress	number	total
2003	female	31	449.82	9	416.59	28	412.08	68	172
	male	29	427.13	41	402.62	34	394.18	104	
2007	female	33	469.00	20	414.39	31	389.58	84	204
	male	29	428.58	38	410.47	53	397.85	120	
2011	female	49	437.15	25	419.66	31	389.74	105	232
	male	39	454.82	39	410.06	49	393.74	127	
2015	female	16	456.37	53	444.91	55	393.03	124	251
	male	20	463.34	63	427.40	44	392.35	127	

According to Table 4, in 2003, 2007, and 2011, female teachers with a teaching experience of fewer than 10 years have the highest number, and the ones with a record of 20 years or more, include have the lowest number. But in 2015, female math teachers with a teaching experience of 10 to 20 years have the highest number and the ones with less than 10 years have the lowest number. About the male teachers, in the years 2003 and 2015 the highest rate is for the ones with 20 years of experience or more. The lowest Number is related to the ones with less than 10 years of experience in all periods except for the year 2011. In 2011 less than 10 years and more than 20 years of experience are at the same rate. In each of the four periods of 2003, 2007, 2011, and 2015, the performance of the students of the Math teachers (male and female) with a record of less than 10 years of teaching and performance of students of mathematics teaching (male and female) with more than 20 years of teaching experience was better.

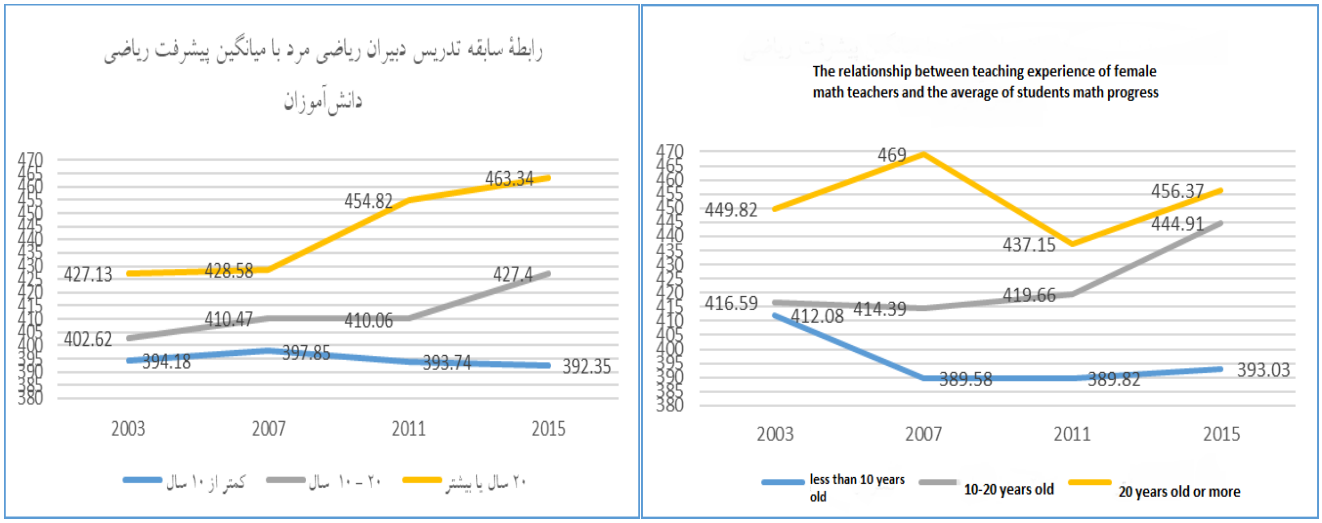

Figure 2.
Fluctuating Changes of Male and Female Teachers and Average Math Progress of Eighth grade Students.

According to the data in Figure 2, the performance of students in the group of female teachers aged 20 years or more except 2011was improving. Students' performance trends in the groups with male teachers with the same amount of background from 2003 to 2015 have been incremental. The process of changing the performance of students in the 10 to 20 year group of male and female teachers is increasingly identical,

in the group with less than 10 years of recording, we witnessed a decline in student performance from 2003 to 2015.

