The Predictive Power of Students' Perceptions of Classroom Assessment Environment for Their Mathematics Anxiety

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In this study, it was aimed to determine the predictive power of students' perceptions of classroom assessment environment for their mathematics anxiety. A correlational model was employed in this study, which was carried out with 410 high school students in the provinces of Diyarbakir in Turkey in the fall of 2014–2015. The Mathematics Anxiety Scale which was developed by Bindak (2005) was employed in the study to measure the students' math anxiety. Then, in order to determine the students' perceptions of the classroom assessment environment, the Classroom Assessment Environment Scale, which was developed by Ilhan and Cetin (2014a), was used. The relationships between students' mathematics anxiety and their perceptions of the classroom assessment environment were investigated via correlation and multiple regression analysis. The results obtained from the correlation analysis demonstrated that learning oriented assessment environment was negatively related to mathematics anxiety. In contrary, performance oriented assessment environment was positively related to mathematics anxiety. As a result of regression analysis, it was determined that students' perceptions of the classroom assessment environment explain 18% of the total variance on their mathematics anxiety.

Key Words: *Mathematics anxiety, Classroom assessment environment, Learning environment*

Introduction

Today's world is marked by fast scientific and technological changes. Mathematics plays a pivotal role in catching up with such changes (Alkan, 2013; Vukovic, Kieffer, Bailey & Harari, 2013). The ability to confront and overcome the problems prevalent in modern technological society requires one to have a strong mathematical background and to use mathematical thinking processes for solving such problems and making proper decisions (Alam & Nadim, 2014). Despite the fact that mathematics makes it easier for one to adapt to rapid changes in science and technology (Cuoco, Goldenberg & Mark, 1996) and to gain a place in society (Maloney, Waechter, Risko & Fugelsang, 2012), many people tend to exhibit mathematics avoidance (Richardson & Suinn, 1982), which is often associated with mathematics anxiety (Alexendar & Cobb, 1989).

Mathematics Anxiety

Mathematics anxiety is described as feelings of tension, panic and fear that one experiences in the face of tasks requiring numerical calculations or mathematical problems (Tobias & Weissbrod, 1980). Students with high levels of mathematics anxiety assume that mathematics is a mysterious area that

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calls for a special ability (Lazarus, 1974) and that it will not help them with their daily tasks (Ashcraft, Krause & Hopko, 2007; Ashcraft & Moore, 2009). As a result, such students will have negative attitudes towards mathematics as a course (Yenilmez & Ozabaci, 2003), suffer from lower academic self-concept (Gourgey, 1984) and decreased motivation (Marsh & Tapia, 2002), and become less likely to participate in classroom activities (Meece, Wigfield & Eccles, 1990).

In addition to the negative affective impacts it brings about, mathematics anxiety leads to a number of cognitive difficulties (Wang et al., 2014). Mathematics anxiety undermines students' abstract thinking skills and mental flexibility (Baymur, 1994); therefore, it diminishes their cognitive capacity to solve mathematical problems (Wang et al., 2014). The negative correlation between mathematics anxiety and mathematics achievement is another consideration in this respect (Hombree, 1990; Ma, 1999). All these suggest that the causes of mathematics anxiety must be understood in order to enable students to fully use their cognitive capacities and to improve their mathematics performance (Taylor & Fraser, 2013). Most previous studies have been focused on the consequences, not the causes, of mathematics anxiety, which makes it harder to find out the factors associated with mathematics anxiety. In other words, there are a limited number of studies that consider mathematics anxiety as a dependent variable and attempt to explore the factors that lead to variations in this dependent variable; therefore, it is not easy to give an answer to the question as to what variables result in mathematics anxiety (Eden, Heine & Jacobs, 2013). Some of the studies considering mathematics anxiety as a dependent variable have listed the variables that could have an effect on mathematics anxiety as follows: *gender* (Dewine, Fawcett, Szűcs & Dowker, 2012; Mutodi & Ngirande, 2014; Yuksel Sahin, 2008) *age* (Chaman & Callingham, 2013), *parental socioeconomic status* (Mahigir, Venkatesh Kumar & Ayat, 2012) and *parental educational status* (Yenilmez & Ozbey, 2006). Since these variables are impossible to control, however, the results of such studies fail to provide satisfactory explanation as to what practices should be adopted to reduce mathematics anxiety. This has caused researchers to focus on other possibly predictive variables of mathematics anxiety that are relatively easier to control. As a result, more emphasis has been placed on studies that explore the correlation between mathematics anxiety and those variables that are relatively easier to change and control, including parental expectations of higher achievement, methods of mathematics instruction, teacher feedback during the learning process, competitive environment in the classroom, classroom goal structures, punitive teacher behaviors, and teacher efforts, excitement and support during the instructional process (Federici, Skaalvik&Tangen, 2015; Frenzel, Pekrun & Goetz, 2007; Taylor, 2004; Taylor & Fraser, 2013). Since most of these variables are components of the classroom environment, the great majority of recent studies on the causes of mathematics anxiety are focused on the classroom environment.

The Classroom Environment

The classroom environment is described as the social, psychological and pedagogical context in which learning activities take place (Fraser, 1998), and it is also known in the literature as the learning environment (Kurt, Ekici, Gokmen, Aktas & Aksu, 2013). Studies on the classroom environment can be traced back to the second half of the 1980s. Some of such studies have considered the classroom environment as a dependent variable and explored whether it is subject to variations depending on the classroom size or curriculum (Diekhoff & Wigginton, 1992), the number of students in the classroom (Kunkul, 2008), the gender of the teacher (Lawrenz & Welch, 1983), the student control ideologies of teacher (Harty & Hassan, 1983), and their personality traits (Kent & Fisher, 1997). On the other hand, those studies considering the classroom environment as an independent variable have explored the effects of students' perceptions of the classroom environment on learning outcomes. These studies have suggested that students' perceptions of the classroom environment significantly affect peer relationships (Barth, Dunlap, Daneb, Lochman & Wells, 2004), tendencies to cheat (Pulvers & Diekhoff, 1999), academic performance (Baek & Choi, 2002; Goh & Fraser, 1998; Wannarka & Ruhl, 2008), attitudes towards the course (Goh & Fraser, 1998; Talton & Simpson, 1987), anxiety levels (Fraser, Nash & Fisher, 1983), academic self-efficacies (Dorman, 2001), preferences for learning

