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Investigating Elementary School Students' Motivational Traits in Science Classrooms
İlköğretim Öğrencilerinin Fen Derslerindeki Güdüsel Özelliklerinin İncelenmesi

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Abstract

This study examined elementary students' motivational traits in science with respect to students' gender and grade levels. A total of 3685 students from 6th, 7th and 8th grade levels participated in the study. Findings showed that gender and grade level differences exist among elementary students. Concerning the gender difference, girls appeared to be more curious, conscientious, and social with a higher level of need for achievement. Moreover, it was revealed that as grade level increased, students' motivational patterns became less positive.

Keywords: gender, grade level, motivational trait, science.

Öz

Bu çalışmada ilköğretim öğrencilerinin fen derslerindeki güdüsel özellikleri araştırılmıştır. Çalışmada ayrıca cinsiyetin ve sınıf düzeyinin öğrencilerin dört güdüsel (başarılı, meraklı, vicdanlı ve sosyal) özelliğine olan etkisi araştırılmıştır. Araştırmaya 3685 altıncı, yedinci ve sekizinci sınıf öğrencisi katılmıştır. Sonuçlar kız öğrencilerin erkek öğrencilere göre daha başarı odaklı, meraklı, vicdanlı ve sosyal olduğunu göstermiştir. Ayrıca sınıf düzeyi arttıkça öğrencilerdeki güdüsel özelliklerin azaldığı görülmüştür.

Anahtar Sözcükler: Cinsiyet, güdüsel özellikler, sınıf düzeyi.

Introduction

Science education has a major role in preparing new generations towards the scientific and technological era. In order to make young people ready for scientific revolutions and real scientists of the new generation, science teachers should be aware of the students' needs and expectations. To respond to those needs and expectations, teachers should note down the factors that motivate their students. Also, instructors should realize that students' learning and memory are closely related to motivation (Kahraman and Sungur, 2011). Students learn what they want to learn and have great difficulty in learning material that does not interest them. Motivated students learn better and apply their scientific knowledge in every aspect of their life. Clearly, student motivation is crucial for learning. Motivation can be defined as a complex psychological construct that attempts to explain behavior and the effort applied in different activities (Gins & Watters, 2000) and as internal states that arouses, directs and maintains behavior (Levy, 2000). While dealing with motivation, researchers come up with an important question "Whether motivation is an inborn characteristic, or a temporary state of mind." Some people believe that motivation is a trait, or an inborn characteristic, while others consider it as a temporary state of mind. Actually it is combination of both (Hill, 1999). As a result of being a broad subject, motivation is reduced to simple components in research. Concepts like motivational patterns, self esteem, self efficacy, task value, goal orientations, intrinsic motivation, and extrinsic motivation are considered as important motivational variables to examine. The motivational patterns

