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Relationship between students' math engagement and math teachers' motivational support

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ABSTRACT This study intended to explore the relationship between middle school students' engagement in mathematics classes and mathematics teachers' motivational support. Explanatory correlational research design was used for this purpose. Participants were composed of 612 students attending 6th, 7th and 8th grades in Alanya district of Antalya Province. Effective Participation Scale and Teachers' Motivational Support Scale were used in data collection. The relationship between the datasets of middle school students' engagement in mathematics classes and their perceptions regarding mathematics teachers' motivational support was investigated via canonical correlation analysis. Findings obtained showed that mathematics teachers' autonomy support provided to middle school 6th,7th, 8th grade students positively affected their behavioral engagement and emotional engagement. It was also identified that mathematics teachers' autonomy and relatedness support provided to middle school 6th,7th, 8th grade students negatively affected their emotional disaffection towards mathematics classes.

Keywords *Engagement, Disaffection, Motivational support, Mathematics classes*

Öğrencilerin matematik dersine etkin katılımları ve matematik öğretmenlerinin güdüsel destekleri arasındaki ilişki

ÖZ Bu araştırmada ortaokul öğrencilerinin matematik dersine etkin katılımları ile matematik öğretmenlerinin güdüsel destekleri arasındaki ilişkinin incelenmesi amaçlanmıştır. Bu amaca uygun olarak araştırmada keşfedici korelasyonel araştırma modeli kullanılmıştır. Araştırmanın çalışma grubunu Antalya ili Alanya ilçesi 6., 7. ve 8. sınıfta öğrenim gören 612 öğrenci oluşturmaktadır. Araştırma verileri "Etkin Katılım Ölçeği" ve "Öğretmen Güdüsel Destek Ölçeği" ile toplanmıştır. Araştırmada ortaokul öğrencilerinin Matematik dersine etkin katılımları ile Matematik öğretmenlerinin güdüsel desteklerine ilişkin algıları arasındaki ilişki kanonik korelasyon analizi ile incelenmiştir. Elde edilen bulgular ortaokul 6., 7. ve 8. sınıf öğrencilerinin Matematik Öğretmenlerinin özerklik desteklerinin öğrencilerin Matematik dersine davranışsal katılım ve duyuşsal katılımlarını pozitif olarak etkilediği belirlenmiştir. Ayrıca ortaokul 6.,7. ve 8.sınıf öğrencilerinin Matematik öğretmenlerinin özerklik ve ilişki desteklerinin öğrencilerin Matematik dersine ilişkin duyuşsal hoşnutsuzluklarını negatif olarak etkilediği belirlenmiştir.

Anahtar Kelimeler *Etkin katılım, Hoşnutsuzluk, Güdüsel destek, Matematik dersi*

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INTRODUCTION

Motivating students in the classroom and ensuring their engagement are problems often encountered by educators. There are students who are willingly and enthusiastically engaged in classroom activities as well as students who do not participate during activities or demonstrate unwillingness and disaffection when they do so. These students participate in activities in a mechanical manner and are not engaged in the activities. This fact has led the researchers to investigate the quality rather than the quantity of engagement. The studies conducted so far have identified that willing and active engagement in learning activities in the classroom predicts student learning, grades, achievement test results, recall, graduation and academic tenacity. Additionally, research results also demonstrate that engagement in classroom activities is preventive against risks such as substance abuse and delinquency (Fredricks, Blumenfeld & Paris, 2004; Kahraman, 2014; Lee, 2014; Skinner, Furrer, Marchand & Kindermann, 2008; Skinner, Kindermann, Connell & Wellborn, 2009; Skinner & Pitzer, 2012).

Engagement is a precondition for students to learn. When students are engaged in program activities functionally and mentally, they can have quality learning. Otherwise, learning will be based on memorization and successful learning cannot be achieved. Skinner et al. (2009) state that effective participation is related to motivational structures: engagement and disaffection. Engagement is an active action between the program and real learning. On the other hand, disaffection or burnout is the opposite of engagement. Disaffection includes lack of student effort in academic learning, passivity, behaviors such as not exerting physical efforts while feigning to engage in tasks and mental aspects such as lack of concentration, indifference and lack of motivation. Affective reactions are important components of disaffection because the pattern of action changes whether lack of participation depends on boredom, anxiety, embarrassment, unhappiness or disappointment (Skinner & Pitzer, 2012). Disaffection is especially important in institutions such as schools where students cannot leave on their own volition. The normal reaction to helplessness and exclusion is to leave but when leaving is prohibited; the form of engagement can develop in a manner that can be reflected in affective states such as tension and disillusionment, mental disinterest or some behaviors. Feelings related to disaffection form the foundation of behaviors such as passivity, lack of entrepreneurship-effort and dropping out of school (Reeve, Jang, Carrell, Jeon & Barch, 2004).

