

Prediction of High School Students' Mathematics Anxiety by Their Achievement Motivation and Social Comparison

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ABSTRACT. As stated in the literature, there are various variables affecting mathematics anxiety. While a variable affecting students' mathematics anxiety is their achievement motivation, another variable affecting students' mathematics anxiety is their social comparison. This study aims to determine if achievement motivation and social comparison are significant predictors of high school students' mathematics anxiety. The study groups were comprised of 166 9th grade students still attending a private tutoring center. In this study, a multiple linear regression analysis was used. In multiple linear regression analysis, the relationship between the predictor variables, students' achievement motivation, and social comparison, and the dependent variable, mathematics anxiety, were tested. It was determined that achievement motivation alone, and achievement motivation and social comparison together are significant predictors of high school students' mathematics anxiety.

Keywords: mathematics anxiety, achievement motivation, social comparison

INTRODUCTION

In the literature, many variables have been determined to provide large effects on mathematics achievement. Of these variables, mathematics anxiety is explained as one of the most significant reasons preventing mathematics achievement. Richardson and Suinn (1972) define mathematics anxiety as a feeling of stress and fear that prevent mathematical problem-solving and calculation in a wide range of regular life and academic occasions. While Aiken (1976) defines mathematics anxiety as an attitude towards mathematics, Lazarus (1974) defines it as a fear state that individuals feel when they encounter mathematics subjects. Although Baloglu (1999) states that there is no concensus on the nature of anxiety, Byrd (1982) identifies it as a fear state experienced by the individual when he/she encounters mathematics. There is a common agreement on the classification of anxiety. It has two different components—trait anxiety and state anxiety. While the individuals with trait anxiety are relatively determined, the ones with state anxiety are limited with “temporary emotional conditions.” Hence, mathematics anxiety is an state anxiety that exists during specific occasions.

Bessant (1995) indicates that mathematics anxiety shows a multi-dimensional structure and contains three dimensions. These dimensions are: 1) mathematics exam anxiety, 2) numeric anxiety, and 3) abstraction anxiety. Hadfield and McNeil (1994) classify the reasons for mathematics anxiety as environmental, mental, and individual reasons. Environmental reasons include experiences in mathematics classes and personality traits of mathematics teachers. Mental reasons are related to high abstraction and logic, which are in the content of mathematics. Self-esteem, physically well, mathematics attitudes, self confidence in mathematics, learning styles in mathematics, and previous experiences related to mathematics may be regarded as individual reasons (Lazarus & Averill, 1972; Fitzgerald, 1997). Brush (1981) puts forward the claim that mathematics anxiety is a content-oriented test anxiety. Harris and Harris (1987) put forward three main reasons for mathematics anxiety: 1) student-related, 2) teacher-related, and 3) subject-related.

As seen in the literature above, there are various variables affecting mathematics anxiety. Another variable affecting students' mathematics anxiety is their achievement motivation. Atkinson (1977) developed the Achievement Motivation Theory and defined achievement motivation as the required tendency concerning motivation to begin a task (for success) to reach success and avoid underachievement (McClelland, Atkinson, Clark, & Lowell, 1953; Atkinson, 1957, 1964). According to Murray (1938), achievement motivation is the tendency or desire of doing something as soon as possible and as better as possible. Murray states that achievement is a motivation because individuals

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wish to overcome their handicaps and have higher criteria to surpass both themselves and their rivals, dominate others, and increase their self-esteem by improving their abilities (Rivera, 2002).

The main factor bringing achievement motivation into existence is the need for achievement (Murray, 1938; Weiner, 1974, 1985). The need for achievement shows itself as a desire to complete a task or behavior according to perfection criteria or even better than these criteria. For instance, doing something much more than the rivals, reaching or obtaining a difficult goal, solving a complex problem, improving skills, and completing homework successfully show the need for achievement. McClelland (1962) claims that individuals with high achievement need to take reasonable risks, prefer activities that can be achieved easily, reach inner satisfaction stemming from their successes, and do not care for anything except their tasks. Low need for achievement is thought to be associated with a sense of low competence, low expectations, and orientation toward failure (Atkinson, 1964; Nicholls, 1976; Atkinson, 1977).

