

The Effect of Academic Involvement and School Climate as Perceived by Gifted Students in Terms of Talent, Creativity, and Motivation in Science¹

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Abstract When drawing up the educational conditions offered to gifted students, it is important to be aware of their characteristics and to reveal the variables affecting their learning processes. Even though there are institutions in many countries that provide services for gifted individuals, there are relatively few studies on how students assess the climate in these institutions and how the institutional climate influences the learning process. Therefore, we investigated the influence of motivation, talent, and creativity levels of students attending Science and Arts Centers, an educational institution in Turkey for gifted students, regarding science classes, the role of academic involvement and parent and teacher support, and the school climate as perceived by students. In this context, 997 gifted students selected through stratified sampling provided the data for the study. When parental and teacher support and school climate perceived by gifted students are considered together, this significantly predicts the students' motivation toward science, their levels of scientific creativity, and science talents. The findings of this study were examined considering the current literature, and the limitations of the study and suggestions for future research are presented.

Keywords Gifted, Parental Involvement, School Climate, Talent, Creativity, Motivation

1. Introduction

Scientific developments are the products of hard efforts made by groups of scientists in various fields of science. As science progresses rapidly in the ever-changing world, the methods used by scientists in keeping up with this change, the motivation of the school-age children who will become scientists in the future and their potential for success in science attract the attention of educational

researchers. Outstanding success in science is a result of a complex process influenced by psychological, social, and contextual factors [1]. We see that the individuals who have the potential to display outstanding achievement in the field of science are called "the gifted in science" in the literature [2, 3].

Heller [4] defined being gifted in science as a special talent for the potential of scientific thinking and outstanding skills in natural sciences. According to Taber [3], the traits that characterize the gifted in science are curiosity, higher cognitive skills, and meta-cognitive maturity. Yager [5], however, presented the indicators of being gifted in science as follows:

- Strong interest in objects and the environment
- High interest in researching scientific phenomena
- The tendency to make observations and ask questions
- Ability to establish relationships between the phenomena observed and scientific concepts
- Outstanding talent in presenting creative and up-to-date statements
- High interest in collecting, separating, and classifying objects.

It is widely accepted by many researchers that talent is a developmental feature [6]. In addition, many studies have shown that cognitive skills, emotional skills, personality traits, and educational opportunities are influential in the development of science competence [4,7,8,9]. When opportunities and supports are not offered, skills may develop more slowly or the student may suffer from such a lack [10]. Outstanding talent is not a guarantee of success, and there are many factors involved in this process [11].

School and family are important variables in the development of talent. Family and school experiences are influential in the development of children's motivation toward their classes and sustaining it throughout the school life. Epstein [12] found that the level of education

increased when strong links were established between home and school. In science, outstanding performance is seen to be positively affected by parental academic involvement and supportive parenting approaches [13-16]. Albert [17] determined that those with outstanding achievements in science come from families with well-adjusted, easy-going, and compromising members. Cho and Campbell [18] showed that the gifted in science are more often and more strongly influenced by family processes at an early age and that their families continue to support and assist them also during high school.

It is important to develop the field-specific skills and motivations of the gifted in an educational setting because one of the main reasons for the failure of gifted students is the lack of motivation [19]. Many teachers assume that gifted students are more motivated than moderately successful students [20], but this is not always the case [7]. With gifted learners, it is essential to create a learning environment in which risk taking is tolerated, opinions are valued and supported, and freedom, creativity, and autonomy are adopted as a principle [21]. Academic achievement and all developments in the learning process depend on the harmony between the individual's abilities and the learning environment [22]. They need content with a suitable difficulty level, considering their level of talent, to avoid such problems [23].

There is a variety of educational institutions dedicated to gifted learners. These institutions aim to offer educational opportunities specific to the individual differences of students through different strategies such as enrichment and accelerating. In the Turkish context, these institutions are named Science and Arts Centers, and they admit students based on various diagnostic criteria (e.g., IQ coefficient, teacher evaluations, and skill points). In these institutions, gifted learners are grouped according to their skill areas and study from grade 2 until grade 12. Just like every other institution, these institutions have a number of distinctive characteristics, an "institutional identity" in a sense, that distinguish them from other institutions [24]. This institutional identity is named the school climate in educational literature. The school climate is generally defined based on people's experiences with school life, as a general structure that involved the norms, goals, values, interpersonal relations, teaching-learning process, and organizational structures [25]. Inter-individual relations, the nature of the learning-teaching process that takes place in this process, and the physical, social, and emotional security of the students take part in the school climate [26]. Positive school climate leads to increased student involvement and loyalty to the school, increased motivation, increased success, and a decrease in undesirable behaviors [27-29]. In addition, the social environment in the classroom and the positive relationships within the classroom are influential in the development of positive attitudes toward schools and classes [30]. Science teachers can also help students grow up as talented young

scientists by appropriately identifying gifted students and providing new points of interest and positive learning experiences [31].

An investigation of some environmental factors that affect the talent, creativity, and motivation in science class will be a guide for the steps to be taken. The education of students with high potentials in science is important both for the individual development of the child and for the economic development of the countries through advancements in science and technology.