approaches (Dart et al., 1999; Yuen-Yee & Watkins, 1994), self-esteem (Harbaugh & Cavanagh, 2012), type of achievement goal orientation adopted (Greene, Miller, Crowson, Duke & Akey, 2004; Lau & Lee, 2008; Popilskis, 2013; Young, 2005), commitment to school and participation in classroom activities (Kunkul, 2008), and learning motivation and pace (Kose & Kucukoglu, 2009). In fact, Dorman (2001) found that most of the variance for learning outcomes is accounted for by students' perceptions of the classroom environment. The notable and decisive influence of the classroom environment on learning outcomes is a result of its being comprised of many a component. The components of the classroom environment involve classroom rules, as well as how clear they are and how they are determined (Fraser, 1998), how fair the teacher is to students in the classroom, whether the focus in the classroom is on cooperation or competition (Dorman, 2001), the communication environment in the classroom, methods and techniques used during the learning process (Kurt et al., 2013), whether students are engaged in the decision-making process in the classroom (Mesa, 2012), the physical structure of the classroom (Wannarka & Ruhl, 2008), and teacher/student characteristics. Another significant component of the classroom environment is the classroom assessment environment (Banks, 2012).

The Classroom Assessment Environment

The classroom assessment environment refers to students' perceptions of classroom assessment practices (Brookhart & DeVoge, 1999). In more clear terms, the classroom assessment environment is comprised of how students' perceptions of the classroom environment are shaped by teachers' assessment purposes and assessment tasks, performance criteria they use for assessment, and the type of feedback they provide (Brookhart, 1997, as cited in Alkharusi, Aldhafri, Alnabhani & Akhalbani, 2013). The classroom assessment environment consists of two dimensions, namely a learning-oriented assessment environment and a performance-oriented assessment environment (Alkharusi, 2008; Ilhan & Cetin, 2014a).

Students perceive a learning-oriented assessment environment when there are assessment practices that involve diversity, innovation and active participation, when students are provided with opportunities to make preferences for and decisions on the assessment process (Ames, 1992), when methods involving a variety of authentic tasks are used rather than one single assessment method (McMillan & Workman, 1998), when assessment tasks are of moderate difficulty, when assessment criteria are clearly specified, when individual development and advancement are prioritized rather than focusing on how a student performs compared to his/her peers in the classroom, when students are provided with feedback as to what they lack and what they can do to compensate it, when the focus is on efforts to learn rather than on the product, when mistakes are considered as a natural part of the learning process, and when students are provided with an opportunity to correct their mistakes (Alkharusi, 2010). On the other hand, students perceive a performance-oriented assessment environment when they are given judgmental feedback rather than feedback that could help improve their performance, when they are not involved in the assessment process (Stiggins & Chappuis, 2005), when achievement criteria are based on social comparisons, when assessment tasks are difficult for students, and when exam grades are prioritized rather than learning or when the focus is on talents rather than efforts (Alkharusi, 2010).

The extent to which students perceive a learning-oriented or performance-oriented classroom environment has an influence on achievement goal orientations (Buldur, 2014; Wang & Cheng, 2010), and self-efficacy beliefs and academic performance (Alkharusi, 2008; Brookhart, Walsh & Zientarski, 2006). The results of the study by Alkharusi (2009) suggested that self-efficacy beliefs are negatively correlated with a perceived performance-oriented assessment environment but positively correlated with a perceived learning-oriented assessment environment. Wang and Cheng (2010) explored the correlations between students' perceptions of the classroom assessment environment and their achievement goal orientations. Their study concluded that a learning-oriented assessment environment is positively correlated with mastery goal orientation but negatively correlated with

performance goal orientation. In contrast, a performance-oriented assessment environment, as they observed, is negatively correlated with mastery goal orientation but positively correlated with performance goal orientation. Empirical evidence of a significant correlation between students' perceptions of the classroom assessment environment and academic performance is based on the study by Brookhart, Walsh and Zientarski (2006), who explored the influence of the classroom assessment environment on students' motivations, their efforts to learn, and their academic performance. The relationships among the variables are illustrated in the Fig. 1.
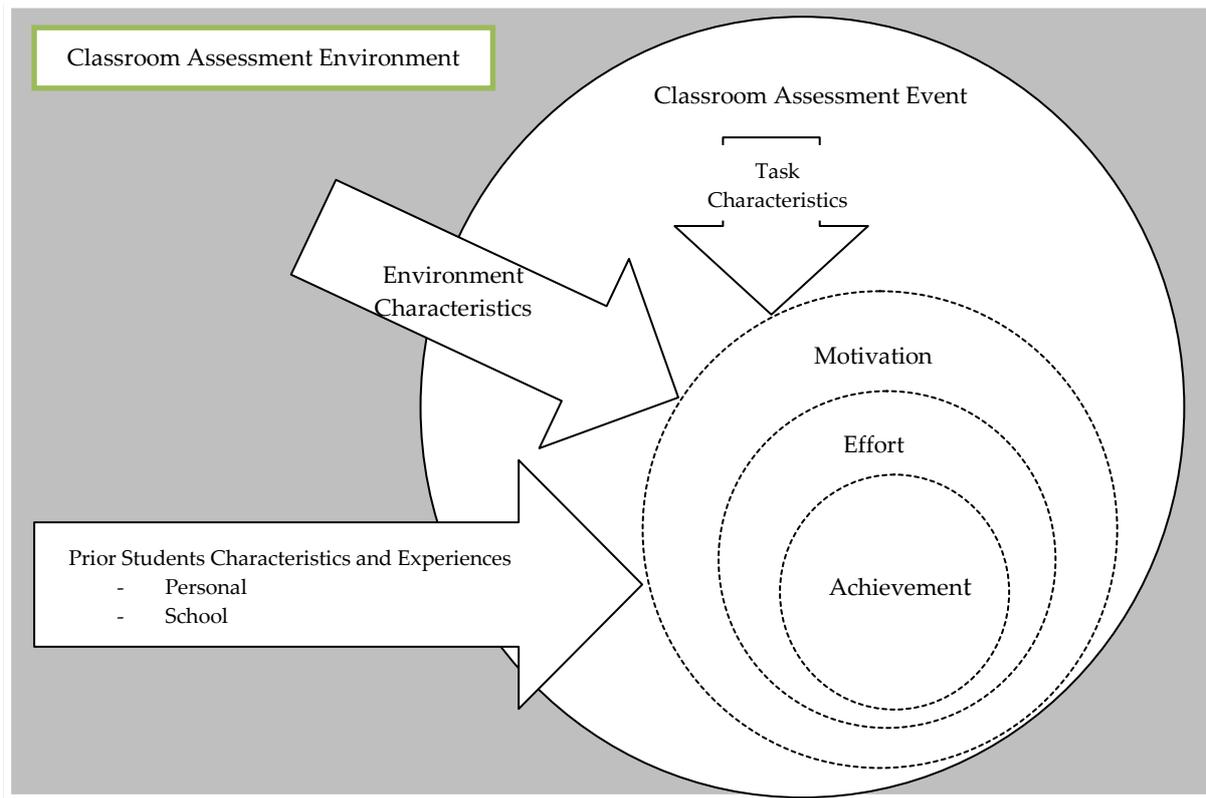

