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The Relationship of the Dimensions of Perceived Teaching Style with Students' Mathematics Achievement and Self-Efficacy

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ABSTRACT

The objective of the present study was to determine the relationship of the dimensions of perceived teaching style with students' mathematics achievement and self-efficacy. To this end, among 432 individuals considered as the statistical population, a corpus of 205 third grade high school students studying mathematics and physics in public high schools in Zahedan in the academic year 2014-2015 was selected based on gender using the stratified random sampling method. The Teacher as Social Context Questionnaire (Belmont et al., 1992) and the Mathematics Self-Efficacy Scale-Revised (Betz & Hackett, 1983) were completed by the subjects and the mean scores on geometry, arithmetic, and algebra were used as indicators of mathematics achievement. To analyze the obtained data, both descriptive (frequency, mean, and standard deviation) and inferential statistics (the Pearson correlation coefficient, simultaneous regression analysis, and one-sample t-test) were applied. The results indicated that the dimensions of perceived teaching style (autonomy support, structure, and involvement) were related to mathematics achievement and self-efficacy and were able to significantly predict them. Finally, the results of the t-test demonstrated a difference between the males and females with regard to self-efficacy; however, no difference was found between them in terms of mathematics achievement.

KEYWORDS
Dimensions of Teaching Style, Self-Efficacy, Mathematics Achievement, Mathematics Self-Efficacy, Self-Determination Theory.

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Introduction

The low efficiency of teaching and learning practices, remarkable growth of human knowledge, scientific advances achieved due to the technology, and

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hundreds of other similar factors have led many researchers and specialists in the realm of education and training to attempt to reform and improve the performance of education systems through creating some major changes in the traditional methods of teaching and learning (Mortazavi, Beshkar, Mesgarani, Ahmadi, & Bakhshalizadeh, 2011). This is while some previously conducted studies have shown that educational and individual factors with a cognitive and social nature have the greatest impact on academic achievement (Golman, 1995; Wong, 2005; Mayee, 2001). Since in any educational system, educational achievement is considered as the most important indicators of the success of scientific and educational activities, examining factors affecting students' academic achievement is of significant importance to educational sciences and psychology researchers.

Literature Review

As cited in a study conducted by Jenaabadi (2012), Islami (2008), with regard to the level of academic achievement, reported a difference between male and female students, Maccoby and Jacklin (1974) stated that males' mathematics performance was better than that of females', and Jorde-Blom (1988) mentioned that males, compared to females, were more confident in their mathematics ability. On the other hand, the results of a study carried out by Pajares and Kranzler (1995) demonstrated that there was not any differences between male and female students comparing their abilities in solving math problems. Additionally, the results of Bourgin (2000), Lapan, Shaughnessy, and Boggs (1996), and Pajares (1996) revealed a significant relationship between gender and mathematics self-efficacy (Shahni Yeilagh, Rajabi, Shokrkon, & Haghighi, 2003). Moreover, no significant differences were found in the structural models considered in studies conducted by Ghazi Tabatabaee, Hatami, and Naghsh (2013) and Keramati and Shahrarai (2004).

Schulz et al. (2002) stated that the perceived self-efficacy creates a pleasant feeling and it is inclusively associated with motivation and successful completion of assignments in all people; therefore, several psychologists have attempted to examine self-efficacy beliefs which represent the power of efficient attitudes towards choosing a field of study and having academic achievement (Zimmerman, 2000). The empirical evidence showed a correlation between self-efficacy and academic achievement, such that students with high levels of self-efficacy, compared to students with low levels of self-efficacy, obtained greater scores on writing assignments and tests (Pajares, 2000; Tuckman, 2007; Patrick, Allison, & Kaplan, 2007). Pajares (2003) indicated that mathematics self-efficacy, compared to mathematics performance, was a more powerful predicator of mental abilities. In addition, students with higher self-efficacy, in comparison with students with lower self-efficacy, were much more accurate in mathematical calculations and were more persistent when solving a hard problem. The results of a study carried out by Ghazi Tabatabaee, Hatami, and Naghsh (2013) demonstrated a significant and positive relationship between mathematics self-efficacy and attitude. Gholami Lavasani, Hejazi, and Khezriazar (2011) revealed the mediating role of approaches to learning and effort in relation to achievement goals and mathematics achievement and put an emphasis on the indirect positive effect of mastery-oriented goals through applying deep and surface learning approaches and attempting to achieve math progressions.

