A CROSS AGE STUDY OF ELEMENTARY STUDENTS' MOTIVATION TOWARDS SCIENCE LEARNING[*]

ÖĞRENCİLERİN FEN ÖĞRENİMİNE YÖNELİK MOTİVASYONLARININ İNCELENMESİ: KARŞILAŞTIRMALI BİR ÇALIŞMA

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ABSTRACT: The purpose of this study was to investigate the effect of grade level and gender on elementary school students' motivation towards science learning. A total of 2231 sixth and eight grade students participated in the study. Data were collected through Students' Motivation towards Science Learning Questionnaire. Two-way Multivariate Analysis of Variance (MANOVA) was conducted to examine the effects of grade level and gender on student motivation (i.e. self efficacy, science learning value, achievement goal and performance goal), active learning strategy use, and learning environment stimulation perceptions. Two-way MANOVA results showed that grade level and gender had a significant effect on the collective dependent variables. Follow-up pairwise comparison indicated that there was a significant difference between 6th and 8th grade students' motivation towards science learning regarding mean scores on each motivational variable. In addition, mean scores on each motivational variable, except leaning environment stimulation, were significantly different for boys and girls, in favors of girls. Results demonstrated that students' motivation towards science learning declined as the grade level increased and girls had a higher motivation towards science learning than boys.

Keywords: motivation, learning strategies, learning environment, grade level, gender

ÖZET: Bu çalışmada sınıf düzeyi ve cinsiyetin ilköğretim öğrencilerinin fen öğrenimine yönelik motivasyonlarına (öz yeterlik algısı, fen öğrenimine değer verme, başarı hedefleri, performans hedefleri), aktif öğrenme stratejileri kullanımına ve öğrenme ortamını algılayışlarına olan etkisi incelenmiştir. Çalışmaya 2231 altıncı ve sekizinci sınıf öğrencisi katılmıştır. Veriler, Öğrencilerin Fen Öğrenimine Yönelik Motivasyonu Ölçeği ile toplanmıştır. Sınıf düzeyi ve cinsiyetin değişkenler üzerindeki etkisi iki-yönlü çoklu varyans analizi kullanılarak test edilmiştir. Analiz sonucunda, sınıf düzeyinin ve cinsiyetin öğrencilerin fen öğrenimine yönelik motivasyonları üzerinde anlamlı düzeyde etkisi olduğu belirlenmiştir. Altıncı sınıf ve sekizinci sınıf öğrencilerinin fen öğrenimine yönelik motivasyonlarının altıncı sınıf öğrencileri lehine anlamlı düzeyde farklılık gösterdiği saptanmıştır. Ayrıca, kız ve erkek öğrencilerin fen öğrenimine yönelik motivasyonları öğrenme ortamı etkisi dışındaki bütün değişkenler açısından anlamlı düzeyde farklılık göstermiştir. Bu çalışmada öğrencilerin fen öğrenimine yönelik motivasyonlarının sınıf düzeyi arttıkça azaldığı ve kız öğrencilerin fen öğrenmeye yönelik motivasyonlarının erkek öğrencilerden daha yüksek olduğu belirlenmiştir.

Anahtar sözcükler: motivasyon, öğrenme stratejileri, öğrenme ortamı, sınıf düzeyi, cinsiyet.

1.INTRODUCTION

Motivation towards learning continues to be an active field of educational research with a growing interest and attention owing to its relation to positive educational outcomes. Research in this area particularly underlines the fact that education should involve motivational aspects as well as cognitive aspects since students' cognitive processing is not isolated from the motivational factors (Anderman & Young, 1994; Tuan, Chin & Shieh 2005). From a constructivist perspective, learning is an active process that each student are required to construct own knowledge in response to environmental stimulation. Construction of knowledge, however, requires effort of learners, which in turn, requires motivation in order to initiate the effort and conserve it during the learning process (Palmer, 2005). The research emphasizing the importance of integrating learning and cognition with motivation found that motivation has an important role in students' achievement, cognitive engagements and conceptual change process (e.g., Wigfield & Wentzel, 2007). In fact, the motivational factors have been found to have a critical role in determining students' future trajectories since students' prior success and attitudes towards science are thought to have an influence on choices