Figure-1: Effect of classroom assessment environment on motivation, effort and achievement (Brookhart, Walsh & Zientarski, 2006).

Students' previous experiences and individual characteristics are included among the variables that could shape their perceptions of the classroom assessment environment (see Fig. 1.). In other words, students in the same classroom could have different perceptions of the classroom assessment environment depending on their individual characteristics and previous experiences (Ames, 1992).

The Relationships between Mathematics Anxiety and Classroom Assessment Environment

Mathematics anxiety is one of the most significant variables that could hinder mathematics achievement. Therefore, it is one of the most fundamental issues to be handled so that mathematics education can become more efficient and students' mathematics achievement can be improved (McLeod, 1992). The alleviation of mathematics anxiety mostly depends on the identification of factors that lead to it. Apparently, it is impossible to eliminate mathematics anxiety before variables that might relieve mathematics anxiety are identified and practices that might lessen mathematics anxiety are put into effect (Lim & Chapman, 2013). Accordingly, the question as to what variables contribute to the prediction of mathematics anxiety has become one of the basic problems explored in the literature on mathematics education. Studies that attempt to find an answer to the question have

introduced a new research subject into the literature, which is actually an intersection of two research areas, namely mathematics education and the classroom environment (Taylor & Fraser, 2013).

Research on the relationship between mathematics anxiety and the classroom environment (Frenzel et al., 2007; Taylor & Fraser, 2013) has demonstrated that the former is of a nature that can be influenced by the latter. For instance, Frenzel et al. (2007) concluded that mathematics anxiety is negatively correlated with the quality of mathematics education and peer respect but positively correlated with punitive teacher behaviors and competitive learning environment. In addition, Taylor and Fraser (2013) found that inter-student support and collaborative and task-oriented classroom environment are negatively correlated with anxiety of learning mathematics. Nevertheless, these studies, which have focused on the link between mathematics anxiety and the classroom environment, fail to inform us about how students' perceptions of the classroom assessment environment affect their mathematics anxiety. That is because the classroom environment scales that are used in such studies do not have any dimensions that could identify students' perceptions of the classroom assessment environment. Considering that the classroom assessment environment is one of the basic components of the classroom environment (Banks, 2012), it is necessary to introduce studies dealing with mathematics anxiety in reference to the classroom assessment environment into the literature so that the link between the classroom environment and mathematics anxiety could be fully identified. In this context, the purpose of the present study is to determine the predictive power of students' perceptions of classroom assessment environment for their mathematics anxiety.

The results will hopefully provide significant implications for efforts to increase the efficiency of mathematics education. For instance, they are likely to provide guidance on what assessment practices trigger mathematics anxiety or help to lower it. Furthermore, since there are dynamic connections between learning conditions and assessment practices (Ornstein & Hunkins, 2009), the results will shed lights, though indirectly, on what considerations should be given to arranging learning conditions. In addition to the implications they could provide, the results will hopefully contribute to filling a gap in the literature. Initially, the potential results of the present study will provide an explanation as to the correlation between the classroom assessment environment and mathematics anxiety, a question unanswered in previous research. Even though studies in the literature identify the classroom assessment environment as a variable in students' self-efficacies, motivations, levels of academic burnout, achievement goal orientations and academic performance, they fail to present the way it influences students' anxiety. The present study will be able to provide an answer to another unanswered question in the literature in that its results will provide empirical evidence of the correlation between anxiety and the classroom assessment environment.

The Purpose of the Research

The purpose of the present study is to determine the predictive power of students' perceptions of classroom assessment environment for their mathematics anxiety. For this purpose, it was aimed to answer the following questions in the research.

1. How are the relationships between the mathematics anxiety and the dimensions of classroom assessment environment?
2. Is the students' perceptions of classroom assessment environment a significant predictor for their mathematics anxiety?

Method

Research Model

The research was designed as a correlational model. Such models attempt to identify any potential correlation between two or more variables (Fraenkel, Wallen & Hyun, 2012). Though they are not as

precise as experimental studies, correlational studies are often used for identifying correlations among variables and speculating about potential consequences (Creswell, 2012).

Participants

The study was conducted on a total of 410 students who studied at three high schools located in the center of Diyarbakir, Turkey, during the fall term of the 2014-2015 Academic Year. While 211 of them (51.5%) were female, the remaining 199 (48.50%) were male. The distribution of the students by grade was as follows: 114 ninth grade students (27.8%), 113 tenth grade students (27.60%), 92 eleventh grade students (22.40%), and 91 twelfth grade students (22.20%). The data were analyzed through multiple regression analysis. There are various recommendations in the literature as to how many participants should be included in the sample for studies based on regression analysis so that its results can be generalized to different samples. According to Pedhazur and Schmelkin (1991), the number of participants to be included in the sample for studies based on multiple regression analysis should be calculated via the formula N>30k (k=the number of predictive variables). On the other hand, Pallant (2005) argues that the sample should have at least 40 participants for each predictive variable whereas Stevens (2009) there should be at least 15 participants for each predictive variable. Tabachnick and Fidell (2013) proposed a different formula for the number of participants to be included in the sample for studies based on regression analysis: N>50+8m, where m refers to the number of predictive variables. The number of students in the sample for the present study meet all these criteria, which suggests that the size of the sample is adequate.