The results of a study conducted by Crisan, Albulescu, and Copacia (2014) showed that there was not any significant relationship between test anxiety and teaching styles; however, Pajares (1996) and Kabiri, and Kiamanesh (2004) demonstrated the relationship between mathematics achievement and mathematics self-efficacy. Moreover, Rabab'h and Veloo (2015) mentioned the spatial visualization and perception of time as intermediary factors which play a role in the relation of learning with academic achievement and motivation.

Hattie (2009), Hardre and Reeve (2003), Reeve, Jang, Carrell, Jeon, and Barch (2004), Su and Reeve (2011) indicated the role of teachers' teaching styles as a key factor in supporting students' perceived competence, independence, and achievement in the process of training. The results of Guay and Boggiano (2001) and Hagger, Chatzisarantis, Culverhouse, and Biddle (2003) put an emphasis on the positive correlation between teachers' training accompanied with parents' support in predicting sources of motivation and achievement among students. In the past, many experts insisted on the role of teaching in helping students to learn and memorize various kinds of data in different fields. In this line, teachers mostly paid attention to methods of presenting facts, events, and examples. Although this is one the main tasks of teachers, new theories suggest methods which make learning easier (Khoshbakht & Kheir, 2005). Accordingly, the self-determination theory describes three important dimensions of teaching including autonomy support, structure, and involvement (Deci & Ryan, 2000). Autonomy support satisfies the need for self-determination, structure satisfies the need for competence and includes the interaction among clear expectations accompanied with respect to students' behaviors, and involvement refers to teachers' sensitivity and accountability to students and includes creating a loving educational environment and being a friendly, intimate, and supportive teacher (Marzie, Ejei, Hejazi, & Ghazi Tabatabaee, 2012; Ryan & Patrick, 2001).

Leptokaridoua, Vlachopoulosa, and Papaioannoub (2014) conducted an experimental longitudinal test and examined the influence of autonomy-supportive teaching on motivation (enjoyment, fear of failure, fatigue, and effort) for participation in physical education among fifth and sixth grade elementary school students. The results of this study indicated that students with high autonomy support had high motivation and those with low autonomy support had low motivation. Furthermore, Gillet, Vallerand, and Lafrenière (2012) and Soenens and Vansteenkiste (2005) challenged the effect of fathers' autonomy support on students. Marzie, Ejei, Hejazi, and Ghazi Tabatabaee (2013) noted the direct effects of the dimensions of perceived teaching style on creativity and revealed the indirect effects mediated by autonomous motivation on creativity. Moreover, they demonstrated the positive and significant correlation of the dimensions of teaching style with academic motivation and involvement. In the same line, Keikha (2015) and Kord Afshari (2012) revealed a significant and positive relationship between the preferred teaching style and involvement. The results of a study conducted by Guay, Ratelle, Larose, Vallerand, and Vitaro (2013) put an emphasis on the key role of two teaching styles (authoritative and authoritarian) in predicting mathematics motivation and mentioned that the valid teaching style was a better predicator compared to other styles. Aldhafri and Alrajhi (2014) showed the importance of the valid and authoritarian teaching styles in predicting mathematics motivation based on both extrinsic and intrinsic motivations and indicated the superiority of the valid teaching style in predicting both types of motivation.

The present study aimed to determine the relationship of the dimensions of perceived teaching style with mathematics achievement and self-efficacy. To this end, it was assumed that the dimensions of perceived teaching style were able to predict mathematics achievement and self-efficacy. Thereafter, the differences between the male and female students in mathematics self-efficacy and achievement were examined.

Method

This descriptive study followed a correlational design. The statistical population of the current study included all third grade high school students (studying mathematics and physics) in district 1 and 2 of Zahedan in the academic year 2014-2015 (N=432). Based on the Morgan's table, 205 students (57 females and 148 males) were selected as the sample based on gender using the stratified random sampling method. The data collection tools were as follows.

The Belmont, Skinner, Wellborn, and Connell Teacher as Social Context Questionnaire (1992): This questionnaire measures three dimensions of teaching (i.e. autonomy support, structure, and involvement). Each subscale consists of 8 items, the answers to which range from 1 to 4. The Belmont et al. (1992) examined the internal consistency of this questionnaire and reported that the Cronbach's alpha coefficients of structure, autonomy support, and involvement were respectively 0.76, 0.79, and 0.80.