and decisions related with their future plans (Singh, Granville, & Dika, 2002). Generally, students experience a decrease in their motivation towards learning that directly or indirectly affect their achievement related outcomes across the grade levels (Anderman & Midgley, 1997; Azizoğlu & Çetin, 2009; Güngören, 2009; Hacıeminoğlu, Yılmaz-Tüzün, & Ertepınar, 2009; Özkan, Sungur, Tekkaya, & Geban, 2004; Şenler & Sungur, 2009; Urdan & Midgley, 2003;Yavuz, 2006). Research evidence showed that students' task (achievement) goal orientation (Anderman & Anderman, 1999), self efficacy beliefs (Urdan & Midgley, 2003; Anderman & Migdley, 1997), and value beliefs gradually decrease across the school years. Thus, a comprehensive investigation of changes in student motivation in early ages can have a crucial role to change the situation in favor of students, because students' negative beliefs and attitudes towards learning can be more difficult to be changed in older ages (Patrick, Mantzicopoulos, Samarapungavan, & French, 2008). The other issue that attracted attention for a long time in many motivation research is gender. Its role in the formation of motivational beliefs continues to be investigated. Boys and girls were found to differ in many motivational beliefs such as self efficacy beliefs (Pajares 1996; Britney & Pajares, 2001, 2006), attributional beliefs (Meece, Glienke, & Burg, 2006), value beliefs (DeBacker & Nelson, 1999), goal orientation beliefs (Anderman & Young 1994; DeBacker & Nelson, 1999, 2000), use of learning strategies (Meece & Jones, 1996). Each of them have crucial role in achievement. Concerning stereotypical images, girls and boys develop different attitudes and interests within science domains; girls are relatively more interested in biological sciences and social sciences whereas boys are relatively more interested in physical sciences (Jones, Howe, & Rua 2000). The examination of gender effect on motivation towards learning, therefore, can be enlightening to construct a clear understanding in order to cope with this issue.

The current research study aimed at exploring the students' motivation towards science learning in relation to grade level and gender. In recent years, Turkish Ministry of Education changed its educational philosophy based on more constructivist perspective and accordingly the elementary school curriculum was redesigned. Thereby, there is a transition from teacher-centered instruction to student-centered instruction in which students are required to construct their own knowledge. However, in order to raise active learner students who have the ability to construct own knowledge and in order to enhance science education, the variables that can be thought to have an effect on student science learning should be investigated more deeply. Although the motivational factors as well as cognitive factors start to become an important field of research in Turkey, there is a need for more research to completely understand the associations between motivation and science learning. As in the present study, examinations of group differences such as grade level and gender differences in motivation towards science learning are also important to give insight into the motivation research in Turkey as well as abroad. Specifically, elementary school years are considered to be a critical period for students in their formation of motivational beliefs towards science learning and revealing their interest in science. In these years, students become more realistic about evaluating their attitudes and abilities. So, in case of negative belief formation in elementary school years, it can be more difficult to change these beliefs in a positive way in high school years. Hence, investigation of changes, particularly a decline, in motivation in these ages has a critical importance to deal with this situation not to be too late since students enter high school with some decision about choosing or not choosing science domain as a first step to their career. Moreover, girls and boys develop different attitudes and interests within science domains; girls are relatively more interested in biological sciences and social sciences whereas boys are relatively more interested in physical sciences (Jones et al., 2000). Therefore, the examination of gender difference in motivation towards science learning can be enlightening to construct a clear understanding in order to cope with this issue.

2.METHOD

2.1. Participants

A total of 2231 students (1093 girls, 1121 boys, 17, students did not provide their gender) across the grade level participated in the study. Of 2231, 1164 were attending 6th grade (52.2 %) and 1055 students were attending 8th grade level (47.3 %). Twelve students did not report their grade level.

2.2 Instrument

Students' Motivation towards Science Learning Questionnaire, SMTSL, developed by Tuan, Chin and Shieh (2005), was used to assess students' motivation towards science learning. The SMTSL was translated and adapted into Turkish by Başer (2007). It is a five- point Likert- type scale consisting of six motivational subscales. These subscales were; Self-Efficacy (SE, 6 items, α=0.66), Active Learning Strategies (ALS, 8 items, α=0.87), Science Learning Value (SLV, 5 items, α=0.70), Performance Goal (PG, 3 items, α=0.67), Achievement Goal (AG, 5 items, α=0.70), and Learning Environment Stimulation (LES, 6 items, α=0.78). Items on the scales are ranging from "1=strongly disagree" to "5= strongly agree".

3. RESULTS

3.1. Descriptive Statistics

Means and standard deviations for gender and grade level with regard to six motivational variables were given in Table 1. This table indicated that sixth grade students had higher mean scores than eight grade students except performance goal. Also, 6th and 8th grades girls had higher mean scores than boys on each motivational variable. Mean scores for whole sample were above the scales' midpoints indicating quite high levels of motivation towards science learning.