Data Collection Instruments

The data for the study were collected through the Mathematics Anxiety Scale, the Classroom Assessment Environment Scale and a personal information form. In the personal information form there are three questions about students' sex, age and their grade.

The Mathematics Anxiety Scale (MAS)

The MAS was developed by Bindak (2005). The instrument had 10 items measured with a five-point Likert-type scale. Whereas nine of the items were positive (supporting mathematics anxiety), one of them was negative (not supporting mathematics anxiety). Bindak (2005) tested the validity and reliability of the scale on 117 seventh grade students and reported that the scale had a one-factor structure accounting for 57.10% of the total variance. He added that the factor loadings of the items ranged from .50 to .78 and that the scale had a Cronbach's alpha of .84. While Bindak (2005) attempted to identify the factor structure of the MAS on primary school students, the sample of the present study was comprised of high school students. Therefore, the present study iterated the procedures for the identification of the factor structure of the MAS. To that end, a confirmatory factor analysis (CFA) was performed to see whether the one-factor structure also applied to high school students or not. The goodness-of-fit indices [χ^2/df=4.11, RMSEA=.087, CFI=.97, IFI=.97, GFI=.94, AGFI=.90, NFI=.96, NNFI=.96 and SRMR=.046] revealed by the CFA indicated that the one-factor structure also applied to high school students. Fig. 2. presents the factor loadings for the one-factor model revealed by the CFA.
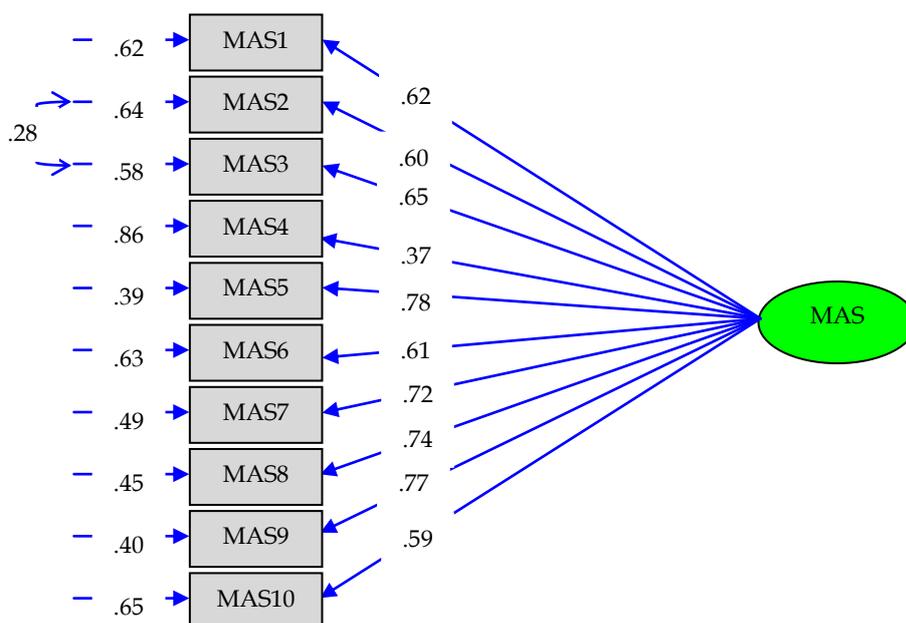
Figure-2: Measurement model for MAS

The factor loadings for the MAS varied between .37 and .78 (Fig. 2.). As for the reliability of the instrument, it was tested through composite reliability coefficients. Composite reliability is a reliability coefficient calculated on the basis of factor loadings revealed by a CFA and error variance values. For the present study, the MAS had a composite reliability coefficient of .88. A composite reliability coefficient of .70 and higher suggests that measurements are reliable enough (Fornell & Larcker, 1981). Thus, the reliability coefficient of the MAS for the present study was acceptable.

The Classroom Assessment Environment Scale (CAES)

The CAES was developed by Ilhan and Cetin (2014a). The instrument contained 18 items measured with a five-point Likert-type scale. The validity and reliability of the scale was tested on a sample comprised of high school students. The construct validity was measured through an exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The results of the former presented a two-factor structure that accounted for 31.52% of the total variance. The first factor, which accounted for 20.93% of the total variance, was named Learning-Oriented Assessment Environment (LOAE). The dimension had nine items whose factor loadings ranged from .33 to .63. *Sample Item*: Assessment practices performed in this classroom help students to decide what subjects they need to study more. On the other hand, the second factor, which accounted for 10.6% of the total variance, was named Performance-Oriented Assessment Environment (POAE). The dimension had nine items whose factor loadings varied between .33 and .69. *Sample Item*: Assessment methods used in this classroom are oriented more towards the outputs that they produce than towards the students' efforts. The CFA concluded that the two-factor structure of the CAES had adequate goodness-of-fit indices [$\chi^2/df=1.84$, GFI=.91, AGFI=.88, CFI=.91, NFI=.91, NNFI=.95, IFI=.96, RMSEA=.056, SRMR=.056, PNFI=.79 and PGFI=.71].

The reliability of the CAES was measured through Cronbach's alpha, composite reliability, and test-retest reliability. The Cronbach's alpha was .73 for both the LOAE and POAE. The composite reliability coefficients were .75 and .76 for the LOAE and POAE respectively. The test-retest reliability was .93 for both of the sub-scales. The present study attempted to identify students' perceptions of the assessment environment in mathematics classes. Therefore, the students were asked to consider the