Murayama and Elliot (2009) indicate that target structures predict intrinsic motivation and academic conceit not only directly, but also indirectly. In their study, Hart et al. (2007) determined that conscientiousness, openness, and extraversion are positively associated with intrinsic achievement motivation; whereas, extraversion, conscientiousness, and neuroticism are positively related to extrinsic achievement motivation. Additionally, agreeableness is also found to be negatively associated with extrinsic achievement motivation.

Students may not have an objective criteria related to achievement motivation, so they evaluate achievement motivation according to social comparison. The hypothesis, "There exists, in the human organism, a drive to evaluate his opinions and abilities" (p. 117) lies in the focus of Festinger's (1954) Social Comparison Theory. Festinger (1954) remarks that while evaluating themselves, individuals compare themselves with other people if objective criteria are unavailable. Making normative comparisons may also prevent children from enjoying the learning process and achieving their potential performance (Brickman & Bulman, 1977; Kohn, 1992; Gordijn & Stapel, 2006). Pietsch, Walker, and Chapman (2003) state that social comparison information was equally influential in the formation of each construct.

Social comparison covers one's examination of to what extent his/her personal beliefs and attitudes are appropriate, compared to other individuals (Forsyth, 1999). Gilbert, Price, and Allan (1995) indicate the need of social comparison is phylogenetically very old, biologically very powerful, and recognizable in many species. In Festinger's theory, there is "similarity hypothesis" in which individuals prefer to compare themselves similar to other individuals. When it comes to evaluating an aptitude and performance, individuals are significantly different from other individuals. According to Festinger (1954), if an individual has low aptitude "deep experiences of failure and feelings of inadequacy" are "not . . . unusual" (p. 137). Marsh and Parker (1984) discovered, an association between average ability level in children's schools between the children's self-esteem. Wood (1989) indicates that people do not accept all consistent information by making comparison. They may make comparisons to improve their self-esteem. Upward comparisons may also contribute to self-improvement goals. Individuals may observe more skillful or successful individuals hoping to learn from them, as well (Berger, 1977). Downward comparisons seem to decrease anxiety or enhance self-esteem (Gibbons, 1986; Lemyre & Smith, 1985).

According to Wood (1989) people do not accept all consistent information by making comparisons. In his study, Bong (1998) determined a positive association between students' verbal and mathematics self-concepts constructed upon internal comparison, and success in one of the areas negatively influences both internal and external comparison-based self-concepts in the other area; and verbal and math self-concepts are positively correlated. Gordijn and Stapel (2006) state that for downward and upward social comparisons, being confronted by someone who does better (upward comparison) is sometimes inspiring (assimilation), but can also be frustrating (contrast). Similarly, they express that someone who is worse-off than oneself (downward comparison) can sometimes raise one's spirits (contrast), but can also have the opposite effect (assimilation). Corpus, Ogle, and Love-Geiger (2006) state that when negative feedback is compared to positive feedback, both develop competence valuation and perceived competence. Therefore, this leads to enhanced intrinsic motivation.

Individuals who have mathematics anxiety may not achieve their potential performance. In mathematics lessons, student's required achievement motivation may play a significant role on

student's achievement without experiencing mathematics anxiety. To emphasize the importance of this role, it is important to highlight the features of the Achievement Motivation Theory. Thus, the purpose of this study is to clarify if middle school students' mathematics anxiety differentiates, according to their low and high achievement motivations, and their level of self-esteem stemming from social comparisons. In this respect, the following questions will be answered in this study:

Are achievement motivation and social comparison significant predictors of high school students' mathematics anxiety?

METHOD

In this study, a quantitative method was used to determine if there are significant associations between independent variables (achievement motivation and social comparison) and dependent variables (mathematics anxiety). In this study, to what extent achievement motivation and social comparison serve as predictors of mathematics anxiety was analyzed by multiple regression analysis.

Participants

Participants in this study were randomly selected among the 9th grade students participating in a private tutoring center in Konya City, Turkey.

Measures

To collect data for this study, the "Mathematics Anxiety Rating Scale," the "Achievement Motivation Scale," and the "Social Comparison Scale" were used. These scales are described below.