Table 5.
Descriptive information about the degree of math teachers and the average math progress

TIMSS	gender	Degree level				number	total
		Associate Degree And diploma	Average of mathematic progress	Bachler and upper degree	Average of mathematic progress		
2003	female	*43*	420.02	25	418.59	68	176
	male	*61*	409.04	47	402.62	108	
2007	female	39	439.31	46	421.48	85	208
	male	65	399.47	58	425.49	123	
2011	female	41	413.64	62	416.78	103	233
	male	44	415.35	86	425.69	130	
2015	female	24	446.18	97	442.17	121	254
	male	28	444.01	95	440.31	123	

The data from Table 5 shows that in 2003 most female math teachers of the eighth-grade had a diploma or Associate Degree. However, in the years 2007-2015, most math teachers had a Bachelor's degree or higher. In the case of male mathematical professors, in the 2003 and 2007 periods, most of them have a Diploma or college degree. While in 2011 and 2015, teachers had bachelor degrees or higher education. In addition, the data indicates that in three periods of 2003, 2007 and 2015, the performance of students with female math teachers with a diploma or Associate degree is higher than the performance of high school students with a teacher who had bachelor's degree and higher. However in the case of male teachers with an associate degree or diploma, this trend is reversed and a score for math progress with undergraduate and postgraduate teachers was higher in the three periods from 2003 to 2011. During 2015 period, the score for the math progress of students who had male teacher with a degree or associate degree was higher than that of the teachers with bachelor degree or higher.

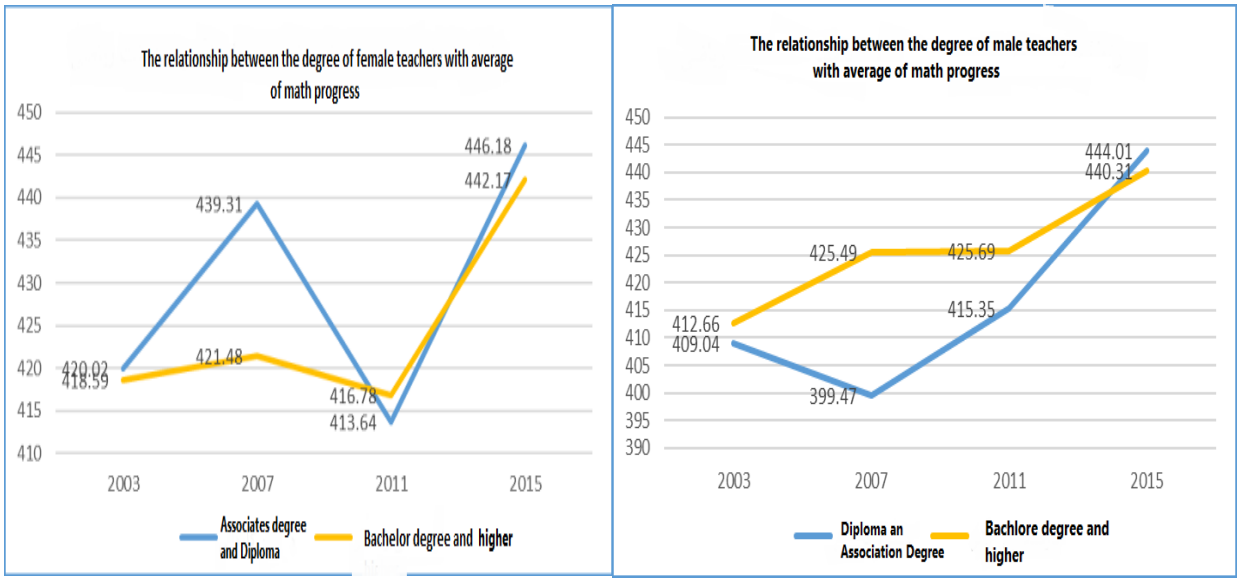

Figure 3.
The process of changing the degree of male and female math teachers and the average student's math progress

According to Figure 3, from 2003 to 2007, the performance of students with female teacher who had a diploma or associated degree or higher has changed more. In 2011 and 2015, the trend was the same. In the

group of male teachers, until 2011 the performance of students with teachers who had bachelor degree or higher, was better and in 2015, the performance of the students with teachers who had Diploma and similar qualifications have been higher for high school students.