assessment practices for mathematics classes while they were responding to the items in the CAES. The present study iterated the procedures for identification of the factor structure of the CAES. The factor structure was tested through a CFA. The results of the CFA indicated that the data confirmed the two-factor structure for the CAES [χ^2/df=2.21, RMSEA=.054, CFI=.96, IFI=.93, GFI=.93, AGFI=.90, NFI=.94, NNFI=.96 and SRMR=.050]. Fig. 3. presents the measurement model revealed by the CFA. While the factor loadings for the LOAE ranged from .40 to .67, the ones for the POAE varied between .27 and .73. The reliability of the measurements presented by the CAES was tested through composite reliability coefficient. The reliability coefficients were .81 and .76 for the LOAE and POAE respectively. A composite reliability coefficient of .70 and higher suggests that measurements are reliable enough (Fornell & Larcker, 1981). Thus, the reliability coefficient of the CAES for the present study was acceptable.
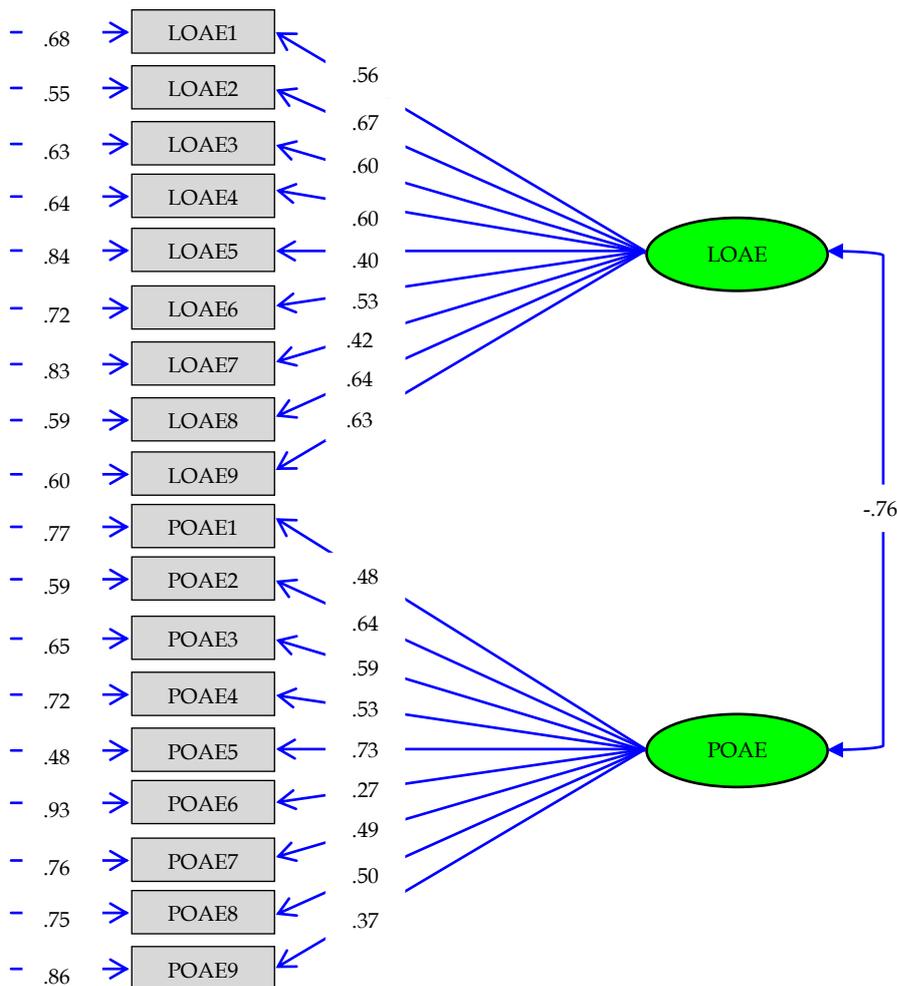

Figure-3. Measurement model for CAES

Data Collection and Analysis

The data were collected during the fall term of the 2014-2015 Academic Year after necessary consents were granted by concerned institutions. The scales were administered to the students in their own classrooms. The participants had already been informed about the purpose of the study. Afterwards, they were informed that they did not have to participate in the study, which ensured that sample would only consist of volunteering students. Furthermore, they were reminded that their sincere

responses were essential so shat valid and reliable results could be obtained. The first part of the data collection instrument was designed for the identification of demographics such as gender, age, and grade. The second part involved the items from the MAS and CAES. The procedure lasted for 10 to 15 minutes for each student. The data were analyzed through correlation analysis and standard multiple regression analysis. Mathematics anxiety was incorporated into the regression analysis as the predicted variable whereas the two dimensions of the CAES, namely LOAE and POAE, functioned as predictive variables.

Results

This section presents the results. The first consideration was given to the correlations between mathematics anxiety and the dimensions of the classroom assessment environment. The related results are presented in Table 1, which also involves descriptive statistics for the variables.

Table 1. Correlation coefficients between mathematics anxiety and dimensions of classroom assessment environment, anddescriptive statistics for the variables

	Mathematics Anxiety	LOAE	POAE
Mathematics Anxiety	1		
LOAE	-.33*	1	
POAE	.41*	-.59*	1
Mean	2.53	2.99	3.31
Standard Deviation	1.01	.82	.81
Skewness	.35	-.16	-.06
Kurtosis	-.67	-.51	-.44

*p<.01

There was a negative correlation between mathematics anxiety and LOAE [r=-.33, p<.01] whereas a positive correlation existed between mathematics anxiety and POAE [r=.41, p<.01] (Table 1). A common assumption for regression analyses is that there is a linear relationship between predictive variables and the predicted variable. The results of the correlation analysis suggested that the correlations between mathematics anxiety and LOAE and POAE were consistent with this assumption. Accordingly, both dimensions of the classroom assessment environment were incorporated as predictive variables into the model designed for the identification of mathematics anxiety in reference to the students' perceptions of the classroom assessment environment. Another assumption for regression analyses is that no collinearity exists between predictive variables. A correlation coefficient of higher than .80 for the link between predictive variables is regarded as an indicator of the collinearity. A value higher than .90 suggests a serious problem in terms of the collinearity (Buyukozturk, 2010). For the present study, there was a negative and intermediate relationship between the LOAE and POAE, the two dimensions of the CAES [r=-.59, p<.01], suggesting that the dimensions met the requirement that there should not be a high-level relationship between predictive variables in multiple regression analysis. Next, a multiple regression analysis was performed so as to identify how much the students' perceptions of the classroom assessment environment could predict their mathematics anxiety. Table 2 presents the results of the regression analysis.