The Betz and Hackett Mathematics Self-Efficacy Scale-Revised (MSES-R): The Persian version of this scale, designed by Betz and Hackett (1983) to examine university students' mathematics self-efficacy, was used. This scale includes 52 items and has 3 subscales including math homework (18 items), math lessons (16 items) and math problems (18 items). In a structural analysis, the Cronbach's alpha coefficients of math homework and math lessons were respectively 0.93 and 0.94. In the current study, the Cronbach's alpha coefficient of mathematics self-efficacy beliefs (the original form) was obtained 0.92.

To measure students' mathematics achievement, the mean scores of the third grade high school students studying mathematics and physics in the academic year 2014-2015 on arithmetic, algebra, and geometry were considered.

Findings

The results obtained from the simultaneous regression analysis conducted to examine the role of the dimensions of perceived teaching style in predicting mathematics achievement are presented in Table 1.

Table 1

The results of the simultaneous regression analysis between the perceived teaching style and mathematics achievement

Variables		R	Adjusted R2	F	B	T	Sig
Mathematics achievement	Involvement	0.842	0.707	492.72	0.842	22.19	0.001
	Structure	0.772	0.595	300.08	0.772	17.32	0.001
	Autonomy support	0.933	0.870	1364.29	0.933	36.93	0.001

As presented in Table 1, the results indicate that involvement, structure, and autonomy support are able to respectively predict 70.7%, 59.5%, and 87.7%

of the variance in the students' mathematics achievement. Therefore, it can be inferred that the dimensions of perceived teaching style are able to predict the students' mathematics achievement. Moreover, the perceived autonomy support is the greatest predicator of the students' mathematics achievement.

The results obtained from the simultaneous regression analysis conducted to examine the role of the dimensions of perceived teaching style in predicting mathematics self-efficacy are presented in Table 2.

Table 2

The results of the simultaneous regression analysis between the perceived teaching style and mathematics self-efficacy

Variables		R	Adjusted R2	F	B	T	Sig
Mathematics self-efficacy	Involvement	0.204	0.037	8.82	0.204	2.97	0.003
	Structure	0.162	0.022	5.49	0.162	2.34	0.01
	Autonomy support	0.183	0.029	7.01	0.183	2.64	0.009

As demonstrated in Table 2, the results show that involvement, structure, and autonomy support are able to respectively predict 37%, 22%, and 29% of the variance in the students' mathematics self-efficacy. Overall, it can be inferred that the dimensions of perceived teaching style are able to predict the students' mathematics self-efficacy. Moreover, the perceived involvement is the greatest predicator of the students' mathematics self-efficacy.

To examine the relationship between the dimensions of perceived teaching style with mathematics achievement, the Pearson correlation coefficient was applied, the results of which are presented in Table 3.

Table 3

The results of the Pearson correlation coefficient of the dimensions of perceived teaching style with mathematics achievement

Variables		R	Sig
Mathematics achievement	Involvement	0.842**	0.001
	Structure	0.772**	0.001
	Autonomy support	0.933**	0.001

The results demonstrate the relationship of the dimensions of perceived teaching style with involvement (r=0.842), structure (r=0.772), and autonomy support (r=0.993). Considering the relationship of the dimensions of perceived teaching style with students' mathematics achievement, it can be stated that autonomy support has the greatest correlation with the students' mathematics achievement.

To determine the relationship of the dimensions of perceived teaching style with mathematics self-efficacy, the Pearson correlation coefficient was used, the results of which are presented in Table 4.

Table 4

The results of the Pearson correlation coefficient of the dimensions of perceived teaching style with mathematics self-efficacy

Variables		R	Sig
Mathematics self-efficacy	Involvement	0.204**	0.003
	Structure	0.162**	0.01

	Autonomy support	0.183**	0.009

As shown in Table 4, the results demonstrate the relationship of the dimensions of perceived teaching style with involvement (r=0.204), structure (r=0.162), and autonomy support (r=0.183). Considering the relationship of the dimensions of perceived teaching style with the students' mathematics self-efficacy, it can be stated that involvement has the greatest correlation with the students' mathematics self-efficacy.