Table 6.
Descriptive information about the field of math teachers and the average mathematical progress

TIMSS	gender	Field of Study				number	total
		Mathematic training	Average of mathematic progress	other	Average of mathematic progress		
2003	female	21	421.42	58	418.58	79	223
	male	45	426.17	106	410.80	144	
2007	female	78	407.97	55	435.04	100	266
	male	65	399.47	88	417.24	166	
2011	female	47	404.60	52	424.45	99	232
	male	74	417.80	49	426.96	123	
2015	female	51	455.72	95	434.14	146	310
	male	58	447.33	106	441.27	164	

According to Table 6, in the four periods of 2003, 2007, 2011, and 2015, the highest number of female teachers in the eighth-grade was related to other majors and the lowest number in all courses were related to math education. About the 8th grade male teachers, the courses for 2003, 2007 and 2015, except for 2011, have the highest number of other majors, and only in 2011, the largest number was related to mathematical education. In addition, in all four periods of 2003, 2007, 2011, and 2015, both women and men, the performance of the students of the faculty whose teachers had a degree in mathematics at the university was lower than the other group.

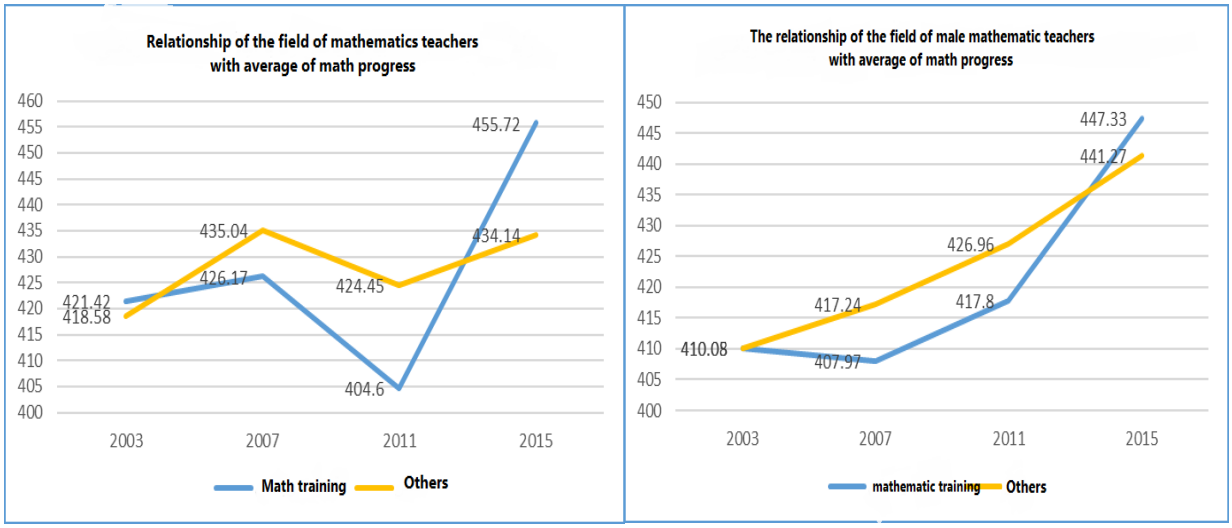

Figure 4.
Changes in the field of study of male and female math teachers and the average student's math progress

According to the data of Chart 4, the average of the mathematics progress of the students whose teachers had studied mathematics, was less than in 2015 compare to other majors, in both male and female groupexceptfor 2015.

Table 7.
Descriptive information about the weekly teaching time of math teachers and the average of mathematics progress

TIMSS	gender	Mathematical weekly teaching time					
		Less than 3 hours	Average of mathematic progress	More than 3 hours	Average of mathematic progress	number	total
2003	female	33	410.02	27	427.86	60	146
	male	53	408.00	33	441.49	86	
2007	female	51	410.07	25	469.10	76	191
	male	80	399.32	35	437.62	115	
2011	female	63	408.00	41	427.68	104	230
	male	68	414.98	58	424.10	126	
2015	female	51	427.35	51	461.74	114	231
	male	58	420.23	48	461.96	117	

According to Table 7, in 2007 and 2015 in the female teacher group, the progress of the students whose teachers work over 3 hours weekly have been more. However, increasing the teaching hours did not have any effect on increasing students' mathematical scores in 2003 and 2011. In the group of male teachers, in all four stages of TIMSS, student's math progresses with more than 3 hours of weekly teaching is increasing.