Table 1: Descriptive Statistics by Grade Level and Gender

	6th grade level				8th grade level			
	Boys (N=593)		Girls (N=551)		Boys (N=510)		Girls (N=525)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
SE	3.58	0.84	3.85	0.83	3.44	0.76	3.61	0.76
ALS	4.00	0.80	4.18	0.75	3.64	0.74	3.85	0.69
LES.	4.01	0.82	4.06	0.75	3.50	0.82	3.60	0.74
SLV	3.98	0.82	4.02	0.77	3.66	0.84	3.88	0.68
AG	3.93	0.85	4.00	0.86	3.77	0.79	3.95	0.77
PG	2.62	0.17	2.76	1.18	2.75	0.93	2.96	0.94

A two- way multivariate analysis of variance was computed to explore the effects of gender and grade level on students' motivation towards science learning. The results showed a statistically significant grade level effect (Pillai's Trace=0.11, $F(6, 2170) = 45.43$, $p=0.00$, $\eta^2 = 0.11$) and gender effect (Pillai's Trace=0.04, $F(6, 2170)=14.85$, $p=0.000$, $\eta^2 = 0.039$) on the combined dependent variables. It was also found that there was a statistically significant interaction effect between grade level and gender on the combined dependent variables, Pillai's Trace=0.01, $F(6, 2170)=4.00$, $p=0.001$, $\eta^2 = 0.011$.

Follow-up pair wise analysis was used to determine on which dependent variables there was a gender and grade level difference, and also on which dependent variables there was an interaction effect. Significant differences were assessed at the 0.008 level of significance by using Bonferroni adjustment to reduce the change of a Type 1 one error. The significance level of 0.008 was calculated by dividing the original alpha level of 0.05 by the number of dependent variables in the study (0.05/6=0.008) (Pallant, 2001). Follow-up pair wise analysis overall revealed statistically significant mean difference on the dependent variables by grade level and by gender separately. Furthermore, there was a grade level by gender interaction (or vice versa) effect only for science learning value (SLV), $F(1, 2175)=7.19$, $p<0.008$, $\eta^2 = 0.003$. This interaction effect indicated that girls in sixth grade level had the highest science value scores than any other group. For the other motivational variables except SLV, no interaction effect by grade level by gender was found.

A statistically significant mean difference was found between 6th grade students and 8th grade students regarding self efficacy, $F(1, 2175)=30.06$, $p=0.000$, $\eta^2 =0.014$. The mean scores indicated that students in 6th grade reported slightly higher levels of self efficacy (*M*= 3.71, *SD*=0.84) than students

in 8th grade level (M= 3.53, SD=0.76). That is, compared to 8th grades, 6th grade students were more likely to develop stronger beliefs about their ability to perform science learning tasks successfully. Also, there was statistically significant mean difference between girls and boys on their self efficacy, $F(1.2175)$=39.71, p<0.008, η^2 =0.018. An examination of mean scores revealed that girls had slightly higher scores on self efficacy (M=3.73, SD=0.80) than boys (M=3.52, SD=0.81) indicating stronger perceptions of girls about their capabilities to do the science learning tasks well and to persist in engaging in learning task when confronted with a difficulty. The result also revealed statically significant mean difference between 6th and 8th grade level students with respect to achievement goal, AG, $F(1, 2175)$=9.12, p=0.003, η^2=0.004. The mean scores of 6th grade students had a higher value (M= 3.96, SD=0.86) than 8th grade students (M= 3.86, SD=0.78) on achievement goal. The mean difference in achievement goal implied that 6th grade students more tended to engage in science learning task for their understanding and self improvement than 8th grade students. Furthermore, the results revealed statistically significant mean difference between boys and girls, $F(1, 2175)$=12.51, p=0.000, η^2=0.006. The mean scores indicated that girls reported higher means on achievement goal (M= 3.98, SD=0.82) than did boys (M= 3.86, SD=0.83) which means that girls were more likely to participate in science leaning activities in order to gain greater understanding and improvement than boys were. Therefore, the overall result on achievement goal pointed out small grade level and gender differences in which girls were appeared to adopt more achievement goal than boys did and 6th grade students possessed higher level of achievement goal than 8th graders did. There was a statistically significant grade level effect on performance goal, PG, $F(1, 2175)$=11.90, p=0.001, η^2=0.005. Performance goal was the only motivational variable that showed an increase from 6th to 8th grade level. Eight grade students had slightly higher performance goal (M= 2.85, SD=0.94) than 6th grade students (M= 2.69, SD=1.18) representing that 8th graders' reason to participate in science learning activities seemed more to get good grades and outperform others compared to 6th grade students. Additionally, there was a gender effect on performance goal, $F(1, 2175)$=14.66, p=0.000, η^2=0.007. The girls adopted more performance goal orientation (M=2.86, SD=1.07) than did boys (M=2.68, SD=1.07). As far as gender differences in achievement goal and in performance goal were concerned, the result revealed that girls reported higher scores on both goals than boys did. Regarding active learning strategies, the findings revealed a statistically significant grade level effect, $F(1, 2175)$=115.9, p=0.000, η^2=0.051. The mean scores signified that 6th grade students reported higher level of active learning strategies (M=4.09, SD=0.78) than 8th grade students (M=3.75, SD=0.72). These findings revealed that 6th grade students appeared to be more active in their engagement in science learning process such that they attempted more to make connections between previous knowledge and newly learned information, to investigate relevant sources when encountering a difficulty during the construction of knowledge. Also, the result indicated statistically significant gender effect, $F(1, 2175)$=36.48, p=0.000, η^2=0.016 The girls reported slightly higher levels of active learning strategies (M= 4.02, SD=0.74) than boys did (M=3.83, SD=0.79). Thereby, girls can be considered to use learning strategies more which activates their thinking in order to reach meaningful understanding during the construction of science knowledge than boys did.