Table 2. Multiple regression analysis results for the relationship between mathematics anxiety and classroom assessment environment

Model	Unstandardized Coefficients		Standardized Coefficients	t	R	R^2	F
	β	Std. Error	Beta				
Constant	1.69	.38					
POAE	.42	.07	.34	6.06**	.42	.18	44.66**
LOAE	-.16	.07	-.13	-2.34*			

**p<.01, *p<.05

The students' perceptions of the classroom assessment environment had a significant influence on their mathematics anxiety [$F_{(2, 407)}$= 44.66, $p<.01$] (Table 2). According to the results of the regression analysis, 18% of the total variance for mathematics anxiety was accounted for by the students' perceptions of the classroom assessment environment [R^2=18]. Whereas a perceived performance-oriented assessment environment predicted mathematics anxiety in a positive way [$β$=.42, t=6.06, $p<.01$], a perceived learning-oriented assessment environment predicted mathematics anxiety in a negative way [$β$=-.16, t=-2.34, $p<.05$].

Discussion

It is through assessment and evaluation practices that it becomes possible to identify the extent to which students have realized the objectives specified in a given curriculum and thus to reveal how functional that curriculum is (Tekin, 2009). Therefore, a great deal of class time is allocated to practices associated with assessment (Crooks, 1988). Such assessment practices will inevitably result in students developing certain perceptions of the classroom environment. The perceptions students have regarding assessment practices in the classroom constitute the classroom assessment environment (Brookhart & DeVoge, 1999). The literature involves many a study motivated by the idea that the classroom assessment environment has a decisive influence on learning outcomes. Research has suggested that students' perceptions of the classroom assessment environment influence their self-efficacy beliefs (Alkharusi, 2009), achievement goal orientations (Wang & Cheng, 2010), and levels of academic burnout (Ilhan & Cetin, 2014b). However, there is no known study in the literature that reveals the way the classroom assessment environment influences students' anxiety of a particular course. The present study will hopefully fill a significant gap in the literature. Considering that mathematics is a course that students are most anxious of, the present study is based on the exploration of the relationship between mathematics anxiety and the classroom assessment environment.

The results of the present study suggest that mathematics anxiety is negatively correlated with a perceived learning-oriented assessment environment but positively correlated with a perceived performance-oriented assessment environment. According to the results of the regression analysis, 18% of the total variance for mathematics anxiety was accounted for by the students' perceptions of the classroom assessment environment. Therefore, the results support the hypothesis suggested for the relationship between mathematics anxiety and the classroom assessment environment. The significant correlation between the two is consistent with the theoretical idea that the classroom environment is one of the variables that might trigger or relieve mathematics anxiety (Rampersad, 2003). As a matter of fact, many studies have suggested that mathematics anxiety can be lessened by a proper arrangement of the classroom environment. For instance, Miller and Mitchell (1994), Tooke and Leonard (1988) and Shields (2006) have reported that an anxiety-free, supportive and democratic classroom environment can help students to control their mathematics anxiety. Yuksel Sahin has stated that teachers' threatening and authoritarian attitudes could lead to fearsome classroom environment in which student have a conditioned reaction to mathematics. Furthermore, the results of the present study are supported by the explanations made by the National Council of Teachers of Mathematics (NCTM) about how mathematics anxiety can be prevented. According to the NCTM

(1995), mathematics anxiety can be partly prevented when students are informed that anybody can make mistakes while he/she is performing mathematical operations and when students are provided with a classroom environment in which they can develop such a perspective. A similar explanation was made by Steele and Arth (1998), who noted that mathematics anxiety can be relieved not by product-based assessment but through process-based assessment approaches in which students will understand that their efforts to learn mathematics are appreciated. In their theoretical study on the effects of achievement goal orientations adopted by students on their mathematics anxiety, Furner and DeHass (2011) reported that a mastery-oriented classroom environment can help relieve mathematics anxiety. All these suggest that classroom assessment practices, as well as students' perceptions of such practices, could affect their mathematics anxiety. Therefore, the results of the present study can be argued to provide empirical evidence of what has been said so far about practices that can reduce students' mathematics anxiety.

As mentioned above, there are direct similarities between some theoretical information in the literature and the results of the present study. Some other theoretical information indirectly supports the results. An example of this would be Rodriguez (2004). Although the study did not refer to the idea that assessment practices could influence students' mathematics anxiety, the author reported that one of the most significant variables in shaping student behaviors is classroom assessment practices. Another example would be Buhagiar (2007), who stressed that a classroom environment that can lead to positive changes in students' affective characteristics can be established when comparative assessment approaches are avoided. In other words, studies by Rodriguez (2004) and Buhagiar (2007) can be argued to provide indirect support for the results of the present study.

The results of the present study are also consistent with other studies concluding that mathematics anxiety can be affected by the classroom environment (Federici, Skaalvik&Tangen, 2015; Taylor, 2004). For instance, Federici, Skaalvik andTangen (2015) concluded that mathematics anxiety is positively correlated with the performance-oriented class structure. In addition, Taylor (2004) found significant relationships between learning mathematics anxiety and three areas of classroom environment listed as student cohesiveness, investigation and task orientation. In brief, the results of the present study can be argued to be consistent with studies by Federici Skaalvik andTangen (2015), and Taylor (2004).

Conclusion and Implications

The study concluded that 18% of the total variance for mathematics anxiety was accounted for by the students' perceptions of the classroom assessment environment. In addition, mathematics anxiety was negatively and positively correlated with LOAE and POAE respectively, which suggests that the classroom assessment environment should be considered as one of the primary variables in reducing mathematics anxiety. Those classroom assessment practices that can contribute to the establishment of a learning-oriented assessment environment in the classroom are expected to alleviate mathematics anxiety. Therefore, classroom assessment practices should focus on students' efforts to learn rather than their products. The learning process should be characterized by a collaborative environment; therefore, students should be prevented from developing a competitive attitude towards the process. Students should be informed about assessment criteria before they are assessed. Following the assessment, students should be provided with feedback as to what they lack and what they can do to compensate it. Furthermore, they should be informed that any student may make mistakes while learning mathematics and that such mistakes can be used as an instrument for improved learning. The classroom environment should be arranged in a way that will enable students to develop such an attitude towards mathematics. The assessment process should involve thought-provoking tasks and questions. In addition, great care should be taken to ensure that selected assessment tasks are related to subjects and assignments covered in the classroom and that they are not detached from the daily life. Moreover, it should not be neglected that there could be variations in the type of assessment practices in which students perform best. Hence, students' understanding of a given mathematics subject should be identified through various assessment methods that involve a combination of some

different tasks such as multiple-choice tests, written and oral examinations, in-class discussions, and project assignments.