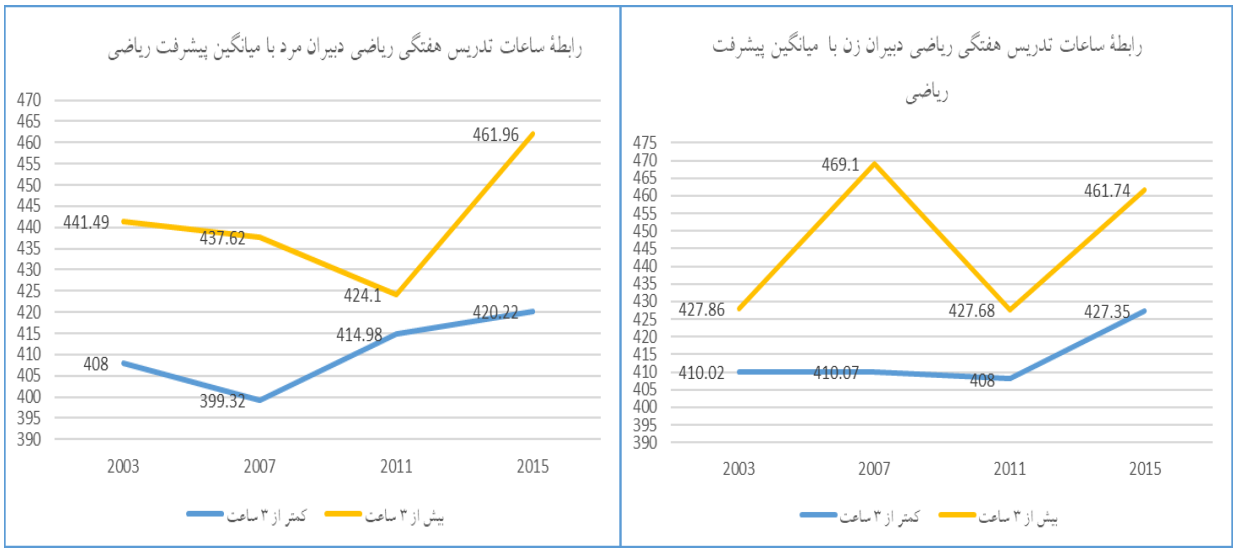

Figure 5.
The process of changing the weekly teaching hours for male and female teachers and the average of mathematics progress

According to Figure 5, in both groups of male and female teachers, the process of students' performance with the teachers who worked more than 3 hours weekly has always been higher. But working more during a week hasn't changed students' performance in 2003 and 2011. In male group of teachers, students' whose teachers work more than 3 hours a week have better performance and it is improving in all four stages of TIMSS.

Inferential statistics

To study the relationships between variables related to teachers and the mathematics progress of eighth grade students, Pearson Correlation Coefficient was used.

Table 8.
Pearson correlation coefficients between predictor variables and mathematics progressive variables

Independent variables related to the eighth-grade mathematics teachers	The correlation	Significance P level
Teaching experience	0.18	P< 0.01
Self Confidence	0.15	P< 0.01
Age	0.12	P< 0.01
Job Satisfaction	0.10	P< 0.01
teaching method	-0.09	P< 0.01
Interacting with other teachers	0.07	P< 0.01
Weekly teaching hours	0.06	P< 0.01
Field of Study	-0.02	P> 0.01
degree of education	-0.007	P> 0.01

Correlation coefficients shows that the mathematical progress of the eighth-grade students with all predictive variables which were introduced in analysis, except for gender and teacher's degree, there is a significant relationship at the level of 0.01 which among them The relationship of one variable (teaching method) is negative and seven variables (teaching history, self-confidence, age, job satisfaction, teaching method, interaction with other teachers, weekly teaching hours, and field of study) is positive. The most significant correlation corresponds to a teacher's experience of 0.18, and the lowest correlation is related to the field variable. (0.06).

To investigate the predictor variables for mathematical progress and determine the contribution of each of the variables in the prediction of regression analysis, multiple systematic methods were used. Table 8 summarizes the unstandardized regression coefficients B, for different variables related to the eighth-grade math teachers, studied in four periods of TIMSS (2003, 2007, 2011 and 2015).