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underlying the view of this study were presented by Adar (1969, cited in Kempa & Diaz, 1990) as achiever students, curious students, conscientious students and social students. According to Adar, achiever students are the ones who need to achieve; curious students are the ones who need to satisfy their curiosity; conscientious students are the students who need to discharge a duty and the social students are the ones who need to affiliate with other people. For decades the effects of these variables on achievement and the factors that affect these motivational variables are studied. Most of those studies also examined the effects of gender, age, grade level, and other factors like family, school type, and socio- economic status on motivational variables (Anderman & Midgley, 1997; Azizoğlu & Çetin, 2009; Güngören, 2009; Güvercin, 2008; Taş, 2008; Wighfield & Ecceles, 1992). Gender has been one of the common variables across the studies related to motivation. The research findings in this perspective are divided into two. Some findings suggest that gender does not affect motivation of the students while a number of motivational studies support the idea of gender differences in academic motivation. Within these research studies related to gender difference, some found that females are more motivated than males in social subjects like language and verbal activities (Dai, 2001; Lightbody, Siann, Stocks, & Walsh, 1996; Skaalvik & Skaalvik, 2004; Wighfield & Ecceles, 1992), while males are more motivated than females in science and mathematics (Kempa & Diaz, 1990; Githua & Mwangi, 2003; Lightbody et al., 1996; Skaalvik & Skaalvik, 2004). Kempa and Diaz (1990) investigated the effect of gender on four motivational traits, namely, achievers, curious students, conscientious students and sociable students and found that for two of the motivational traits, major differences existed between males and females. The boys (M=2.94) were more achievement oriented than the girls (M=2.57; p= .001) and girls (M=3.81) were more conscientious than boys (M=3.65; p=.001). Also they found that the girls were more interested in the motivational traits than boys. Similar to this study, Trumper (1995) found that more girls than boys might be categorized as conscientious and girls and boys might be categorized almost equally as sociable. In another study, Güvercin (2008) demonstrated that girls hold more favorable motivational beliefs compared to boys. Age or grade levels of the students also considered as a variable effecting the motivation (Azizoğlu & Çetin, 2009; Güngören, 2009; Hacıeminoğlu, Yılmaz-Tüzün, & Ertepınar, 2009; Lepper, Corpus & Iyengar, 2005; Otis, Grouzet & Pelletier, 2005; Şenler & Sungur, 2009; Trumper, 1995; Wighfield & Ecceles, 1994; Yeung & McInerney, 2005). In general, the studies related to the effect of grade level or age on motivation reveal that motivational characteristics of the students decrease as grade level increases or they get older (Anderman & Midgley, 1997; Güngören, 2009; Şenler & Sungur, 2009; Urdan & Midgley, 2003; Wigfield, Eccles, Mc Iver, Reman, & Midgley, 1991). For example, Şenler and Sungur's (2009) study revealed a significant difference between first level elementary school students' (Grades 4-5) and second level elementary school students (Grades 6-8) with respect to motivational beliefs in science in favor of first level elementary school students. Moreover, in a study investigating the motivational traits of girls and boys with respect to grade level Trumper (1995) demonstrated that distribution of boys and girls differed in some traits according to the grade level of the students. In 8^{th} grade and 9^{th} grade more boys than girls are categorized as achievers, and in 8^{th} grade and 11^{th} grade more girls than boys are categorized as conscientious. In 9^{th} grade, more boys than girls are found to be in curious student category. In 11^{th} grade, more girls than boys are categorized as conscientious. In 10^{th} graders, however, no significant difference between boys and girls' motivational traits are found.

Purpose

The research in the field of science education, mainly focused on the effectiveness of teaching methods and the cognitive variables on student achievement. Although motivational constructs are very important for science teaching and learning, less attention has been given to these constructs especially the motivational patterns and their influences on students' performance. Accordingly, the aim of this study was to fill this gap in literature by investigating the elementary school students' motivational traits (achiever, curious, conscientious and social) in science. More specifically the present study aims at addressing the following research questions:

1) Is there a difference between elementary school boys and girls with respect to their motivational traits in science?

2) Is there a grade level difference in elementary school students' motivational traits in science?

3) What is the pattern of elementary school students' motivational traits in science?

Method

Sample

A total of 3685 students attending 15 randomly selected elementary schools located in five districts of Ankara, (i.e.,Çankaya, Yenimahalle, Mamak, Etimesgut, and Keçiören) participated in the study. The districts in Ankara were selected by convenience sampling method and the schools, which were thought as clusters in those were selected randomly from each districts. Of 3685 students, 1291 were in sixth grade, 1177 were in seventh grade and 1207 were in eighth grade.The sample consisted of 1927 girls and 1748 boys, aged between 12 and 14 years. Students' science grades distributed equally and were ranging from 1 to 5. Majority (23.74%) reported their science grades as 4.

Instruments

The data were collected by the Motivational Pattern Questionnaire developed and validated by Kempa and Diaz (1990). It contains 60 self rating items representing personal responses of the students related to four motivational traits. The questionnaire has a five-point Likert scale and the responses on the questionnaire range from "very true to me" to "absolutely inapplicable to me". The questionnaire was translated and adapted into Turkish by the researchers. The validity of the translated and adapted version of the questionnaire was established through review by three experts in the field of science education. All were asked if the items in each dimension were relevant to the goal of the questionnaire. Revisions were made based on their comments and suggestions. The revised Turkish version of the questionnaire was pilot-tested with 174 students. The reliabilities related to the four motivational patterns are measured as achiever student scale .81, curious student scale .79, conscientious student scale is .79 and sociable student scale is .68.

Results

Descriptive statistics concerning students' motivational traits in science with respect to gender and grade level was presented in Figure 1 and Figure 2. As shown in the figures, the mean scores for girls were higher than that of boys. Additionally, a steady decline was observed in means across grade levels.