Science learning value was the only variable on which statistically significant interaction effect of grade level by gender (and vice versa) was found, $F(1, 2175)$=7.19, p=0.007, η^2=0.003. This interaction effect indicated that there was a significant difference in the effect of grade level on science learning value for girls and boys. That is, grade level effect depended on gender (and vice versa) with respect to science learning value. The result showed that girls in 6th grade had a higher science learning value than any other group. As far as main effects were concerned, a statistically significant grade level effect was found on science learning value, SLV, $F(1, 2175)$=47,48 p=0.000, η^2=0.021. With respect to mean scores, 6th grade students reported slightly higher levels of science learning value (M= 4.00, SD=0.80) than 8th grade students did (M= 3.77, SD=0.77). Compared to 8th graders, 6th grade students seemed to be more motivated to grasp the value of science learning through the understanding the relevancy of science with daily life, gaining problem solving ability and engaging in inquiry activities. Additionally, statistically significant gender effect was found $F(1, 2175)$=13,75 p=0.000, η^2=0.006. Girls had higher mean scores on science learning value (M= 3.95, SD=0.72) than boys (M=3.84, SD=0.84). Furthermore, the decline in science learning value as proceeding from 6th to

8th grade was high for boys as compared to girls. The result pointed out statistically significant grade level effect on learning environment stimulation, $F(1, 2175)=204,8$ $p=0.000$, $\eta^2=0.086$. The mean scores on learning environment was found to be higher for sixth grade students ($M=4.03$, $SD=0.79$) than 8th grade students ($M=3.55$, $SD=0.78$) referring a decrease in learning environment stimulation from 6th to 8th grade level. As a result, it can be said that the features of learning environment such as teacher-student interaction, student-student interaction, instructional strategies, class activities and curriculum content had a more simulative effect on 6th grade students' motivation to enhance their science learning than its effect on 8th grade students. Surprisingly, no statistically significant gender effect was identified in learning environment stimulation $F(1, 2175)=5,52$ $p>0.008$, $\eta^2=0.003$. The mean scores of girls ($M=4.03$, $SD=0.79$) and the mean scores of boys ($M=3.84$, $SD=0.78$) seemed to be closer to each other within each grade level, indicating that girls and boys did not significantly differ in their perception of learning environment regarding its simulative effect on science learning motivation.

It is necessary to mention that, the reported effect sizes ranging from 0.003 to 0.086 were considered to be small according to Cohen (1988). These results, therefore, should be interpreted with caution.

4. DISCUSSION AND CONCLUSION

The present study investigated the effects of grade level and gender on 6th and 8th grade students' motivation towards science learning i.e., self efficacy, science learning value, and goal orientations. Students' active learning strategy use and learning environment stimulation perceptions were also examined across grade levels and gender. Regarding the grade level, the findings of the study indicated that when grade level increases, students' motivation towards science learning decreases. This result is consistent with motivation research that pointed out a decrease in motivation in science and also other academic domains across the grades (Eccles et al., 1993; Güngören, 2009; Wigfield & Eccles, 1994; Neber, He, Liu, & Schofield 2008, Şenler & Sungur, 2009). For instance, Güngören's (2009) study showed a significant grade level effect on elemantary students' motivational beliefs. More specifically, 6th grade students were reported to be more self-efficacious and have more intrinsic interest in science. In addition, they were found to study science course for the reasons of learning and mastering as well as showing their abilities to others than 7th grade and 8th grade students. Results aslo indicated that 7 grade students hold more favorable motivational beliefs compared to 8 grade students. In a separate study, Şenler and Sungur (2009) found that elementary school students (Grades 4-5) had higher levels of science self-concept and task value beliefs compared to middle school students (Grades 6-8). However, working with 6th and 7th graders, Azizoğlu and Çetin (2009) reported that there was no statistically significant effect of grade level on students' motivation.