The significant correlation between mathematics anxiety and the classroom assessment environment, as revealed by the present study, not only suggests what classroom assessment practices should be included but also sheds lights on what classroom assessment practices should be avoided. The positive and significant correlation between mathematics anxiety and the performance-oriented assessment environment indicates that mathematics anxiety is triggered by those assessment practices that could cause students to have a perceived performance-oriented assessment environment in the classroom. Therefore, such assessment practices should be avoided so as to lessen mathematics anxiety. Similarly, students should not be subject to social comparisons during the assessment process. They should not be subject to comparative assessment approaches that are based on how well other students perform. Mathematics exams should exclude questions that are so difficult that students are prevented from experiencing the feeling of accomplishment or their self-efficacy beliefs are undermined. Examinations should more often focus on moderately difficult questions and include questions of varying difficulties. Similarly, product-based methods that are focused on the importance of performance should be avoided while students' mathematics achievement is assessed.

To sum up, the results of the present study support the idea of Elton and Laurillard (1979) that "the easiest way to change student learning is to change the assessment system" and that current assessment approaches should be reviewed and revised so that students can become impervious to the effects of mathematics anxiety. Since mathematics anxiety is significantly correlated with a number of variables such as attitudes towards mathematics classes (Kargar, Tarmizi & Bayat, 2010), self-regulative motivational beliefs (Uredi & Uredi, 2005) and academic self-concept (Ahmed, Minnaert, Kuyper & van der Werf, 2013), assessment practices designed for the alleviation of mathematics anxiety are likely to bring about, either directly or indirectly, desirable changes in these variables. In this respect, the present study will hopefully fill a significant gap in the literature. Nevertheless, the present study is not independent of limitations. Awareness of these limitations will help determine what studies are needed to overcome them.

The limitations of the study, as well as future directions, can be listed as follows. First, the study attempted to identify the correlation between mathematics anxiety and the classroom assessment environment with a sample comprised of high school students. Further studies could attempt to identify the correlation through samples with students from different grades and thus contribute to the generalizability of the results. Seeing that mathematics anxiety can be traced back to primary and secondary schools (Lazarus, 1974), further studies could be carried out on primary and secondary school students. Secondly, the present study was designed as a correlational study in which mathematics anxiety and perceptions of the classroom assessment environment were considered as the predicted variable and the predictive variable respectively. By their nature, correlational studies allow for limited interpretations regarding the causality of results (McMillan & Schumacher, 2010). Thus, empirical studies could be conducted on the effects of LOAE and POAE on students' mathematics anxiety. Finally, the data were collected through self-report scales. Further studies could have more diversified data collection methods, including teachers' references to assessment practices in their lesson plans, in-class observations, and interviews with teachers and students.

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Öğrencilerin Sınıf Değerlendirme Atmosferine Yönelik Algılarının Matematik Kaygılarını Yordama Gücü

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Matematik kaygısı, öğrencilerin matematik başarısını engelleyen en önemli değişkenlerden biridir. Dolayısıyla matematik kaygısı, matematik eğitiminde etkinliğin arttırılabilmesi ve öğrencilerin matematik başarılarının geliştirilebilmesi için iyileştirilmesi gereken temel özelliklerden biridir. Matematik kaygısının iyileştirilmesi; büyük ölçüde bu kaygıya kaynaklık eden faktörlerin belirlenmesine bağlıdır. Matematik kaygısını azaltma potansiyeline sahip değişkenler ve uygulamalar belirlenip hayata geçirilmeden matematik kaygısının önlenmesi mümkün görünmemektedir. Buna bağlı olarak; matematik kaygısının yordanmasına katkıda bulunan değişkenlerin neler olduğu sorusu matematik eğitimi alanında yapılan çalışmalarda yanıt aranan temel problemlerden biri haline gelmiştir. Bu probleme yanıt aramak amacıyla yürütülen çalışmalar; matematik eğitimi ve sınıf ortamı şeklindeki iki farklı çalışma alanın kesişimi ile oluşan yeni bir araştırma konusunu literatüre kazandırmıştır.

Matematik kaygısı ile sınıf ortamı arasındaki ilişkinin incelendiği çalışmalar; matematik kaygısının sınıf ortamından etkilenmeye açık bir doğaya sahip olduğunu göstermiştir. Örneğin; Frenzel, Pekrun ve Goetz (2007) tarafından yapılan araştırmada, matematik kaygısının matematik öğretiminin kalitesi ve akran saygısı ile negatif; cezalandırıcı öğretmen davranışları ve yarışmacı öğrenme ortamı ile pozitif anlamlı ilişki içerisinde olduğu sonucuna ulaşılmıştır. Taylor ve Fraser (2013) tarafından yürütülen çalışmada ise; öğrenciler arası desteğin ve işbirlikli sınıf ortamının matematik öğrenme kaygısı ile negatif anlamlı ilişki içerisinde olduğu saptanmıştır. Ancak; matematik kaygısı ile sınıf ortamı arasındaki ilişkinin incelendiği bu araştırmalar, öğrencilerin sınıf değerlendirme atmosferine yönelik algılarının matematik kaygılarını nasıl etkilediğine yönelik herhangi bir bilgi vermemektedir. Çünkü söz konusu araştırmalarda kullanılan "Sınıf Ortamı Ölçekleri" öğrencilerin sınıf değerlendirme atmosferine yönelik algılarını belirlemeye hizmet edecek herhangi bir boyut içermemektedir. Sınıf ortamını oluşturan temel bileşenlerden birinin sınıftaki değerlendirme atmosferi olduğu dikkate alındığında, sınıf ortamı ve matematik kaygısı arasındaki ilişkinin tam olarak ortaya konulabilmesi için öğrencilerin matematik kaygılarının sınıf değerlendirme atmosferine yönelik algıları açısından incelendiği araştırmaların literatüre kazandırılması ihtiyaç haline gelmektedir. Bu kapsamda, araştırmada öğrencilerin sınıf değerlendirme atmosferine yönelik algılarının matematik kaygılarını yordama gücünün incelenmesi amaçlanmaktadır.