Motivation theories are basically related to the psychological processes that underline energy, direction and durability of human activity (Deci, 1992). Engagement qualities such as effort, endeavor, vigor, intensity, gratification and enthusiasm are indicators of energy. Interest, focus and concentration are the signs of direction whereas adoption, determination and tenacity show durability. While motivation reflects the sources underlying energy, direction and durability, engagement is the form through which they are observed (Skinner & Pitzer, 2012). In other words, engagement is the outward manifestation of motivation (Skinner et al, 2009). By their nature, motivation and engagement are related and affect one another. Engagement is regarded as the output of the motivational process and motivation is the source of engagement (Reeve, 2012).

Motivation is generated from various different sources (needs, comprehension, emotions, events in the environment, etc). In this study, motivation was investigated with a needs-based perspective in the framework of *Self-Determination Theory*. According to self-determination theory, individuals have basic need such as relatedness, competence and autonomy. *Competence* reflects the need for feeling efficient and competent in actions, *relatedness* reflects the need to be cared for and accepted by others and *autonym* points to the need to act in harmony with one's own values and others. Autonomously motivated behaviors emerge when individuals define their behaviors as important or valuable (Ryan & Deci, 2002).

Students have their own needs, goals and values. A student can spend hours on a topic that he/she finds interesting. In this case, the student is independently motivated. However, context is important in classroom environments. In the classroom, students interact with a social world that may support or threaten their needs, goals, interests and values. Teaching and learning environment in classrooms has significant impact on supporting or diminishing student motivation and engagement. Student engagement cannot be regarded as separate or independent from the social context in which it occurs. Hence, it is a firm fact that each student's engagement is the common product of student motivation, in-class support or obstacles that he/she experiences. Supportive conditions, especially supportive

teacher-student relations are necessary to enhance student motivation and engagement (Reeve, 2012). Teacher-student interactions have three significant qualities: pedagogical caring (to support experiences of relatedness), optimal structure (to facilitate competence) and autonomy support (to promote self-determined motivation) (Skinner & Pitzer, 2012). According to self-determination theory, when these needs are not met, students may experience disaffection (Wilding, 2015). Students whose needs are met will be more motivated compared to students whose autonomy, competence and relatedness needs are overlooked during learning activities or students who are disappointed during teaching. Teachers' role is not to create student motivation, but support the existing student motivation and engagement to create high quality of motivation and engagement (Reeve, 2012).

There is a mutual relationship between the teacher and the student. Teachers' motivational styles will result in student autonomy, engagement and wellbeing. Controlling styles inhibits autonomous engagement, results in the refusal of new motivational resources and generates less optimal student outputs (Reeve, 2012). Studies present findings that support this view (Demir, 2011; Güvenç, 2015c; Reeve et al., 2004; Skinner et al, 2008). In addition, outcomes of engagement related to learning and school achievement cause students to feel academically more competent and committed, receive more support from their teachers and form more positive relationships. While engagement increases, students are allowed to enter into relationships with more engaged classmates and peers and create friendships. Disaffected students display bad performance at school and they feel excluded. Teachers provide less support for these students or pressure them more. There is a high possibility that these students enter into relationships with peer groups that feel more disaffection. This cycle keeps repeating. Teachers' motivational support increases student engagement and teachers provide more motivational support to students when engagement increases (Skinner, et al., 2008; Skinner & Pitzer, 2012).

Compared to studies on engagement in the literature, it was identified that studies conducted in Turkey mostly focus on high school students (Eryılmaz & Aypay, 2011a; Eryılmaz & Aypay, 2011b; Eryılmaz, 2013; Güvenç, 2015c; Sever, 2014) and the studies conducted on middle school students are limited (Güvenç, 2016; Kahraman, 2014). Also, there were no studies that examined teachers' motivational support at middle school level as a variable that affected engagement.

The influence of teachers' motivational support on engagement is an important topic in the context of all subjects. However, the current study was undertaken in the framework of mathematics teachers' motivational support. It was identified in Turkey that high school students' engagement in mathematics classes is low and these students tend to not participate during classes (Sever, 2014). National and international mathematics exam results in Turkey demonstrate that students' mathematics achievement is also low. According to 2015 Transition from Primary to Middle Education Exam (TEOG) results, the means in mathematics for 20 questions was found to be 7,6; according to 2016 Transition to Higher Education Examination (YGS) results, the means in mathematics for 40 questions was 7,9 (Student Selection and Placement Centre [OSYM], 2016a) and according to Undergraduate Placement Exam (LYS) the means in mathematics for 50 questions mathematics was found to be 10,4 (OSYM, 2016b). In PISA exams, Turkey was listed as 41st among 65 countries in 2009, 44th in 2012 and 72nd in 2015 (Taş, Arıcı, Özarkan & Özgürlük, 2016). In TIMMS exams, Turkey was listed as the 35th country among 50 countries in 4th grades in 2011 (Büyüköztürk, Çakan, Tan &Atar, 2014a), and 24th among 42 countries in 8th grades 8 (Büyüköztürk, Çakan, Tan & Atar, 2014b). Turkey was listed as 36th among 49 countries in TIMMS 2015 exam in 4th grades and 24th among 39 countries in 8th grades (Yıldırım, Özgürlük, Parlak, Gönen & Polat, 2016). In line with this information, this study investigated the relationship between middle school students' engagement in mathematics classes and mathematics teachers' motivational support. It is expected that the study will provide indicators for teachers and educators about the most effective methods in increasing student engagement in mathematic classes and determine the state of teachers' motivational role in affecting student engagement and therefore indirectly contribute to increased achievement in mathematics and literature.