The present study also identified gender differences, although small in magnitude, in all motivational variables and active learning strategy use. For example, present study revealed statistically significant grade level differences in students' goal orientations. While 6th grade students were found to be more achievement goal oriented, 8th grade students were found to be more performance goal oriented. The results indicated that although its practical significance was small, there was a tendency from achievement goal (mastery) to performance goal as grade level increases. Compared to 6th graders, 8th grade students more focused on getting good grades, outperforming others and being perceived as smart. The result that 8th grade students adopted more performance goal than 6th grade students was not surprising considering the findings reported in the literature and the situation in Turkey. In fact, although the present study did not assess the classroom goal structure directly, the findings of the personal goal orientation give some clues about the features of classroom goal structure in 6th and 8th grade level. The findings may imply that as grade level increases, students become more concentrated on preparation for nation-wide examinations in order to get a good score. As a result, they are more likely to adopt more performance goal orientations while proceeding across grade levels. Additionally, classroom environments where grades, tests scores and competition have a dominative role in their education and for their selection to high schools can lead to the adoption of performance goals more than achievement goals. Indeed, results concerning learning environment stimulation perceptions indicated that compared to 8th grade students, 6th grade students have a greater

tendency to participate in science course. Because they had stronger perceptions of the learning environment stimulation such that the science content is exciting and dynamic, the teacher uses a variety of teaching methods, the learning environment is challenging and open to discussion, the teacher pay attention to them and does not put a lot of pressure on them. Interpretation of these features of classroom environment demonstrated that 6th grade students were more likely to view their classroom environment as more learner-centered. Consistent with the findings of the present study, Meece et al. (2003) reported school level effect on students' perception of learning environment. The authors found that middle school students perceived their environment more learner-centered than high school students did (less than 2 % of the variance). They stated that the learner-centered classroom environment matching with the developmental needs of student can have a potential to counterbalance negative changes in motivation during adolescence. Similar to this view, researchers indicated that when students believe that they are encouraged for understanding, independent thinking, peer interactions and autonomy, they become more likely to be motivated towards learning (Ryan & Patrick, 2001). Therefore, competitive nature of the educational system which becomes more apparent in 8th grade affects classroom practices fostering the teachers' and students' intentions to integrate preparation for the nationwide exams into classroom activities can be the reason for higher levels of performance goal orientation of 8th grade students. In literature, many studies also underlined the tendency from mastery to performance goal orientation as proceeding across grades. Concerning a tendency from mastery goal to performance goal, researchers suggested that the learning environment of the classroom has an influence on the formation of the personal goal orientations. They emphasized that when students perceive their classroom environment more performance oriented such as stressing more getting good grades, outperforming others, they tended to develop more performance goal whereas when they perceive the classroom goal structure more mastery oriented such as stressing learning and improvement, they were more likely to develop mastery goal (Anderman & Young 1994; Anderman & Midgley, 1997; Urdan & Midgley, 2003). As far as the gender differences in goal orientations are considered, in the present study, girls found to be more inclined than boys to adopt achievement goal and also performance goal. Compared to boys, girls focused more on learning and improving their competence in science as well as getting good grades and doing better than others. Anderman and Young's (1994) study indicated that girls adopted more learning goals (i.e. achievement goal) than boys in science course whereas boys were more ability focused (i.e. performance) than girls. In line with the present study, girls were found to be more learning focused than boys in different academic domains (Martin, 2004; Middleton & Midgley, 1997).

Besides, the present study revealed that as grade level increases, science learning value decreases. Compared to 6th grade, 8th grade students seemed to be less intensive in their perception of important features of science learning value such as finding relevancy of science with daily life, gaining problem-solving ability, experiencing inquiry activity and stimulating their own thinking and satisfying own curiosity in science. This finding was consistent with the findings reported in the literature (George, 2006; Zusho, Pintrich, Arbor, & Coppola) For example, in a longitudinal study, George pointed out changes in students' beliefs about the utility of science in Grade 7th to Grade 11th. He found that although students' beliefs about utility of science showed an increasing trend, it decreased after 10th grade. Earlier, Wigfield and Eccles (1994) identified a decrease in students' task value beliefs (usefulness and importance of the task) during the transition from 6th to 7th grade. If students know why they learn subjects, if they know the relevancy of the subjects with daily life and if they know where they would use related information, they can value the science learning much, particularly in the situation that the topics become more abstract in upper grades. So teachers should generate opportunities for students to integrate the topics with the life out of school in appropriate situations. Concerning science learning value, girls appeared to perceive the value of science better than boys did through engaging in science learning with the important value features such as problem solving, thinking, finding relevancy of topics with daily life. In the present study, although the effect size in relation to science learning value was small, the findings were promising regarding girls, because many studies reported girls as having gender stereotyped view of science as a male domain (Kahle, Parker, Rennie, & Riley 1993; Debacker & Nelson, 1999). Furthermore, the findings demonstrated a decline in students' self efficacy towards science learning as grade level increased.