Araştırmadan elde edilen bulguların, matematik eğitiminde verimliliği arttırmaya yönelik önemli doğurgularının olacağı düşünülmektedir. İlk olarak; araştırmadan elde edilen bulgular matematik kaygısını tetikleyen ve matematik kaygısının azaltılmasına katkıda bulunan değerlendirme uygulamalarının neler olduğu konusunda bir kılavuz niteliği taşıyacaktır. Ayrıca; öğrenme durumları ile değerlendirme etkinlikleri arasında dinamik ilişkiler bulunduğundan, araştırmada ulaşılacak bulgular dolaylı olarak öğrenme durumları düzenlenirken nelere dikkat edilmesi gerektiği konusuna da ışık tutacaktır. Araştırmanın uygulamaya dönük doğurgularının yanı sıra literatürdeki boşluğun giderilmesine yönelik bir takım katkılarının da olacağı öngörülmektedir. Öncelikle; bu araştırmada ulaşılacak sonuçlar, matematik kaygısı ile sınıf ortamı arasındaki ilişkinin ele alındığı önceki araştırmalarda yanıtsız kalan "Sınıf değerlendirme atmosferi ile matematik kaygısı arasındaki ilişki nasıldır?" sorusuna cevap olabilecektir. Literatürdeki araştırmalar sınıf değerlendirme atmosferinin öğrencilerin öz yeterlilikleri, motivasyonları, akademik tükenmişlik düzeyleri, başarı yönelimleri ve akademik başarıları üzerinde etkili bir değişken olduğunu gösterse de; öğrencilerin kaygılarını nasıl etkilediği sorusuna cevap olamamaktadır. Araştırma bulgularının; kaygı ile sınıf değerlendirme

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atmosferi arasındaki ilişkiye dair deneysel (ampirik) kanıtlar sunacak olması, bu çalışmanın ilgili literatürde yanıtsız kalan sorulara cevap olabilecek bir diğer yönüdür.

Çalışmada korelasyonel araştırma modeli kullanılmıştır. Korelasyonel araştırmalarda, iki ya da daha çok sayıda değişken arasında ilişki olup olmadığının belirlenmesi amaçlanır. Deneysel araştırmalarda olduğu kadar kesin olmasa da; değişkenler arasındaki ilişkileri ortaya koymak ve olası sonuçlar hakkında kestirimde bulunmak için korelasyonel araştırmalardan sıklıkla yararlanılmaktadır. Araştırma 2014-2015 Öğretim Yılı Bahar Dönemi'nde, Diyarbakır il merkezindeki üç farklı liseden 211'i (%51.50) bayan ve 199'u (%48.50) erkek olmak üzere toplam 410 ortaöğretim öğrencisi üzerinde yürütülmüştür. Öğrencilerin 114'ü (%27.80) 9. sınıfta, 113'ü (%27.60) 10. sınıfta, 92'si (%22.40) 11. sınıfta ve 91'i (%22.20) 12. sınıfta öğrenim görmektedir.Araştırmada veri toplama aracı olarak, Matematik Kaygısı Ölçeği (MKÖ) ile Sınıf Değerlendirme Atmosferi Ölçeği (SDAÖ) kullanılmıştır.Verilerin analizinde korelasyon ve standart çoklu regresyon analizi kullanılmıştır. Matematik kaygısı yordanan değişken olarak regresyon analize dâhil olurken; SDAÖ'nün öğrenme odaklı değerlendirme atmosferi ile performans odaklı değerlendirme atmosferi boyutları regresyon analizinin yordayıcı değişkenleri olarak işlem görmüştür.

Araştırmadan elde edilen bulgular; matematik kaygısının sınıf değerlendirme atmosferine yönelik öğrenme odaklı algı ile negatif; performans odaklı algı ile pozitif anlamlı ilişki içerisinde olduğunu ortaya koymuştur. Regresyon analizi sonucunda, matematik kaygısına ilişkin toplam varyansın %18'inin öğrencilerin sınıf değerlendirme atmosferine yönelik algıları ile açıklandığı belirlenmiştir. Dolayısıyla, araştırma sonuçları; matematik kaygısı ve sınıf değerlendirme atmosferi arasında nasıl bir ilişki bulunduğuna yönelik olarak kurulan hipotezleri doğrulamaktadır.Matematik kaygısı ile sınıf değerlendirme atmosferi arasında saptanan anlamlı ilişki; sınıf ortamının matematik kaygısını arttırma ya da azaltma potansiyeline sahip değişkenlerden biri olduğu (Rampersad, 2003) şeklindeki kuramsal bilgiler ile örtüşmektedir.

Araştırma sonuçları, sınıf değerlendirme atmosferinin öğrencilerin matematik kaygılarının azaltılabilmesi için öncelikli olarak ele alınması gereken değişkenlerden biri olduğu anlamına gelmektedir. Öğrenme odaklı değerlendirme atmosferi ile matematik kaygısı arasındaki negatif ilişki dikkate alındığında, sınıfta öğrenme odaklı değerlendirme atmosferinin oluşmasına hizmet edecek değerlendirme uygulamalarının öğrencilerin matematik kaygılarını azaltması beklenmektedir. Öte yandan; sınıf değerlendirme atmosferine ilişkin performans odaklı algı ile matematik kaygısı arasındaki pozitif ilişki göz önünde bulundurulduğunda, matematik kaygısının önlenebilmesi için öğrencilerde performans odaklı değerlendirme algısının oluşmasına sebebiyet verecek değerlendirme uygulamalarından uzak durulması gerektiği söylenebilir. Araştırmada ulaşılan sonuçlar Elton ve Laurillard (1979), tarafından ifade edilen "Öğrencinin öğrenmesini değiştirmenin en kolay yolu değerlendirme sistemini değiştirmektedir" yargısını desteklemekte ve öğrencilerin matematik kaygısının etkilerinden sıyrılmalarına yardımcı olmak için değerlendirme anlayışının gözden geçirilmesi gerektiğini yansıtmaktadır.Matematik kaygısı; matematik dersine yönelik tutum, öz düzenleyici motivasyonel inançlar ve akademik benlik kavramı gibi çok sayıda değişken ile anlamlı ilişki içerisinde olduğundan, matematik kaygısını azaltmaya yönelik değerlendirme uygulamaları doğrudan ve/veya dolaylı olarak sıralanan değişkenlerde de arzu edilen yönde değişiklikler oluşturabilir.

Anahtar Kelimeler: Matematik kaygısı, Sınıf değerlendirme atmosferi, Öğrenme ortamı