METHODOLGY

Research Design

This study intended to explore the relationship between middle school students' effective participation in mathematics classes and mathematics teachers' motivational support. The explanatory correlational research design was used for this purpose. Exploratory correlation studies are used to understand important phenomena by analyzing interrelationships between variables (Fraenkel & Wallen, 2006)

Participants

The study was conducted in Alanya district of Antalya province with voluntary participation of 612 students from 6th, 7th and 8th grades of 10 middle schools for which research permits were obtained. Out of 612 participants, 55.6% (n=340) were females and, 44.4% (n=272) were males. 32 % (n=196) of the students were from 6th grade, 34.3% (n=210) from 7th grade and 33.7% (n=206) from 8th grade.

Data Collection Tool

In this study, data were collected "Effective Participation Scale" (Güvenç, 2015b) and "Teachers' Motivational Support Scale" (Güvenç, 2015a) implemented on 6th, 7th and 8th graders.

Effective Participation Scale was developed to identify students' engagement and disaffection related to a specific lesson. The four point likert scale developed by Güvenç (2015b) has 16 items. While drafting the Effective Participation Scale, studies and scales that were developed in this area were examined first. Also semi-structured interviews were held with 9 high school students. These interviews recorded with voice recorder were transcribed. The draft form prepared with the help of semi-structured interviews conducted with students included some of the items developed by Wellborn (Güvenç, 2015b).

Validity and reliability analyses for the scale were conducted for both high school and middle school students. The scale was used to measure middle school students' perceptions of engagement in mathematics classes. Four of the scale items measure Behavioral Engagement (I participate in all activities), four items measure Emotional Engagement (I am interested in what goes on in the class), four items measure Behavioral Disaffection (I think about other things during class) and four items measure Emotional Disaffection (I am not interested in what goes on in the classroom). Cronbach's Alpha internal consistency coefficients of the subscales were found to be as follows: .81 for Behavioral Engagement, .71 for Emotional Engagement, .75 for Behavioral Disaffection and .71 for Emotional Disaffection. Cronbach Alpha coefficient for the 8-item engagement section of the scale was .82 and Cronbach Alpha coefficient for the 8-item disaffection part was.83. Confirmatory factor analysis results for the scale were: chi square (χ^2=265.24), degree of freedom (df=98, p=.00) rate χ^2/df=2.71; RMSEA= 0.069; SRMR= .053, AGFI= .88; CFI=.91; GFI=.92 and NNFI=.89. Chi square distribution with a degree of freedom rate lower than 2, RMSEA and SRMR values lower than.05, AGFI values higher than .85 and CFI, GFI and NNFI values higher than .95 are regarded as good fit indices (Şimşek, 2007). Accordingly, the obtained values point to the fact that the 4-dimension construct proposed for Effective Participation Scale is suitable.

The scale was developed to identify students' perceptions based on self-determination regarding their teachers' motivational support. The scale, developed by Güvenç (2014), is a four point Likert type scale with 3 sub scales composed of teacher autonomy, competence and relatedness support and 24 items. Competence support includes 12 items. Items such as "Explicitly expressed what he/she expects from me in the lesson" and "He/she tries to convince me that I can handle the most difficult tasks" can be given as examples to competence support sub scale. Autonomy support includes 6 items and "He/she cares for my ideas" and "He/she presents all the options when assigning me tasks" can be given as examples. Relatedness support sub scale includes 6 items and some examples are "He/she knows me well" and "His/her words and behaviors are honest". Validity and reliability analyses of the scale were completed for both middle school and high school students. In this study, the scale was used to determine middle school students' perceptions regarding their mathematics teachers' motivational support. Cronbach's Alpha reliability coefficients of the subscales were found to be as follows: .77 for relatedness support; .87 for autonomy support and .81 for competence support. The Cronbach's Alpha reliability coefficient for the whole scale was .92. Confirmatory factor analysis results for the scale were calculated as chi square (χ^2= 537.09), degree of freedom (df= 249, p=.00)

rate χ^2/df=2.16; RMSEA= .079; SRMR= .053, AGFI= .84; CFI=.90; GFI=.91 and NNFI=.85. Chi square distribution with a degree of freedom rate lower than 5, RMSEA value between 0.05 and .0.08, SRMR value lower than.10, AGFI values higher than .85 and CFI and GFI values higher than .90, AGFI value higher than .85 and NNFI values higher than .90are regarded as acceptable fit indices (Çokluk et. al., 2010). Accordingly, the obtained values point to the fact that the 43-dimension construct proposed for Effective Participation Scale is suitable.