Although the grade level effect was quite small explaining 1.4 % of the variance in self efficacy; 8th graders had a lower level of self efficacy than 6th graders indicating their low perceptions of capabilities to perform well in science learning tasks. The possible explanation for the decrease in self efficacy beliefs is that students can assess their capabilities in science learning more realistically as they get older (Eccles & Wigfield 2000). The classroom environment in 8th grades may also make them think they are less able in science learning because of the nature of classroom learning environment being a more competitive as a consequence of high school selection exams. Research showed a decline in students' self efficacy beliefs in science and also in different academic domains as proceeding across the grades (Anderman & Midgley, 1997; Urdan & Midgley 2003; Neber et al. 2008). Researchers stressed an important aspect of self efficacy as being sensitive to the features of learning environment and suggested the way of increasing students' self efficacy by providing them with a challenging environment in which they can accomplish the task successfully (Linnenbrink & Pintrich, 2003). The longitudinal study by Urdan and Midgley (2003) demonstrated the context-specific features of self efficacy. They found that when students perceive a decrease in mastery goal structure of the classroom, they also show a decline in self efficacy beliefs in their transition from 5th to 6th and 6th to 7th grade. Thus, educators can change the negative situations in favor of students suffering a decrease in self efficacy by generating learning environment appropriate to students' developmental needs. The current study also demonstrated that girls have stronger self efficacy beliefs compared to boys. Although the finding of present study was in line with the findings of Britner and Pajares (2001, 2006), majority of the studies found opposite results (Anderman & Young, 1994; Hassan 2008; Neber et al., 2008) Concerning girls' lower self efficacy, the researchers suggested that providing effort related attributional feedback on girls' achievements by the teachers may be a positive attempt in order to cope with the negative beliefs of girls about their capabilities. They claimed that although girls and boys do not differ in their achievement in science, girls had a lower perception of abilities not because of having low aptitudes, because of having stereotypical perceptions of science as a male domain.

When the effect of grade level on students' active learning strategies are considered, the findings pointed out that as grade level increases, use of active learning strategies decreases. Grade level accounted for the 5.1 % of the variance in active learning strategies. Compared to 8th grade students, 6th grade students possessed higher level of active learning strategies such that they were more likely to make connections between previous and new learning, they tended to discuss the topic with teachers and students in the case of difficulty during their construction of knowledge, they have a more attempt to find relevant sources to clarify their understanding. The decrease in active learning strategy use may be attributed to many factors such as teacher instructional strategies, classroom goal structures, students' adoption of different personal goals, and their self efficacy beliefs. For instance, if teachers' autonomy is high as Hanrahan (1998) mentioned, and if the instructional strategies are not appropriate to create a challenging environment such as lecture format instruction, students may not expected to think actively during the learning process. Also, if students pursue performance goal in science, they are more likely to use superficial learning strategies such as memorization to reach their aims with a minimal effort. On the contrary, if they pursue mastery goal, they tended to use deep learning strategies to reach meaningful learning since such students have a desire to increase competence and improve self (Lee & Brophy, 1996). Girls, in the present study, reported stronger active learning strategies use than did boys. Therefore, girls were more vigorous to apply active learning strategies during engagement in science learning activities such that they exert more effort to link the new and previous understanding, to seek to way of understanding in face of unclear and conflicting situations (Meece & Jones, 1996; Neber et al., 2008). For example, in Neber et al.'s study boys found to display more use of superficial learning strategies than girls during physics learning. In Turkey, Başer (2007) indicated that boys focus on more rote learning strategies such as memorization and they reported lower level of the use of active learning strategies than girls in biology learning. On the other hand, Şenler and Sungur's (2009) study revealed no gender difference with respect to motivational beliefs. Similarly, Azizoğlu and Çetin (2009) found that there was no gender difference on 6th and 7th grade students' motivation.