To investigate the difference between the male and female students in mathematics achievement, the one-sample t-test was applied, the results of which are presented in Table 5.

Table 5

The results of the one-sample t-test conducted to examine the difference between the males and females in mathematics achievement

Variables	Gender	N	Mean	SD	T	df	Sig
Mathematics achievement	Females	57	13.66	2.36	1.56	203	0.12
	Males	148	13.02	2.72			

The above results indicate that the difference between females (N=57) with a mean of 13.66 and a standard deviation of 2.36 and males (N=148) with a mean of 13.02 and a standard deviation of 2.72 is not significant at the 95% confidence level (P>0.05). Therefore, it can be stated that the levels of mathematics achievement in male and female students are the same.

To investigate the difference between the male and female students in mathematics self-efficacy, the one-sample t-test was applied, the results of which are presented in Table 6.

Table 6

The results of the one-sample t-test conducted to examine the difference between the males and females in mathematics self-efficacy

Variables	Gender	N	Mean	SD	t	df	Sig
Mathematics self-efficacy	Females	57	120.80	30.61	-1.90	203	0.05
	Males	148	129.16	27.23			

The above results show that the difference between females (N=57) with a mean of 120.80 and a standard deviation of 30.61 and males (N=148) with a mean of 129.16 and a standard deviation of 27.23 is significant at the 95% confidence level (P<0.05). Therefore, it can be stated that the levels of mathematics self-efficacy in the male and female students are different and the male students' self-efficacy is higher than that of the females'.

Discussion and Conclusion

The present study aimed to determine the relationship of the dimensions of perceived teaching style with mathematics achievement and self-efficacy. The obtained results demonstrated that the dimensions of perceived teaching style were able to predict the students' mathematics achievement. In addition, the subscale of autonomy support was the best predicator of the students' mathematics achievement. These findings are in line with the results of a study, conducted by Guay, Ratelle, Larose, Vallerand, and Vitaro (2013), in which three groups of students were considered. Group 1 (17%) included students who perceived low autonomy support by their mother, father, and teacher, Group 2

(7%) included students who perceived low autonomy support by their father, but moderate autonomy support by their mother and teacher, and Group 3 (76%) included students who perceived all sources as moderately autonomy-supportive. The results of the abovementioned study demonstrated that the third group had higher levels of academic achievement. Marzie et al. (2013) noted the direct effects of the dimensions of perceived teaching style on creativity and revealed the indirect effects mediated by autonomous motivation on creativity. Additionally, the findings of the current study are consistent with the results obtained from a study, conducted by Aldhafri and Alrajhi (2014), which showed the importance of the valid and authoritarian teaching styles in predicting mathematics motivation and indicated the superiority of the valid teaching style in predicting both types of motivation. Moreover, these findings are in line with the results of some previously carried out studies which mentioned that autonomy support is a key factor in increasing motivation, the lack of which leads to a decrease in the level of motivation (Hattie, 2009; Hardre & Reeve, 2003; Reeve, Jang, Carrell, Jeon, & Barch, 2004; Su & Reeve, 2011; Guay & Boggiano, 2001; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Leptokaridoua, Vlachopoulosa, & Papaioannoub, 2014). In addition, the findings are consistent with the results of Vallerand, Fortier, and Guay (1997) and Grolnick, Ryan, and Deci (1991) who demonstrated that autonomy support was a powerful factor in predicting the educational success. However, these findings are not in line with the results of studies carried out by Gillet, Vallerand, and Lafrenière (2012) and Soenens and Vansteenkiste (2005) who challenged the effect of fathers' autonomy support on students.

Evidence showed that supporting students' psychological needs including their autonomy, competence, and sense of belonging by teachers can facilitate students' self-determination, self-regulated learning, academic performance, and well-being. The results indicated that children whose teachers believed in self-autonomy had higher levels of intrinsic motivation, perceived competence, and self-esteem compared to those who had controlling teachers (Ruco & Albert, 2009; Reeve, Jang, Carrell, Jeon, & Barch, 2004; Marzie et al., 2013). Gholami Lavasani, Hejazi, and Khezriazar (2011) revealed the mediating role of approaches to learning and effort in relation to achievement goals and mathematics achievement and put an emphasis on the indirect positive effect of mastery-oriented goals through applying deep and surface learning approaches and attempting to achieve math progressions. Moreover, the results of Crisan, Albulescu, and Copacia (2014) showed that there was not any significant relationship between test anxiety and teaching style; however, Pajares (1996) and Kabiri and Kiamanesh (2004) demonstrated the relationship between mathematics achievement and mathematics self-efficacy. Moreover, Rabab'h and Veloo (2015) mentioned the spatial visualization and perception of time as intermediary factors which play a role in the relation of learning with academic achievement and motivation.