Data Analysis

SPSS and LISREL were used in data analysis for exploratory and confirmatory factor analyses respectively. The relationship between 6th, 7th and 8th graders' engagement in mathematics classes and their perceptions regarding mathematics teachers' motivational support was investigated via canonical correlation analysis. Stastica program was utilized for canonical correlation analysis. Multiple Correlation Analysis is used in quantitative data to conduct correlation analysis to determine the relationship between variables when there is a single dependent variable but more than one independent variable. In cases where both dependent and independent variables are not single, none of the correlation coefficients cited above can be used in determining the relationship between two variable sets (clusters). In this case, Canonical Correlation Analysis was used which is based on determining the relationship structure between canonical variables by transforming variable sets or clusters into canonical variables consisting of linear components of the variables in these sets. Canonical Analysis is a special case of multiple regression analysis. While multiple regression analysis studies the relationship between a single dependent and multiple independent variables, canonical analysis includes p times dependent and q times independent variables. Canonical correlation is used to present the relationships between two datasets (Set 1 and Set 2) with a>1 and b >1 number of variables (Tatlıdil, 1996). It is possible not to differentiate among dependent and independent variables in canonical correlation analysis (Albayrak, 2010). There are 4 assumptions for canonical correlation analysis: linearity, normality, equality of variances and the assumption of multiple linearity. Whether the data met the hypotheses of canonical correlation analysis was checked before analysis and the result showed that the data met the conditions. The number of observations in canonical correlation analysis should be at least 20 times more than the number of variables (Stevens, 2009). In this study, there were four variables in the dependent variable set and three variables existed in the independent variable set (total 7x20=140). The number of observations in this study was 612. The expected criterion was met in the study. Since they failed to provide answers to some of the items in the measurement tools, 10 students were excluded from the study. z-test was performed to determine one-dimensional outliers and 7 surveys were excluded since the z values were outside critical values (z = ± 3.26). Mahalanobis Distance Coefficients were calculated to determine multi-dimensional outliers. No outliers were identified based on Mahalanobis Distance Coefficients. Levene's Test and Box's M analysis were performed to test assumption of variance and variable variances were determined to be homogeneous. Correlation coefficients between variables and VIF and tolerance values were examined for multicollinearity assumption. Relationship between predictive variables that are higher than r >.90, VIF values equal or higher than 10 and tolerance values lower than .10 point to multicollinearity (Çokluk et. al., 2010). This study found that the highest correlation between predictive variables was .52, tolerance values varied between .35 and .40 and VIF values varied between 2.46 and 2.85. According to these results, multicollinearity was not observed.

Descriptive methods were used to determine whether data had normal distribution and arithmetic means, mode, median, skewness and kurtosis coefficients were examined. Equal or close values for arithmetic means, mode and median and skewness and kurtosis values close to 0 in ±1 limits point to the existence of normal distribution (Tabachnick & Fidell, 2013). This study identified the lowest and highest skewness coefficient for the variables as -.52 and .91. It was also identified that kurtosis value changed between -.27 and .17. Arithmetic means, mode and median values were close. According to these results, the distribution was regarded as normal. In the study, set 1 represents autonomy, competence and relatedness (Set 1= a1, a2, a3 variables) support variables about student perceptions regarding mathematics teachers' motivational support. Set 2 includes the behavioral engagement, emotional engagement, emotional disaffection and behavioral disaffection (Set 2= b1, b2, b3, b4 variables) variables related to students' engagement in mathematics classes. The study intended to determine the relationship between the dataset for student perceptions regarding mathematics teachers'

motivational support composed of autonomy, competence and relatedness support and the dataset for students' behavioral engagement, emotional engagement, emotional disaffection and behavioral disaffection perceptions in engagement with mathematics. In canonical correlation analysis, the number of possible variable pairs and the number of canonical correlations are identified with the smallest number of variables in both data sets (min (a, b) (Cohen, Cohen, West &Aiken, 2003). Since the first set included 3 variables (teachers' motivational support) and the second set included 4 variables (engagement); the number of maximum canonical variable pairs was calculated to be 3 (a=3 b=4 therefore (3,4).

FINDINGS

There canonical correlations were obtained as a result of the canonical correlation analysis is necessary to examine the significance of each canonical function in canonical correlation analysis. Table 1 displays canonical correlation coefficients, canonical correlation squared, (variance), Chi-square values and Wilks's λ values.

Table 1
Canonical correlation Significance (Chi-square Test) Results

	Canonical r	Canonical r^2	χ^2	df	*p*	Wilks's λ
1	.64	.41	380.49	12	.00	.53
2	.30	.09	60.87	6	.00	.90
3	.06	.00	2.62	2	.26	.99

According to Table 1, three different canonical variable pairs and three different canonical correlation coefficients were obtained for a and b variables. When Chi-square (χ^2) values are examined by using Wilks's λ values in the canonical correlation significance tests demonstrated in Table 1, the obtained first and second canonical variable pairs were observed to be significant. (Wilk's λ = .53, $\chi^2_{(12)}$ =380.49, *p*= .00; Wilk's λ =.90, $\chi^2_{(6)}$ =60.87, *p*= .00). The other canonical correlation pair was not found to be statistically significant (Wilks's λ =.99, $\chi^2_{(2)}$ =2.62, *p*= .26).