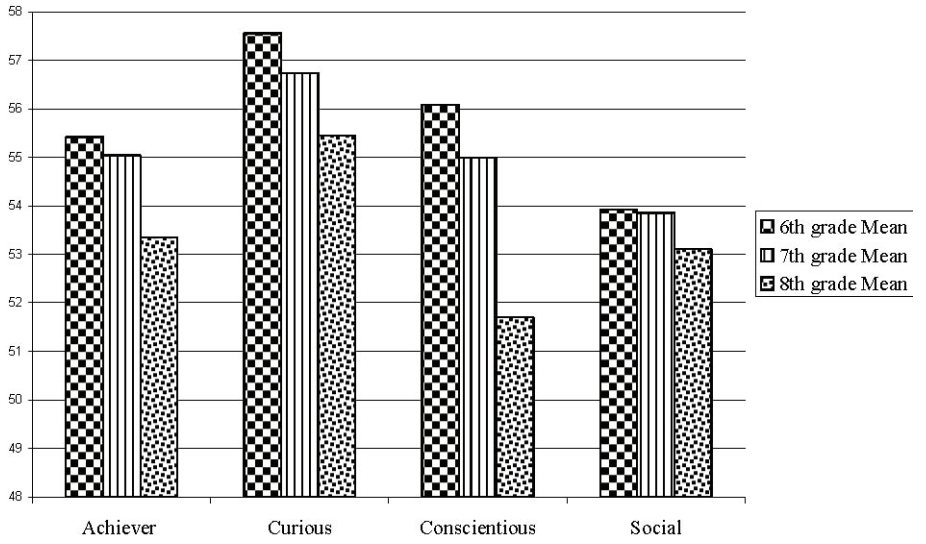

Figure 1. Mean scores of females and males with respect to four motivational traits.

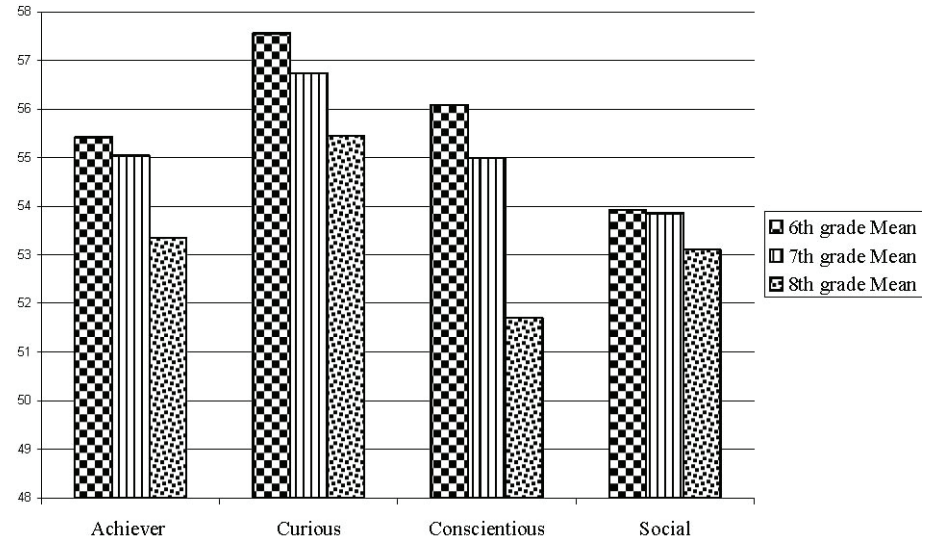

Figure 2. Mean scores of 6th, 7th, and 8th grade students with respect to four motivational traits.

In order to investigate gender and grade level differences in students' motivational traits in science two separate MANOVAs were conducted. Results related to gender difference revealed significant gender effect on students' motivational traits F(4, 3673)=27.918, p=.000; Wilks' Lambda=.970; partial eta squared=.030) (Table 1)

Table 1.
Tests of between subject factors for gender

Motivational pattern	F	p	Partial eta squared	Observed power
Achiever	15.565	.000	.004	.976
Curious	17.341	.000	.005	.986
Conscientious	53.588	.000	.014	1.000
Social	76.499	.000	.021	1.000

As seen from the following table, girls had higher mean scores on each motivational pattern, indicating that girls tend to be more achiever, curious, conscientious and sociable than boys. As a result of this finding, one could concluded that girls need to achieve more than boys, girls need to satisfy their curiosity more than boys; girls need to discharge a duty than boys and girls need to affiliate with other people than boys

Table 2.
Means and standard deviations of the students by gender and motivational patterns

Motivational pattern	Girls		Boys	
	M	S.D.	M	S.D.
Achiever students	55.05	6.71	54.14	7.21
Curious students	57.12	7.80	56.06	8.14
Conscientious students	55.14	6.97	53.38	7.61
Sociable students	55.44	5.57	52.75	6.12

Similarly, results of multivariate analysis of variance indicated a significant grade level differences in students' motivational traits (F(8, 7338)=34.227, p=.000; Wilks' Lambda=.926; partial eta squared=.037) (see Table 3).