Furthermore, with regard to the relationship of the dimensions of perceived teaching style with self-efficacy, the results obtained from the simultaneous regression analysis and independent t-test indicated that the dimensions of perceived teaching style were able to predict the students' self-efficacy and the subscale of involvement was the best predicator of self-efficacy in the students. This finding is in line with the results of some previously conducted studies which showed the positive and significant relationship of the dimensions of

perceived teaching style with academic achievement and involvement (Keikha, 2015) and the positive and significant correlation between the preferred teaching style and involvement (Kord Afshari, 2012). Aksu, Ozkaya, Damla Gedik, and Cihan Konyahoglu (2016) revealed significant relationships between math anxiety and self-efficacy, concern in mathematics and mathematics achievement, and math test anxiety and mathematics numerical anxiety.

Examining the difference between the male and female students in mathematics achievement indicated that the levels of mathematics achievement were the same in the male and female students. This finding is consistent with the results of Pajares and Kranzler (1995) who demonstrated that there was not any differences between the male and female students comparing their abilities in solving math problems. Moreover, no significant differences were found in the structural models considered in the studies conducted by Ghazi Tabatabaee, Hatami, and Naghsh (2013) and Keramati and Shahrarai (2004). However, this finding is not in line with the results of some previously conducted studies including Islami (2008) who reported a difference between male and female students with regard to the level of academic achievement, Maccoby and Jacklin (1974) who stated that males' mathematics performance was better than that of females', and Jorde-Blom (1988) who mentioned that males, compared to females, were more confident in their mathematics ability (Jenaabadi, 2012). Additionally, the results of Bourgin (2000), Lapan, Shaughnessy, and Boggs (1996), and Pajares (1996) which revealed a significant relationship between gender and mathematics self-efficacy (Shahni Yeilagh, Rajabi, Shokrkon, & Haghighi, 2003) are not consistent with the results obtained from the current study.

The results of the current study can provide significant information for those working in educational institutions. Considering the role and importance of the dimensions of teaching style, training teachers is of significant importance. A class social structure has a huge impact on the learning process. Therefore, creating a respectful atmosphere which aids students to participate in class activities and ask their questions without having a concern about the possibility of being ridiculed or threatened is greatly suggested. Moreover, students should be aware of the objective of the class schedules. Supporting students' motives and interests can also play a key role in their progress. Moreover, the physical structure of a class should be in a way that it provides students the opportunity and possibility to have intellectual interactions with other students. Furthermore, teachers, who pay attention to their students' interests and give them the opportunity to choose their class activities freely, aid students to satisfy their psychological needs including the need to self-autonomy and competence (Deci & Ryan, 2012). Additionally, students' perception of their teacher's behaviors, as a person who supports self-autonomy, creates a sense of self-autonomy in students and promotes the level of autonomous motivation (Runco & Albert, 2009). In the same line, self-efficacy is a key factor affecting students' learning and progress. Therefore, increasing self-efficacy can be considered as an important objective of an education system. It often seems that being good at school probably leads to an increase in students' positive academic self-efficacy. Moreover, those who have a positive self-efficacy have a better feeling about their abilities and, thus, do their homework assignments better. Psychologist and motivation theorists believe that students' positive attitudes towards learning and their positive perception of their abilities have significant

impacts on their academic achievement. Given the significance of mathematics achievement, teachers are highly suggested to design tests from easy to hard in order to help their students to have positive experiences and promote their mathematics self-efficacy. Additionally, teachers are recommended to be patient and precise when teaching fundamental mathematical skills. Holding mathematical forums for students and teachers, holding math classes in the form of workshops, and dividing students into small groups which provides an appropriate environment for cooperative learning aid students to succeed in mathematics achievement.

Disclosure statement

No potential conflict of interest was reported by the authors.

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