The Mathematics Anxiety Rating Scale. The Mathematics Anxiety Rating Scale, developed by Richardson and Suinn (1972), measures levels of mathematics anxiety. It consists of 98 items. Participants are required to rate each item according to the degree of anxiety. The total of the scale points is obtained by summing all points given to the items. Higher points signify higher mathematics anxiety. The range for the total scale points is between 98 and 490. The reliability of the test, analyzed by Baloğlu (2005) in terms of Turkish language validity and pre-psychometric analysis, is examined by using the consistency of the items method. The internal reliability of this scale was high ($\omega = .95$).

The Achievement Motivation Scale. Developed by Umay (2002), this scale has 14 items and is three-dimensional. This scale is used to measure achievement motivation of the students, who are expected to have high achievement motivation. The internal reliability of this scale was high ($\omega = .84$).

The Social Comparison Scale. Social Comparison Scale, developed by Gilbert, Allan, and Trend (1991), was adapted to Turkish by Şahin and Şahin in 1992 (Gilbert et al., 1991; Şahin, & Şahin, 1992; adapted by Savaşır & Şahin, 1997). This self-evaluation scale measures how individuals perceive themselves when they compare themselves with others, based on various dimensions. It is two-dimensional and consists of 18 items. The internal reliability was calculated as .87.

Procedures and Analysis

Permission for the participation of the students was obtained from the chief of the private tutoring center and the students participated voluntarily in this research. The scales (which were anonymous and a guarantee of confidentiality) were administered to the students in groups in the classroom environment. Prior to administration, the purpose of this study and how the study would be achieved were clearly stated.

In this study, a multiple linear regression analysis was used. In multiple linear regression analysis, the relationship between the predictor variables, students' achievement motivation, and social comparison, and the dependent variable, math anxiety, were tested. This analysis was completed via SPSS 15.0 (Statistical Package for Social Sciences) software.

RESULTS AND DISCUSSION

The stepwise regression analysis method was used to determine if high school students' achievement motivation and social comparison predict students' mathematics anxiety. As seen in Figure 1, the sample consisted of 166 students—99 males (59.6%) and 67 females (40.4%).

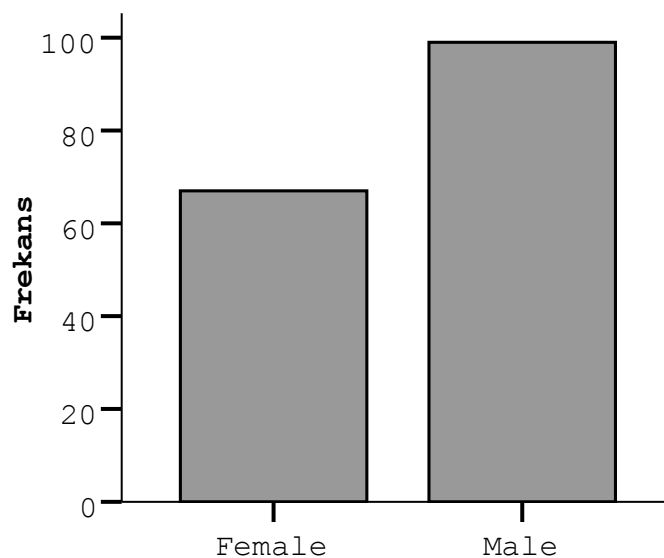


Figure 1. Gender Distribution

Findings from the stepwise regression analysis are summarized in Table 1. It was determined that high school students' achievement motivation and social comparison are significant predictors of mathematics anxiety ($p < .05$). Achievement motivation alone predicts about 20% (19.5%) of the variation. On the other hand, about 24% (23.6%) of the variation were related to mathematics anxiety is explained with achievement motivation and social comparison together.

Table 1. Summary for Stepwise Regression Analysis of Mathematics Anxiety

Model ^a	R	R ²	R ² _{adj}	SE	R ² _{chg}	F _{chg}	Df	F _{chg}
1	.441 ^b	.195	.190	47.22	.195	39.65	1 / 164	.000
2	.486 ^c	.236	.227	46.12	.042	8.86	1 / 163	.003

^a: Dependent variable: mathematics anxiety

^b: Predictors: (Constant), achievement motivation.

^c: Predictors: (Constant), achievement motivation, social comparison.