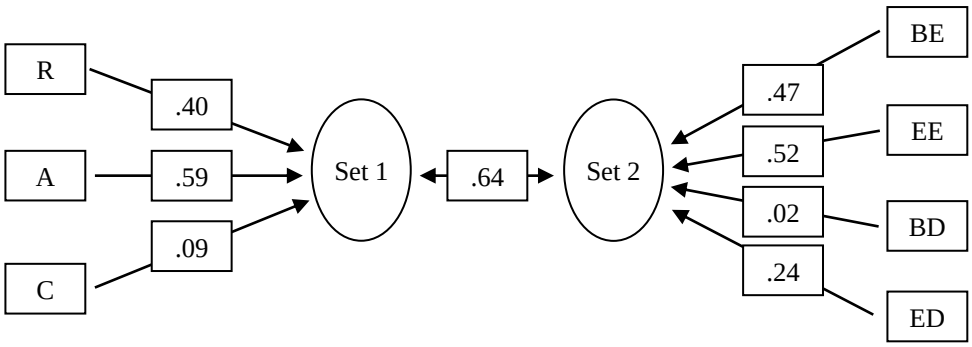
Table 1show that the first canonical correlation was .63 and the variance shared between teacher motivational support dataset and engagement dataset in the first canonical function was approximately 41%. In the second canonical function, canonical correlation was calculated to be .30 and the shared variance between teacher motivational support dataset and engagement dataset was 9%.

In order to determine how the variables included in the datasets contributed to canonical variables, standardized coefficients (sc) and structural coefficients (r_s) for the first and second canonical functions were examined and the results are presented in Table 2. The shared variance between the dataset for student perceptions regarding mathematics teachers' motivational support composed of autonomy, competence and relatedness support and the dataset for students' behavioral engagement, emotional engagement, emotional disaffection and behavioral disaffection perceptions in engagement with mathematic was given as r_s^2. The sum of r_s^2's in the first and second canonical functions shows the variance shared by the variables with the dataset in the canonical model. This value was given as srs^2. The criterion for the significance of the variance that the variables shared with the datasets should be .30 at the least (Tabachnick & Fidel, 2013). Values over .45 and higher point to more significant contribution (Shery & Henson, 2005).

Table 2
Canonical Analysis of the Relationship between Teacher Motivational Support and Engagement

Variables	1st Canonical function			2nd Canonical function			
	sc	r_s	r_s^2(%)	sc	r_s	r_s^2(%)	srs^2(%)
Relatedness	.89	.40	.16	-.13	-.04	.00	16
Autonomy	.95	.60	.36	.18	1.16	1.34	100
Competence	.78	.09	.00	-.58	-1.36	1.85	100
r^2		40.91		.09			
Behavioral engagement	.88	.47	.22	-.23	-.02	.18	40
Emotional engagement	.90	.52	.27	-.13	-.20	.04	31
Behavioral disaffection	-.36	.02	.00	-.66	-.38	.14	14
Emotional disaffection	-.53	-.24	.05	-.80	-.78	.61	66

According to the findings presented in Table 2, the contribution of autonomy variable to teacher motivational support dataset in the first canonical function was over .45. Therefore, it can be argued that the contribution of autonomy support variable to teacher motivational support dataset was significant in the first canonical function. Also, it was observed in the first canonical function that the contributions of behavioral engagement and emotional engagement variables to engagement dataset were over .45. Accordingly, it can be argued that the contributions of behavioral engagement and emotional engagement variables to engagement dataset were significant in the first canonical function. The signs of the variables that contributed to the dataset point to the direction of the relationship. Hence, it can be claimed that the structural coefficients for the autonomy support which was included in teacher motivational support dataset had a positive relationship with the behavioral engagement and emotional engagement variables that were included in the engagement dataset. This result shows that increased teacher autonomy support also increases emotional engagement and behavioral engagement.
According to Table 2, rs^2 value for the first canonical function was 40.91. This value points to the variance shared between teacher motivational support and engagement datasets in the first canonical function. Figure 1 displays the structural coefficients for the first canonical function and the canonical correlation coefficient between teacher motivational support and engagement datasets in the first canonical function.



(R: Relatedness, Autonomy, C: Competence, BE: Behavioral engagement, EE: Emotional engagement, BD: Behavioral disaffection, ED: Emotional disaffection)

Figure 1 The first canonical function and the canonical correlation coefficient between teacher motivational support and engagement

Based on the findings in Table 2, it was observed in the second canonical function that the contributions of autonomy support and competence support to teacher motivational support dataset in the second canonical function were over .45. Accordingly, it can be argued that the contributions of autonomy and competence support variable to teacher motivational support dataset in the second canonical function were significant. Also, the contribution of emotional disaffection to engagement dataset was over .45 in the second canonical function. Hence, the contribution of emotional disaffection to engagement dataset can be regarded as significant in the second canonical function. It can be argued that the structural coefficients for the autonomy and competence support which were included in teacher motivational support dataset had a negative relationship with emotional disaffection included in engagement dataset. This result shows that increased teacher autonomy and competence support decreases emotional disaffection.
According to Table 2, r_s^2 value for the second canonical function was .09. This value points to the variance shared between teacher motivational support and engagement datasets in the second canonical function. Figure 2 displays the structural coefficients for the second canonical function and the canonical correlation coefficient between teacher motivational support and engagement datasets in the second canonical function.