Table 9.
The coefficients of the prediction model of mathematics progress based on the predictor variables in four periods of TIMSS

TIMSS	age	gender	degree of education	Field of Study	Math's weekly teaching hours	Teaching experience	teaching method	Interacting with other teachers	Self Confidence	degree of education
2003	-25.55	8.84	0.23	0.00	0.22	1.75	_	_	_	_
2007	9.02	0.00	16.28	-6.41	0.13	2.18	_	_	_	_
2011	12.49	0.00	12.37	0.00	0.15	3.37	-3.37	0.00	5.78	0.00
2015	0.00	0.00	0.00	17.22	0.12	2.46	-4.76	0.86	6.43	1.24

As seen in Table 9:

- In 2003, the highest predictive value of the student's math progress was related to the teacher's age (25.55), and the lowest one is the weekly teaching hours of mathematics (0.22). The variables of the field of study, job satisfaction, self-esteem, interaction with other teachers and teaching methods are not included in the regression equation.
- In 2007, the highest predictive value of the student's math progress was related to the teacher's degree (16.28), and the lowest rate is related to the weekly teaching hours of mathematics (0.13). Gender variables, job satisfaction, self-confidence, interaction with other teachers and teaching methods are not included in the regression equation.
- In 2011, the highest predictive value of the student's math progress was related to the teacher's age (12.49), and the lowest is the weekly teaching hours of mathematics (0.15). The variables of gender, the field of study, Job satisfaction, and interaction with other teachers are not included in the regression equation.
- In 2015, the highest predictive value of student's math progress was related to the academic field variable (17.22), and the lowest is the weekly teaching hours of the math (12.2). The variables of gender, age, and the degree are not included in the regression equation.

Discussion and Conclusion

Based on the data from TIMSS studies in a 12-year period, the process of changes and the role of demographic and personality variables such as Mathematic major and their influence on the mathematical development of students in the eighth-grade participating for TIMSS studies from 2003 to 2015 was studied. The findings of this study are discussed in two sections below: (a) Studying the process of variables, and (b) studying the role of variables. Given that in the two periods of 2003 and 2007 the teacher's personality variables has not been examined, only the demographic variables in these two periods were examined.

(A) The results of the study of the variables such as age and teaching history showed that in all four periods of TIMSS, age 30 or older, and teaching experience of 20 years and more in both male and female teachers have been associated with better performance of students. In explaining this finding, it can be said that teachers' experience increases with age. The experienced teachers can identify and predict students' educational and cognitive issues by mastery of teaching skills and class management. To predict a high teaching experience has led to more professional skills in teaching methods and impact on quality is taught, which in turn affects students' academic performance. These findings are aligned with the results of Research by Fang et al. (2017), Liang and Jia (2015), Alikhani (2014), Soleimani (2011), Sarmadi, Saif,Talebi, and Abedi (2010), as well as Abedi, Karmudost, Rahiminejad, and Hejazi (2009).

According to a research background, it is expected that by increasing the hours allocated to the math class, the result of the performance Students gets better. Because of individual differences in learning, the amount of time they reach for the mastery of learning a specific assignment is different. So, by assigning more time to the lesson and doing exercises, the student's problems are more likely to be resolved and learning is provided for students. This is true for all male teachers at all four periods of TIMSS the. However, the process of changing weekly teaching hours about female teachers does not show this increase in 2003 and 2011.

In the field of education, there is a completely different trend in both male and female teachers in the three periods of 2003 to 2011. Because it is expected that the teacher mastery and knowledge of the subject he or she teaches, is aligned with the major the person has studied at the university, and this will lead to better and learning of the students. In other words, if the knowledge of the content of the mathematics course that the teacher teaches and had learned are the same, the teacher is more successful. This was only seen in TIMSS 2015. In explaining this finding it can be said that that the professional knowledge collection of teachers is not only about knowledge of the content of the course but it also consists of three other areas, namely, knowledge of Education, knowledge of learners and knowledge of learning style (Seif, 1395). To be successful in teaching, one should be equipped with all four knowledge and abilities.