This study aims to examine the link between the perceptions of parental and teacher academic involvement and school climate and the levels of talent and motivation. The research questions under focus were as follows:

1. Do perceived school climate and perceived parental and teacher academic involvement significantly predict motivation toward science?
2. Do perceived school climate and perceived parental and teacher involvement significantly predict science talent?
3. Do perceived school climate and perceived parental and teacher involvement significantly predict scientific creativity?

2. Materials and Methods

2.1. Research Design

This study aims to reveal the relationship between factors such as the academic involvement of parents and teacher and school climate, as perceived by gifted students, and their motivation for learning science, creativity, and talent in science. Relational screening model was used since the study required an investigation of relationships between the variables without creating an effect in order to change the current situation.

2.2. Sample

The research sample consisted of 997 students who were previously identified as gifted in the mental field and selected through stratified sampling method. Of all the forms collected, 52 forms were excluded from the sample because they were mostly unfilled. For the analysis of the data, univariate normality and multivariable normality conditions were examined and extreme values were excluded from the data set. Data from 698 students were included in the analysis.

2.3. Data Collection Tools

Science Ability Test, Scientific Creativity Test, School Climate Scale, Perceived Parental and Teacher Academic Involvement Scale, and Science Learning Motivation Scale were used to collect data.

2.3.1. Science Ability Test

This is a test developed by Akkanat and Gökdere [32] to reveal the achievement levels of students in employing scientific logic and scientific process skills that may be indicative of the science talent in students. This test consists of 21 multiple-choice items. The internal consistency coefficient of the test (KR 20) was found to be .85. CFA analyses confirmed the model and that the scale has a single factor with good fit indices ($\chi^2 = 721.29$ ($df=188$, $p<.001$), $(\chi^2/df) = 3.83$, $GFI=.91$, $RMSEA=.06$, $CFI=.89$ and $AGFI= .89$). The internal consistency coefficient (KR20) for this administration was found to be .737.

2.3.2. Scientific Creativity Test

Scientific Creativity Scale, developed by Hu and Adey [33] and adapted to the Turkish context by Deniz-Çeliker and Balım [34], was used to measure the scientific creativity of students. The CFA analysis of the one-factor scale indicates an acceptable fit. ($\chi^2 = 62.08$ ($df=14$, $p<.001$), $(\chi^2/df) = 4.42$, $GFI=.98$, $RMSEA=.07$, $CFI=.96$ and $AGFI= .95$). For this study, the Cronbach alpha internal consistency coefficient of the scale was found to be .66.

2.3.3. Students' Motivation toward Science Learning Scale

"Students' Motivation toward Science Learning Scale" developed by Tuan, Chin and Shieh [35], was used to determine the motivation of students to learn science. The validity and reliability analyzes of the scale in Turkey were made by Yılmaz and Çavaş [36]. They found the Cronbach alpha reliability coefficient as .87 in the reliability studies of the scale. In this study, the CFA and EFA analyzes were repeated for the sample of gifted learners. Factor load values ranged from .44 to .76 for the scale consisting of 33 items and 6 sub-dimensions. The total variance explained is 53.3. It can be said that the fit indices obtained confirm the model ($\chi^2 = 1439.9$ ($df=457$, $p<.001$), $(\chi^2/df) = 3.14$, $GFI=.89$, $RMSEA=.05$, $CFI=.97$ and $AGFI = .87$). The Cronbach alpha internal consistency coefficient of the scale was found to be .89.

2.3.4. School Climate Scale

School Climate Scale, developed by Çalık and Kurt [37] to reveal the perceptions of the students about the school climate, was adapted for use in Science and Arts Center, which is the institution that offers education to gifted students. The adapted form of the scale consists of 21 items and 4 sub-dimensions. Factor load values range from .46 to .78. The total variance explained is 55.05. The fit indices obtained from CFA are excellent ($\chi^2 = 621.92$ ($df=185$, $p<.001$), $(\chi^2/df) = 3.36$, $GFI=.92$, $RMSEA=.05$, $CFI=.97$ and $AGFI = .90$). The Cronbach alpha internal consistency coefficient was .88 for the scale.

2.3.5. Perceived Parental and Teacher Academic Involvement Scale

Perceived Parental and Teacher Academic Involvement Scale, developed by Régner, Loose and Dumas [38] and adapted to the Turkish context by Dünder [39], was used to determine the level of parental involvement as perceived by students. CFA and EFA analyses were conducted because the scale was used for gifted students for the first time. Factor load values vary between .56 and .86 in the model consisting of 13 items and 4 factors. The total variance explained is 73.8. The fit indices obtained as a result of CFA are at the desired level ($\chi^2 = 298.16$ ($df=59$, $p<.001$), $(\chi^2/df) = 5$, $GFI=.94$, $RMSEA=.07$, $CFI=.98$, and $AGFI = .90$). The Cronbach alpha internal consistency coefficient was found to be .90 for the scale.