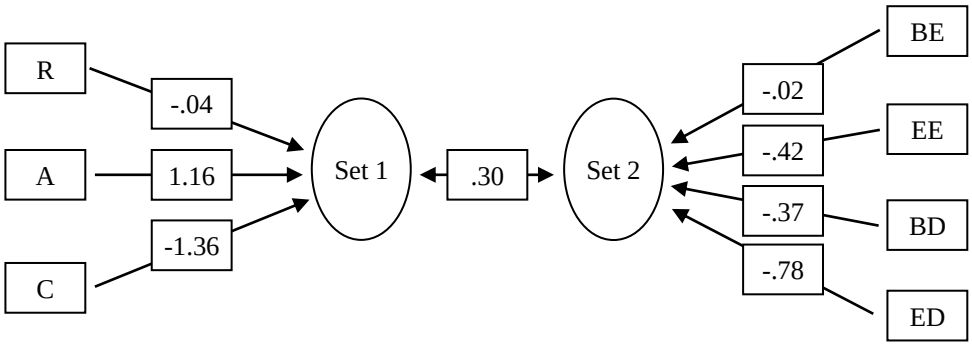


Figure 2 The structural coefficients for the second canonical function and the canonical correlation coefficient between teacher motivational support and engagement

Adding the r_s^2 values for the first and second canonical functions gave the variance shared between teacher motivational support and engagement datasets as 41.8 and Figure 3 displays the relationship between them.

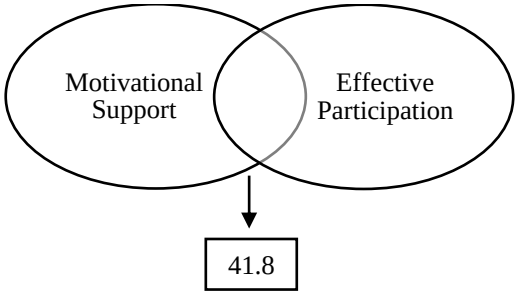


Figure 3 The variance shared between teacher motivational support and engagement

DISCUSSIONS and CONCLUSION

This study examined the relationship between middle school 6th, 7th and 8th graders' perceptions on mathematics teachers' motivational support and their engagement in mathematics classes by using canonical correlation analysis. The analysis provided two canonical functions for this relationship. The correlation between the datasets was calculated to be .64 in the first canonical function. According to this result, teachers' motivational support and engagement datasets shared a variance of 40.91% in the first canonical function. The correlation between the datasets was calculated to be .30 in the second canonical function. Accordingly, teachers' motivational support and engagement datasets shared a variance of 9% in the second canonical function.

The variance shared between teachers' motivational support and engagement datasets was found to be 41.8% in the canonical model composed of cumulative values of the canonical functions obtained from the canonical correlation analysis. Findings obtained from canonical functions determined that mathematics teachers' autonomy support provided to middle school 6th,7th, 8th grade students positively affected their behavioral engagement and emotional engagement. It was also identified that mathematics teachers' autonomy and relatedness support provided to middle school 6th,7th, 8th grade students negatively affected their emotional disaffection towards mathematics classes. Based on these findings, it can be argued mathematics teachers' increased autonomy support increases middle school 6th,7th, 8th graders' behavioral engagement and emotional engagement in mathematics classes. Findings also show that teachers' increased autonomy and relatedness support decreases students' emotional disaffection in mathematics classes. Studies show that teachers' positive supportive interactions with students and emotions such as affection, closeness and trust for teachers, positively affect classroom engagement. Çelik, Örenoğlu Toraman and Çelik (2018) investigated the level of relationship between student engagement and sensed teacher immediacy and reported a positive relationship between teacher immediacy and affective and cognitive engagement. Birgin, Akar, Uzun, Göksu, Peker and Gümüş (2017) found that secondary school students with higher affection for their Mathematics teachers had higher engagement levels compared to other students. Menteş (2011) identified a positive and significant relationship between students' trust for their teachers and

engagement. In their study on 5th graders, Martin and Rimm (2015) reported that effective interaction between students and teachers increase affective and social engagement levels. Therefore, positive relationship between teachers' autonomy support for students and students' affective and behavioral engagement is an expected finding. Also, negative relationships between autonomy support and affective and behavioral engagement are not surprising as well and literature provides parallel results.

In their study, Skinner et. al. (2008) showed that perceived control, autonomy, relatedness and teacher support had positive relationships with behavioral engagement and emotional engagement whereas they had negative relationships with emotional disaffection and behavioral disaffection. Teacher support and especially autonomy perceptions predicted decreases in disaffection. It was identified that autonomy and relatedness support significantly predicted decreased boredom, perceived control predicted increases in changes in the state of anxiety and autonomy predicted decreases in the feelings of disappointment. In their study, Reeve et al (2004) determined that teachers who received training to foster autonomy support behaved supportive of autonomy and their students were more engaged. Similarly, Kiefer, Alley and Ellerbrock (2015) reported positive relationships between teachers' autonomy support and academic motivation, classroom engagement, and feelings of belonging to school.