The process of changing teacher's degree about female teachers showed that the performance of students whose math teachers had Diplomas and associate degree were higher than those who had a bachelor degree and higher. In the case of male teachers, the opposite was seen. That is, teachers who had a bachelor or higher degree had better performance of students. Studying at university leads to more familiarity with the related topics in that area. This recognition can lead to the teacher's better control over the scientific content of the subject. In this way, the teacher can address a variety of field issues and their surroundings. Despite the fact that in recent years, there has been an increasing trend in women's education levels. Higher education is expected to increase the level of information in the professional field.

B) The findings of the research showed that among all 6 demographic variables, except for 2003, the teacher's gender variable enter the regression equation. The highest predictive value of students' mathematical progress in two periods of 2003 and 2011 was the age variable. The teaching experience has been influential in all courses. Weekly teaching hours of math in all courses has the least predictive value of the students' mathematical progress. The major in 2015 has the highest predictive value of the students' mathematical progress and the degree in all courses except for 2015 has not entered the equation. In addition, among the four personality variables, self-confidence variable has the highest impact and the interaction variable with other teachers has the least effect. These findings are found in studies conducted by researchers such as Ghelani, Kadivar, Sarrami and Esfandiari (2012), Vakili Harris, Hejazi and Ezhey (2009), Taleh (2008), as well as Coral, Tavares, Jajj and Kuhn (2005).

In general, it can be said that the teacher can, directly and indirectly, influence the students' mathematics progress. Teacher's confidence is one of the characteristics associated with more rate success. The more these features in teachers, the more likely they are to be confident in their work and expect more success in their field of work. In other words, with increasing self-esteem, the flexibility of a person goes

up with people and subjects, and he or she can communicate better with others. On the other hand, self-confidence, in work, practice, skill and specific efficiency goals plays a vital role in certain areas. Confidence makes an individual likely to succeed in anticipating similar activities in the future. Teachers with higher self-efficacy have higher-level goals for teaching. They consider themselves to apply more effective methods of teaching, make students more aware of the materials and they have better communication and interaction with the students (Qolani, Kadivar, Sarrami & Esfandiari, 2012).

Although job satisfaction is one important factor in success and motivation in the job and increases the efficiency and the feeling of Job Security (Shafiabadi, 1396), in explaining the reason why job satisfaction plays a less important role in predicting math performance, it can be said that perhaps the moral commitment and the sense of responsibility of teachers in this field have been bolder. Because teaching is not a well-paid job if the teacher is interested in his job, then the energy and the good vibes from the presence of students can compensate salary and other shortfalls.

The use of effective teaching methods is essential for better learning of students. This idea has been confirmed in various researches such as Zakaria, Sulfatiri, Davood and Abedin (2013), Soleimani, Sepehrian Azar and Ghaderi (1395), Capar And Tarim (2015), Dortaj (2013), Ebrahimi, Saber, and Sharifzadeh (2014), Mortazavi, Bashkar, Mesghani, Ahmadi and Ali Zadeh (2011) and Ho, Zing and To (2018). In this study, the effect of the teaching method in prediction of mathematics progress has been shown. Nevertheless, the reasons for the negative impact of teaching methods on the student's math performance also need to be studied more.

Various researches have pointed to the participatory professional development of teachers (; Goddard & Moran, 2007; Liu, Tasa & Han, 2015; Mortazi Mehrabani & Goya, 1393). Many educational experts and researchers believe that professional growth can increase the teacher's learning, provide an informal and continuous presentation on improving teaching skills, improving educational decision making and and day-to-day assessment of students through compilation work (Conley et al., 2004). Teachers who work in common field and learn together are more successful in identifying the causes of problems and finding solutions for those problems. Other researchers (Harrison, 2004; Stone & Cooper, 2006; Tallerico, 2005) have also confirmed this statement. In this research, the reason why the variable effect of interaction with other teachers is less important than the other studied variables could be because of cultural differences.

Because of the size of the study, the possibility of examining the scores of the criteria or in relation to the content and cognitive dimensions of the mathematics was not feasible which needs further consideration and it is suggested that these cases be considered in future studies. Also, for further examination of the reasons , the difference in the performance of female teachers with bachelor degree and higher, the effect of more teaching hours on performance, the related academic major and the negative impact of teaching methods are needed to be studied further. Given the size of the effect found for variables of teaching history and self-confidence, it is required to value experienced teachers and use their knowledge also transferring their knowledge to other teachers is encouraged.

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