Table 3.
Tests of between subject factors for grade level

Motivational pattern	F	p	Partial eta squared	Observed power
Achiever	31.341	.000	.017	1.000
Curious	22.244	.000	.013	1.000
Conscientious	127.767	.000	.067	1.000
Social	7.412	.001	.004	.941

As can be seen from the following table, 6th graders appeared to be more achiever, curious, conscientious and sociable than 7th and 8th graders. Therefore, it can be said that scores of the students related to the motivational traits decreases as the grade level increases.

Table 4.
Means and standard deviations of the students by grade level

Motivational pattern	6th graders		7th graders		8th graders	
	M	S.D.	M	S.D.	M	S.D.
Achiever students	55.42	6.57	55.04	6.80	53.34	7.36
Curious students	57.56	7.69	56.73	7.60	55.45	8.50
Conscientious students	56.09	7.00	54.99	6.88	51.70	7.39
Sociable students	53.93	5.65	53.85	5.90	53.10	6.13

Moreover, each student assigned to the motivational pattern according to the highest percentage. In order to classify students according to particular motivational traits a procedure suggested by Professor Kempa was followed (Trumper, 1995). Students were assigned to four percentile groups on the basis of their z-scores on each trait scale. This resulted in each student receiving four assignations in accordance with his or her placement on the four motivational trait scales. The classification of each student was then made on the basis of her or his highest grouping. The results show that some students are assigned to two or more motivational patterns and approximately half of the students could not assigned to a motivational pattern. The percentages of the girls at the top quartile of each motivational dimension are grater than the percentages of boys. Moreover, more boys placed in the bottom quartile than the girls. This results show that the number of the female students assigned to the motivational traits is greater than the number of the male students. The percentages of the 6th graders are greater than the percentages of 7th and 8th graders for achievers, curious students and conscientious student dimensions. However the percentage of the 7th graders is greater than the percentages of 6th and 8th graders. Also the percentages of 8th graders at the bottom quartile are greater than the percentages of other grades. This means that the numbers of the 8th grade students who are assigned to any of the motivational traits are less than the 6th grade students. Only 53.1% of the students had scores at the top quarter of at least one motivational trait. About 27.5 % of the students were assigned in one motivational trait, 16.0% of the students associated with the two particular motivational traits, 7.8 % of the students were placed in three motivational traits and 1.7 % of the students were placed in four motivational traits. In addition approximately half of the students did not placed in the top quartile of the four motivational traits and they could not be placed in at least one of the motivational traits.

Table 5.
Distribution of students according to the motivational trait

Description of the Motivational Trait	Frequency	Percentage
Four major motivational traits	63	1.7
Three motivational Traits	287	7.8
Achievers + Curious + Conscientious	104	2.8
Achievers + Curious + Social	54	1.5
Achievers + Conscientious + Social	39	1.1
Curious + Conscientious + Social	90	2.4
Two motivational Traits	590	16.0
Achievers + Curious	63	1.7
Achievers + Conscientious	108	2.9
Achievers + Social	81	2.2
Curious + Conscientious	177	4.8
Curious + Social	104	2.8
Conscientious + Social	57	1.6
One motivational Traits	1013	27.5
Achievers	262	7.1
Curious	220	6.0
Conscientious	277	7.5
Social	254	6.9
No Trait	1722	46.9

Discussion and Conclusion

This study demonstrated that gender and grade level differences regarding motivational traits exist among elementary students. Concerning gender difference, compared to boys, girls appeared to be more curious, conscientious, and social with a higher level of need for achievement in science. These results shares similarities with the results of the study held by Kempa and Diaz (1990).Using the Motivational Patterns Questionnaire, the authors found that there was a statistically significant mean difference between girls and boys in conscientious students dimension in favor of girls. However, boys were found to be more achievement oriented than the girls. Additionally, Trumper (1995) demonstrated that compared to girls, boys can be categorised as achievers in junior high school. However, this gender gap found to reduce as grade level increases. Generally, girls reported to be more conscientious while boys tended to be more curiosity-oriented in their motivation across grade level. Girls and boys were found to be sociable throughout all grade levels. However, no significant gender difference were demonstrated regarding motivational traits at grade 10. According to Kempa and Diaz, the reason why girls appear to be exhibit more conscientious trait is that they are less competitive and more cooperative in their characteristics.