The first and second canonical functions gave the variance shared between teacher motivational support and engagement Güvenç (2007) found that university students' perceptions about teacher motivational support significantly predicted their engagement in class and that student perception about teachers' motivational support affected motivational regulations. Student perception about their teachers' motivational support was identified to be effective in engagement by indirectly affecting their motivational regulations and it was observed that this indirect influence was more effective than direct influence. Güvenç (2015c) also determined that perceptions of high school students regarding mathematics teachers' motivational support positively affected engagement whereas the construct negatively correlated with disaffection.

In previous studies, teachers in Turkey were found to believe that students should be given autonomy support but they generally displayed less of the behaviors that correspond to this belief (Oğuz 2013; Özkal & Demirkol, 2014) and provide their students with medium level autonomy support and medium level control support (Sünbül, Kesici & Bozgeyikli, 2003; Güvenç, 2011; Oğuz, 2013). This study investigated middle school students' perceptions regarding mathematics teachers' motivational support. Güvenç and Güvenç (2014) identified primary school mathematics teachers' autonomy support to be at medium level and in their study on classroom and branch teachers, Özkal and Demirkol (2014) found that mathematics teachers displayed behaviors that supported learner autonomy at the lowest level.

Findings obtained in this study showed that mathematics teachers' motivational support positively affected student engagement in mathematics. When mathematics teachers' motivational support is insufficient, student engagement will be negatively affected and will result in disengagement during class. In line with the findings, the significance of providing motivational support to students by mathematics teachers and mathematics teacher candidates and the need to train them in accordance with relevant teacher behaviors to that effect should be emphasized. It is also suggested to examine the other factors that may be effective in students' mathematics engagement and to replicate the current study at different educational levels and subject fields.

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TÜRKÇE GENİŞLETİLMİŞ ÖZET

Öğrencileri derse güdülemek ve etkin katılımlarını sağlamak eğitimcilerin önemli sorunlarından birisidir. Sınıfta etkinliklere istek ve merakla katılan öğrencilerin yanı sıra etkinliklere katılmayan, katılsa bile bunu isteksizce, hoşlanmadan yapanlarda vardır. Bu öğrenciler mekanik bir şekilde etkinliklere katılırlar. Yapılan çalışmalar sınıftaki öğrenme etkinliklerine istekli, gayretli etkin katılımın öğrencinin öğrenme, notlar, başarı testi sonuçlarını, devam, hatırda tutma, mezuniyet ve akademik olarak azmini yordadığını göstermektedir. Araştırma sonuçları etkin katılımın madde bağımlılığı, suç işleme gibi risklere karşı koruyucu olduğunu da göstermektedir (Fredricks, Blumenfeld ve Paris, 2004; Kahraman, 2014; Lee, 2014; Skinner, Furrer, Marchand ve Kindermann, 2008; Skinner, Kindermann, Connell ve Wellborn, 2009; Skinner ve Pitzer, 2012).

Öğrencilerin kendilerine has gereksinimleri, amaçları, ilgi ve değerleri vardır. Bir öğrenci ilginç bulduğu bir konuya saatler harcayabilir. Burada öğrenci bağlamdan bağımsız olarak güdülenmiştir. Sınıfta ise bağlam önemlidir. Öğrenciler sınıfta kendi gereksinimlerini, amaçlarını, ilgilerini ve değerlerini destekleyici ya da bunları tehdit eden sosyal etkileşimde bulunurlar. Sınıf içindeki öğretmen ve öğrenme ortamı öğrenci güdülenmesi ve etkin katılımını desteklemek ya da azaltmakta önemli bir etkiye sahiptir. Öğrenci güdülenmesi ve etkin katılımıiçin destekleyici şartlar, özellikle de destek sağlayan öğrenci-öğretmen ilişkileri gereklidir (Reeve, 2012). Öğrenci öğretmen etkileşimlerinin üç önemli niteliği vardır. Bunlar; eğitimsel önem (ilişki deneyimi destekleri), optimal yapı (yetkinlik kolaylaştırıcılar) ve özerklik desteğidir (öz belirlemeli güdüyü arttırma) (Skinner ve Pitzer, 2012). Öz belirleme teorisine göre öğrencilerin bu gereksinimleri karşılanmazsa hoşnutsuzluk deneyimleri yaşayabilirler (Wilding, 2015). Öğrenme etkinliği esnasında özerklik, yetkinlik ve ilişki destekleri göz ardı edilen ya da öğretim esnasında hayal kırıklığına uğrayan öğrencilere göre bu gereksinimleri karşılananlar daha fazla güdüleneceklerdir (Reeve, 2012). Ayrıca etkin katılımın öğrenme ve okul başarısı ile ilgili sonuçları öğrencilerin akademik olarak yetkin ve bağlanmış hissetmelerine ve öğretmenlerinden daha fazla destek almalarına, daha olumlu ilişkiler kurmalarına neden olur. Etkin katılımarttıkça öğrencilere daha fazla etkin katılan sınıf arkadaşları ile akran gruplarına ve arkadaşlık ilişkilerinin içine girişlerine izin verilir. Hoşnutsuzöğrenciler okulda kötü edim gösterirler, dışlanmış hissederler. Öğretmenler bu öğrencilere daha az destek verirler ve daha fazla baskı yaparlar. Bu öğrencilerin daha fazla hoşnutsuzluk yaşayan arkadaş gruplarına katılma olasılıkları yüksektir. Bu durum döngüsel olarak devam eder. Yani öğretmen güdüsel desteği etkin katılımı artırır, etkin katılım arttıkça öğretmenler öğrencilerine daha fazla güdüsel destek sağlarlar (Skinner, et al, 2008; Skinner & Pitzer, 2012).