High school students' achievement motivation and social comparison were determined to be a significant predictor of mathematics anxiety. About 20% of mathematics anxiety was explained with achievement motivation. Schunk (2000) stated that mathematics ability consists of computation skills and problem-solving skills; thus, mathematics has task difficulty and high-motivated students' experiencing mathematics anxiety may be explained with task difficulty. It is important to take the required responsibility, to be successful at mathematics. However, students with low motivation do not take responsibility for their failure (Ketz, 1967; Weiner & Kukla, 1970).

Twenty-four percent of mathematics anxiety is associated with achievement motivation and social comparison. Students study hard to become successful. In the process of achievement, they make social comparisons with the desire of proving they are better than others, instead of determining and overcoming their deficiencies and mistakes. The direction for this comparison is determined by their desire to learn how they are similar with and different from the other students (Schunk, 2000). Students who make upward comparisons develop negative self-concepts and they evaluate their own potentials negatively. Self-concept beliefs are more heavily influenced by processes of social

comparison than efficacy beliefs (Bong & Clark, 1999). Similarly, Bong and Skaalvik (2003) argue that self-concept has cognitive and affective components.

CONCLUSION

In conclusion, about a quarter of the variance regarding high school students' mathematics anxiety is explained by achievement motivation and social comparison together. This finding and the related literature (Kesici, & Erdogan, 2010) show the importance of these two variables to overcome the mathematics anxiety. Teachers may give feedback to their students having mathematics anxiety to increase their achievement motivation. In addition, teachers may first present problems that students understand clearly and can solve easily. This may raise the self-efficacy beliefs of student in mathematics. Teachers should solve more difficult problems with their students. Also, the comparison of students who have mathematics anxiety with the one who do not have it may even increase their anxiety levels more. Hence, instead of using upward social comparison, teachers should use verbal and behavioral feedback to develop their personality positively and to enhance their achievement motivation.

In the present study, there are several limitations to be expressed. The total score for social comparison is considered in the data analysis instead of using the subscale scores. Although a significant portion of the variance in mathematics anxiety is explained by the achievement motivation and social comparison, additional variables, such as environmental and institutional measures, might be included in the analysis to extend our understanding of student anxiety in mathematics. The participants of the current research study are limited to high school students. However, future studies might focus on its applicability to other grade levels.

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Lise Öğrencilerinin Başarı Güdülerinin ve Sosyal Kıyaslama Düzeylerinin Matematik Kaygılarını Yordaması

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ÖZ. Literatürde de belirtildiği gibi öğrencilerin matematik kaygısını etkileyen pek çok değişken söz konusudur. Öğrencilerin matematik kaygısını etkileyen değişkenlerden birisi onların başarı güdülere iken bir diğeri de sosyal kıyaslama düzeyleridir. Bu çalışmada, lise öğrencilerinin başarı güdülerinin ve sosyal kıyaslama düzeylerinin onların matematik kaygılarının yordayıcısı olup olmadığını araştırmak amaçlanmaktadır. Çalışma grubunu, özel bir dershaneye devam eden 166 tane 9. sınıf öğrencisi oluşturmaktadır. Bu çalışmada, çoklu lineer regresyon analizi kullanılmıştır. Çoklu lineer regresyon analizinde, yordayıcı değişkenler olan başarı güdüsü ve sosyal kıyaslama ile bağımlı değişken olan matematik kaygısı arasındaki ilişki test edilmiştir. Araştırmanın bulgularına göre, hem başarı güdüsünün tek başına hem de başarı güdüsü ve sosyal kıyaslamaların birlikte, lise öğrencilerinin matematik kaygılarının anlamlı yordayıcıları olduğu görülmüştür.

Anahtar Kelimeler: matematik kaygısı, başarı güdüsü, sosyal kıyaslama

ÖZET

Amaç ve Önem: Bu çalışmada lise öğrencilerinin başarı güdülerinin ve sosyal kıyaslama düzeylerinin matematik kaygılarını yordamada ne derece etkili olduğunu araştırmak amaçlandı. Literatürde de bahsedildiği gibi, matematik kaygısını etkileyen pek çok değişken bulunmaktadır. Öğrencilerin matematik kaygılarını etkileyebilecek bir etken onların başarı güdülere iken bir diğere etken de sosyal kıyaslamalarıdır. Literatürde başarı güdüsü, olabildiğince çabuk ve olabildiğince iyi yapma eğilimi ya da isteği olarak tanımlanmakla birlikte, başarının bir güdülenme olduğu çünkü bireylerin engelleri aşmayı ve yüksek standart edinmeyi, kendilerini ve rakiplerini geçmeyi, diğere baskın olmayı, yeteneklerini geliştirerek özsaygıyı arttırmayı istedikleri belirtilmektedir. Sosyal kıyaslama ise birisinin kişisel inanç ve tutumlarının diğere bireylerle kıyaslamasının ne derece doğru olduğunun incelenmesini kapsar.