Moreover, in the present study, it was found that as grade level increased, students' motivational patterns became less positive. This finding is parallel to the findings in the literature (Güngören, 2009; Lepper, Corpus and Iyengar, 2005; Neber, He, Liu, & Schofield 2008, Otis et al., 2005; Şenler & Sungur, 2009). For example, Otis et al. (2005) found a gradual decrease in student motivation as the grade level increases. The authors attributed this result to an increased student' interests on nonacademic activities like social activities and sports rather than academic activities. Similarly, Güngoren's (2009) study revealed that as grade level increases, elementary students' motivation in science becomes less favorable. Additionally, Lepper et al. (2005) found that student motivation decreased from third grade through eighth grade. Accordingly, the youngest students had a higher level of intrinsic motivation, while the oldest students had a lower level of intrinsic motivation. The authors suggested that this finding can be explained by increased school control and reduced student autonomy over the learning and to the shift from task focused vision to the performance focused vision. In addition to the abovementioned reasons, in the present study, the results concerning the decrease in student motivation across grade levels can be explained by the pressure exerted by the nationwide examination on 8 graders especially when they are close-by the High School Entrance Examination.

Another finding of the current study was that mixed motivational traits were observed in elementary students. Therefore, it was not possible to assign students to one specific motivational trait. Distribution of the students in motivational traits in this study is quite similar to the distribution of the students in Kempa and Diaz (1990) and Trumper's (1995) studies. Kempa and Diaz, for example, reported that 43% of the students had scores at the top quarter of at least one motivational trait, 34% of the students placed in only one motivational trait, 7% of the students showed two motivational traits and 2 % of the students showed three motivational traits. Besides, Trumper (1995) found that 77% of the students had scores at the top quarter of at least one motivational trait, 48% of the students placed in only one motivational trait and 29% of the students show two motivational traits and 15 % of the students showed three motivational traits. In current study the percentage of the students placed in one or more motivational traits was 46.9%. About 27.5%, of the students were placed in two motivational traits and 16.0% of the students placed in two motivational traits and 7.8% of the students were placed in three motivational traits. While there is no data related to the students assigned into four motivational traits in Kempa and Diaz study while in Trumper's study 8% of the students were assigned into four motivational traits. In current study 1.7% of the students had the highest score at four motivational traits. To sum up, motivation as one of the major factors that affect the student achievement is highly affected by the gender and the grade level. This study suggests that gender has a significant effect on students' motivation in favor of females. It is also found that as the grade level increases the motivational characteristics of the students' decreases.

In line with the aforementioned findings, this study will be a guide for curriculum developers and the teachers who want their students to be successful in their courses. If education system is planned to be student centered then the beliefs and the motivation of the students and the factors that affect their motivation should be considered. Teaching strategies developed according to the students' motivational patterns will provide long time retention of knowledge in science classes. A match between the learner characteristics and teaching method will increase the efficiency of both teaching and learning processes. If this matching is not provided then some learning difficulties will arise among the students. The teaching procedures should be parallel to the students' aims, goals, motivation and the other factors that affect their learning. As the needs of the students changes the curricula about the education also changes. Accordingly, it is suggested that science teachers implement student-centered instructional strategies addressing the students' developmental needs. These may include cooperative learning strategies, discussion, and hands-on activities which have potential to prevent negative changes in students' motivation and promote better science learning.

In addition, although new science and technology curriculum emphasizes use of alternative assessment techniques, use of classical paper-and-pencil type exams in science classes is still over-emphasized and lessons and nation-wide examinations have dominant roles in students' academic life. Since competitive academic life has detrimental effect on students' motivation, science teachers should give more emphasis on implementation of alternative assessment techniques which help students' realize their own progress. Moreover, science teachers should help students value science by giving them opportunuity to realize the real life applications of what they learn in science classes.

Overall, to make the science education more effective not only the teachers, but also the curriculum developers should be aware of students' educational goals and their motivational trait. We hope this study will contribute to studies in the literature related to the motivational component of teaching and learning.

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