Bu araştırmada ortaokul öğrencilerinin Matematik dersine etkin katılımları ile Matematik öğretmenlerinin güdüsel destekleri arasındaki ilişkiler incelenmiştir. Araştırmada keşfedici korelasyonel araştırma modeli kullanılmıştır. Araştırma Antalya ili Alanya ilçesinde yer alan ve uygulama izni alınan 10 ortaokulda 6., 7. ve 8. sınıfta öğrenim gören 612 öğrencinin gönüllü katılımıyla gerçekleştirilmiştir. Bu araştırmada, veriler ortaokul 6., 7. ve 8. sınıf öğrencilerine uygulanan "Öğretmen Güdüsel Desteği" (Güvenç, 2015a) ve "Etkin Katılım Ölçeği" (Güvenç, 2015b) ile toplanmıştır. Çalışmada, ortaokul 6., 7. ve 8. sınıf öğrencilerinin Matematik öğretmenlerinin güdüsel desteklerine ilişkin algıları ile Matematik dersine etkin katılımları arasındaki ilişki Kanonik Korelasyon analizi ile incelenmiştir. Kanonik korelasyon analizi, iki ve daha fazla değişken içeren iki değişken seti arasındaki ilişkiyi doğrusal bileşenler aracılığı ile değerlendiren çok değişkenli bir yöntemdir (Albayrak, 2010).

Araştırma sonucunda ortaokul 6., 7. ve 8. sınıf öğrencilerinin Matematik öğretmenlerinin güdüsel desteklerine ilişkin algıları ile Matematik dersine etkin katılımları arasındaki ilişkiye ait iki kanonik fonksiyon elde edilmiştir. Birinci kanonik fonksiyonda veri setleri arasındaki korelasyon .64 olarak hesaplanmıştır. Buna göre, birinci kanonik fonksiyonda Öğretmenlerinin güdüsel destekleri ile etkin katılım veri setlerinin %40.91'luk bir varyans paylaştıkları belirlenmiştir. İkinci kanonik fonksiyon için veri setleri arasındaki korelasyon değeri .30 olarak hesaplanmıştır. Buna göre, ikinci kanonik fonksiyonda Öğretmenlerinin güdüsel destekleri ile etkin katılım veri setlerinin % 9'luk bir varyans paylaştıkları belirlenmiştir. Kanonik korelasyon analizinden elde edilen kanonik fonksiyonların yığılmalı değerlerinden oluşan kanonik modelde öğretmen güdüsel desteği ile etkin katılım veri setlerinin paylaştıkları ortak varyans %41.8 olarak hesaplanmıştır. Kanonik fonsiyonlardan elde edilen bulgular ortaokul 6., 7. ve 8. sınıf öğrencilerinin Matematik öğretmenlerinin özerklik desteklerinin

öğrencilerin Matematik dersine davranışsal katılımlarını ve duyuşsal katılımlarını pozitif olarak etkilediği belirlenmiştir. Ayrıcaortaokul 6., 7. ve 8. sınıf öğrencilerinin Matematik öğretmenlerinin özerklik ve ilişki desteklerinin öğrencilerin Matematik dersine ilişkin duyuşsal hoşnutsuzluklarını negatif olarak etkilediği belirlenmiştir. Bu bulgulara göre Matematik öğretmenlerinin özerklik destekleri arttıkça ortaokul 6., 7. ve 8. sınıf öğrencilerinin Matematik dersinde davranışsal ve duyuşsal katılımlarının artmakta olduğu söylenebilir. Yanı sıra bulgular Matematik öğretmenlerinin özerklik ve ilişki destekleri arttıkça öğrencilerin Matematik dersinde duyuşsal hoşnutsuzluklarının azaldığını göstermektedir. Bu araştırmada ulaşılan sonuçlar Matematik öğretmenlerinin güdüsel desteklerinin öğrencilerin Matematik dersine etkin katılımını olumlu olarak etkilediğini göstermiştir. Öğrencilerin Matematik öğretmenlerinin güdüsel desteklerinin yetersiz olması öğrencilerin derse etkin katılımlarını olumsuz olarak etkileyecektir. Öğrencilerin derste hoşnutsuz duygular yaşamalarına neden olacaktır. Bu doğrultuda Matematik öğretmenlerinin ve Matematik öğretmeni adaylarının öğrencilerine güdüsel destek sağlamalarının önemi ve onların gereksinimlerine uygun öğretmen davranışları konusunda yetiştirilmesi gerektiği söylenebilir.