5. IMPLICATIONS

There can be many implications derived from this study that need great considerations from educators. The present study found moderate grade level effect on learning environment stimulation. In fact, research evidence suggested that motivational decline can be linked to the features of classroom learning environment. Therefore, students' motivation towards science learning can be changed in desired direction by creating appropriate classroom learning environment. More specifically, student-centered instructional strategies that address the students' developmental needs such as using cooperative learning strategies, discussion, and hands-on activities can be beneficial for preventing negative changes in students' motivation and encouraging them for science learning. Also, teachers may emphasize the importance of learning, understanding, improving competence rather than comparing students' abilities, stressing grades. What is more, even there has been an effort to bring alternative assessment techniques such as portfolio, performance work, project work in schools, classical exams in lessons and nation-wide examinations still have dominant role in determining students' achievement in schools and also enrollment in high schools in Turkey. Educators should rearrange the role of alternative assessment techniques in determining students' achievement during schooling. Otherwise, it is usual to identify shifts from learning-focused students to performance-focused students. Furthermore, the relevancy of science to daily life is a strong feature of science in order to motivate students more. This feature of science should be strongly emphasized in every opportunity by the science teachers to make the students be aware of the importance of science and science learning in their life. When students value the science learning and understand the utility of science, they can be more likely to pursue science courses in high schools and to choose science related careers for their university education as the literature indicated. Furthermore**,** this study found small gender differences in students' motivation towards science learning in favor of girls, but the existing differences may not remain the same in proceeding years. Educators should try to maintain and also increase the positive beliefs of girls much, because the gender stereotypic image of science as a masculine domain is a widespread belief that may have more influences on girls' motivation in science than boys. From this point of view, teachers and parents should also approach girls' science learning free from such a stereotypic belief of science as a masculine domain.

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Geniş Özet

Son yıllarda eğitim ve psikoloji alanlarında yapılan çalışmalar, hem bilişsel faktörlerin hem de motivasyona yönelik faktörlerin öğrenci başarısında son derece önemli olduğunu ortaya koymuştur