Yöntem: Bu çalışmada başarı güdüsü ve sosyal kıyaslama bağımsız değişkenleri ile matematik kaygısı bağımlı değişkenleri arasında anlamlı bir ilişki olup olmadığını araştırmak için nicel bir yöntem kullanıldı. Bu çalışmada, başarı güdüsü ve sosyal kıyaslamaların matematik kaygısının ne ölçüde yordayıcısı olduğu analiz edildi. Çalışma Konya ilindeki özel bir dershaneye devam eden 9. sınıf öğrencileri üzerinde yürütüldü. Çalışmanın örneklemini oluşturan 166 öğrencinin 99'u (%59,6) erkek ve 67'si (%40,4) kızdır. Veri toplamak için "Matematik Kaygısı Derecelendirme Ölçeği", "Başarı Güdüsü Ölçeği" ve "Sosyal Kıyaslama Ölçeği" kullanıldı. 98 maddeden oluşan 5 dereceli likert tipindeki matematik kaygısı derecelendirme ölçeğinin güvenilirlik katsayısı 0.97 dir. Diğere taraftan 14 maddeden oluşan ve 3 alt boyutu bulunan başarı güdüsü ölçeğinin güvenilirlik katsayısı 0.75 ve 18 maddeden oluşan ve 2 alt boyutu bulunan sosyal kıyaslama ölçeğinin güvenilirlik katsayısı 0.87 dir. Verilerin analizinde çoklu lineer regresyon analizi tekniği kullanıldı. Bu analiz SPSS 15.0 paket programı kullanılarak yapıldı.

Bulgular: Lise öğrencilerinin başarı güdülere ve sosyal kıyaslama düzeylerinin matematik kaygılarının yordayıcısı olup olmadığını anlamak için yapılan çoklu lineer regresyon analizi sonucunda lise öğrencilerinin başarı güdülere ve sosyal kıyaslamalar, matematik kaygılarının önemli bir yordayıcısı olduğu görüldü ($p < .05$). Başarı güdüsü tek başına matematik kaygısına ilişkin varyansın %19.5'ini açıklamaktadır. Diğere taraftan, başarı güdüsü ve sosyal kıyaslama birlikte matematik kaygısına ilişkin varyansın %23.6'sını açıklamaktadır.

Tartışma, Sonuç ve Öneriler: Araştırmanın bulgularına göre, lise öğrencilerinin başarı güdülere ve sosyal kıyaslama düzeylerinin matematik kaygılarının önemli bir yordayıcısı olarak bulundu. Başarı güdüsü matematik kaygısına ilişkin varyansın yaklaşık %20'sini açıklamaktadır. Literatürde matematik becerisinin hesap beceresi ve problem çözme becerisinden oluştuğu belirtilmektedir ve bu durumda da matematik dersi görev/ödev zorluğu olan bir derstir. Başarısı güdüsü yüksek olan öğrencilerin matematik kaygısı yaşamaları matematik dersindeki görev/ödev zorluğu ile açıklanabilir. Başarı güdüsü ve sosyal kıyaslama ikisi birlikte matematik kaygısına ilişkin varyansın yaklaşık %24'ünü açıklamaktadır. Öğrenciler başarılı olmak için çalışmakta ve bu başarı sürecinde eksik ve yanlışlarını tespit edip bunları gidermek yerine diğere öğrencilerle rekabete girerek diğere öğrencilerden daha iyi olduklarını ortaya çıkarmak arzusu içinde sosyal kıyaslama yapmaktadırlar. Bu kıyaslamaların yönünü de diğere öğrencilerle olan benzerlik ve farklılıklarını öğrenme istekleri belirlemektedir. Bu durum ise öğrencilerde matematik kaygısının artmasına neden olmaktadır.

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