(Anderman ve Young, 1994; Pintrich, Marx ve Boyle, 1993; Tuan, Chin ve Shieh 2005). Özellikle fen bilimleri gibi öğrencilerin bilişsel anlamda güçlükler yaşadığı alanlarda, motivasyon anlamlı öğrenmenin gerçekleşmesine önemli katkı sağlamaktadır. İlgili çalışmaların sonuçlarına göre öğrencilerin hedef yönelimleri, derse verdikleri değer, beklentileri, ihtiyaçları, kaygıları, öz-yeterlik algıları, öğrenciden öğrenciye değişiklik göstermekte ve öğrenmeyi oldukça etkilemektedir. Örneğin, Bandura'ya göre (1986) kişilerin beceri, yetenek ve bilgilerinin yanında, inaçlarının da (öz-yeterlik inancı) başarılarını ve davranışlarını belirlemede önemli bir etkisi vardır ve kişilerin özyeterlik inançları duruma ve alana göre değişkenlik göstermektedir. Buna bağlı olarak, bir öğrencinin öz yeterliliği fen ve matematik gibi alanlarda düşük, sosyal alanda yüksek olabilmektedir. Yapılan araştırmalar, öz-yeterliği yüksek olan öğrencilerin öğrenme sürecinde daha fazla çaba gösterdiği ve bu çabaların uzun sürdüğünü göstermektedir. Ayrıca, bu öğrencilerin derslerinde daha başarılı oldukları gözlemlenmiştir. Bu algının olumsuz olduğu durumlarda ise başarısızlık oranının ve kaygısının arttığı saptanmıştır (Bandura, 1977, 1994). Benzer bir şekilde, son yıllarda yapılan pek çok çalışma öğrencilerin hedef yönelimleri, akademik başarıları ve kullandıkları öğrenme stratejileri arasında anlamlı bir ilişki olduğunu ortaya koymaktadır. Performansa yönelik hedefleri olan öğrenci kendini diğerleriyle kıyaslar ve onlardan daha başarılı, daha zeki olduğunu kanıtlamak veya en başarısız olmamak için çalışır. Başarıya (öğrenmeye) yönelik hedefleri olan öğrenci akademik zorluklardan kaçınmazken, performansa yönelik hedefleri olan öğrenci kendilerini gösterebilecekleri kolay çalışmaları tercih ederler (Pintrich, 2000; Pintrich ve Schunk, 2002). Ancak, ilgili çalışmalar sınıf düzeyi ve cinsiyetin öğrencilerin motivasyonlarını etkilediğine ve sınıf düzeyi artıkça öğrenci motivasyounda bir azalma olduğuna dikkat çekmektedir. Cinsiyetin motivasyon üzerindeki etkisini inceleyen çalışmalar ise, kızlar ve erkekler arasında farklıklar olabildiğini ortaya koymuştur (örn, Pajares 1996; Britney ve Pajares, 2001). Bu araştırmada sınıf düzeyi ve cinsiyetin ilköğretim öğrencilerinin fen öğrenimine yönelik motivasyonlarına (öz yeterlik, fen öğrenimine değer verme, başarı hedefleri, performans hedefleri), aktif öğrenme stratejileri kullanımına ve öğrenme ortamını algılayışlarına olan etkisi incelenmiştir. Çalışmaya 2231 (1121 erkek, 1093 kız) altıncı (n = 1164) ve sekizinci (n = 1055) sınıf öğrencisi katılmıştır. Veri toplama aracı olarak, Tuan, Chin ve Shieh (2005) tarafından geliştirilen ve Başer (2007) tarafından Türkçe'ye adapte edilen Öğrencilerin Fen Öğrenimine Yönelik Motivasyonu Ölçeği kullanılmıştır. Ölçek, öğrencilerin öz-yeterlik algısı, fen öğrenimine verdikleri değer, başarı hedefleri, performans hedefleri, kullandıkları öğrenme stratejileri ve sınıf ortamını nasıl algıladıklarını ölçmeye yönelik olan toplam altı alt-boyuttan oluşmaktadır. Sınıf düzeyi ve cinsiyetin adı geçen değişkenler üzerindeki etkisinin incelenmesi için, varsayımları kontrol edildiktern sonra, iki-yönlü çoklu varyans analizi (MANOVA) kullanılmıştır. Analiz sonucunda, sınıf düzeyinin (Pillai's Trace=0.11, $F(6, 2170) = 45.43$, $p=0.00$, $\eta^2 = 0.11$) ve cinsiyetin (Pillai's Trace =0.04, $F(6, 2170)=14.85$, $p=0.000$, $\eta^2 = 0.039$) öğrencilerin fen öğrenimine yönelik motivasyonları üzerinde anlamlı düzeyde etkisi olduğu belirlenmiştir. Altıncı sınıf öğrencilerinin öz-yeterlik algısı, başarıya (öğrenmeye) yönelik hedefleri, fen dersine verdikleri değer sekizinci sınıf öğrencilerine göre daha yüksek seviyelerde bulunmuştur. Ayrıca altıncı sınıf öğrencilerinin anlamlı öğrenmeyle sonuçlanan öğrenme stratejilerini daha üst seviyelerde kullandıkları ve sınıf ortamını çok daha eğlenceli ve öğrenci katılımına yönelik olarak algıladıklarını ortaya koymuştur. Diğer taraftan, altıncı sınıf öğrencilerinin yeteneklerini başkalarına göstermek, en iyi öğrenci olmak ve en iyi notu almak gibi hedef yönelimlerinin sekizinci sınıf öğrencilerine göre daha düşük seviyede olduğu bulunmuştur. İlgili literatürle uyumlu olarak (Eccles ve ark., 1993; Güngören, 2009; Wigfield ve Eccles, 1994; Neber, He, Liu, ve Schofield 2008, Şenler ve Sungur, 2009), bu sonuçlar genel olarak sınıf düzeyi arttıkça öğrencilerin motivasyonlarında bir düşüş olduğunu göstermektedir. Ayrıca, öğrenci motivasyonu ve fen derslerinde kullanılan öğrenme stratejileri açısından kızlar ve erkekler arasında da fark olduğu ve kızların fen derslerindeki motivasyonlarının erkeklere göre daha yüksek olduğu bulunmuştur. Cinsiyet ve sınıf düzeyi arasında fen derslerine verilen değer haricinde ($F(1, 2175) = 7.19$, $p<0.008$, $\eta^2 = 0.003$), hiçbir değişken için anlamlı bir etkileşim bulunmamıştır. Öğrencilerin fen derslerine verdikleri değere yönelik etkileşim gözönüne alındığında, altıncı sınıfa devam eden kız öğrencilerin diğer öğrencilere göre fen derslerine daha fazla değer verdikleri ve fen derslerini daha fazla önemsedikleri ortaya konmuştur. Bu çalışmanın sonuçları fen derslerindeki sınıf içi etkinliklerin öğrenci motivasyonunu arttırmaya yönelik olarak gözden geçirilmesi gerekliliğini ortaya koymaktadır.

Yapılan pek çok araştırma öğrencilerin sınıf ortamını nasıl algıladıklarının motivasyonları üzerinde önemli bir etkisi olduğunu göstermiştir. Bu nedenle öğrencilerin derste gördükleri konular ve günlük hayatları arasında bağlantıyı kurabildikleri, kendi gelişimlerini gözlemleyebildikleri ve arkadaşlarıyla birlikte çalışabildikleri etkinliklerin yer aldığı öğrenci merkezli sınıf ortamlarının oluşturulmasına ihtiyaç duyulmaktadır. Bu tür sınıf ortamlarında öğrenciler arkadaşlarıyla yarışmak ve en iyi öğrenci olmak gibi hedeflerden çok arkadaşlarıyla işbirliği içersinde çalışarak öğrenmeye yönelik hedefler geliştirebilirler ve bu durum onların öz-yeterlik algısının yükselmesine katkıda bulunabilir. Ayrıca günlük hayatla bağlantının kurulduğu etkinliklere yer verilmesi öğrencilerin derslere verdikleri önemi de arttırıcı yönde bir etki yapabilir.