2.4. Data Collection Process

First, the approval to administer the tests was granted by the Ministry of National Education. Next, after contacting the directors at Science and Arts Centers in Turkey, which offer education to the gifted students in Turkey, the data collection tools were administered to students by the researcher.

2.5. Data Analysis

Descriptive analysis and regression analysis were used in the analysis of the data. SPSS Statistics 17 software was used in the analysis of the data.

3. Findings

Firstly, descriptive statistics of data collection tools were examined. Descriptive statistics regarding the scales in this study are presented in Table 1.

Motivation levels of the students in this study were high. They had a positive school climate perception and their perceived parental and teacher involvement levels were very high. The link between students' motivation to learn science and school climate perceptions and parental and teacher academic involvement was examined by multiple regression analysis. Results related to the analysis can be seen in Table 2.

Table 1. Descriptive statistics

The scales (N=698)	Min.	Max.	M	SD
Motivation	2.55	5.00	4.07	0.51
Scientific creativity	2.00	83.00	38.45	17.06
Science ability	4.00	20.00	13.39	3.73
School climate	2.24	5.00	4.04	0.64
Perceived academic involvement	1.50	5.00	4.11	0.79

Table 2. Multiple Regression Analysis for Predicting Motivation

Model	Variable	B	Standard error	β	t	p
1	Fixed	2.34	0.12		20.26	.000
	Academic involvement	0.17	0.02	0.26	7.12	.000
	School climate	0.26	0.03	0.33	8.90	.000
$R = 0.497 \quad R^2 = 0.247$						
$F_{(2,695)} = 114.062$						

Perceived academic support and school climate had a significant relationship with motivation scores ($R = 0.497$, $R^2 = 0.247$, $p < 0.01$). These variables together account for 25% of the total variance in motivation. The model was successful in predicting motivation ($F_{(2,695)} = 114.062$, $p < 0.01$). According to the standardized regression coefficient (β), among the predictive variables, the variable which had the greatest effect on motivation was the school climate.

The relation between students' scientific creativity and school climate perceptions and parental and teacher academic involvement was examined by multiple regression analysis. Results related to the analysis can be seen in Table 3.

Table 3. Multiple Regression Analysis for Predicting Creativity

Model	Variable	B	Standard error	β	t	p
1	Fixed	17.46	4.40		3.98	.000
	Academic involvement	-0.74	0.90	-0.034	-0.83	.407
	School climate	5.94	1.09	.224	5.45	.000
$R = 0.211 \quad R^2 = 0.45$						
$F_{(2,695)} = 16.228$						

Perceived academic support and school climate had a significant relationship with scientific creativity scores ($R = 0.211$, $R^2 = 0.45$, $p < 0.01$). These variables account for 45% of the total variance in scientific creativity. The model was successful in predicting creativity ($F_{(2,695)} = 16,228$, $p < 0.01$). The standardized regression coefficient (β) showed that school climate has the most significant effect among the predictive variables. The results of a t-test on the significance of the regression coefficients showed that the effect of perceived academic involvement is not significant ($t = -0.829$, $p > 0.01$).

The link between students' scientific aptitude and school climate perceptions and parental and teacher academic involvement was examined by multiple regression analysis. Results related to the analysis can be seen in Table 4.

Table 4. Multiple Regression Analysis for Predicting Science Ability

Model	Variable	B	Standard error	β	t	p
1	Fixed	9.16	0.96		9.53	.000
	Academic involvement	-0.23	0.19	-0.05	-1.17	.243
	School climate	1.28	0.24	0.22	5.34	.000
$R=0.204 \quad R^2 = 0.042$						
$F_{(2,695)} = 15.084$						

Perceived academic support and school climate had a significant relationship with scientific aptitude scores ($R = 0.204$, $R^2 = 0.042$, $p < 0.01$). These variables account for 4% of the total variance in scientific aptitude. The model was successful in predicting motivation ($F_{(2,695)} = 15,084$, $p < 0.01$). The standardized regression coefficient (β) showed that school climate has the most significant effect among the predictive variables. The results of a t-test on the significance of the regression coefficients showed that the effect of perceived academic participation is not significant ($t = -1,168$, $p > 0.01$).

4. Discussion and Conclusions

Investigating motivation, creativity, and aptitude in learning science in the context of parental and teacher academic involvement and school climate, this study found a number of important results that will contribute to practice in this field. It was observed that the students who participated in this study had a high motivation to learn science, a positive perception of school climate, and a high level of perceived parental and teacher academic involvement.

The literature on the gifted learners indicates that they have a high motivation to learn science [40], they perceive the climate at schools that serve exclusively to them as being positive [41], and they believe they receive sufficient support from their parents and teachers [42].

According to Hennessey [43], the quality of being gifted can develop when appropriate conditions exist between the individual and the environment; intrinsic motivation and creativity thrive in situations where there are no external restrictions, so if student motivation, creativity, and special skills are to be developed, the school climate should be approached with great care (p.62). Academic involvement and school climate perceived by gifted students together have a significant relationship with motivation scores. This indicates that parents, teachers, and the school climate together influence student motivation. There are other studies that support the results of this study. Lüftenegger et al. [44] determined that successful gifted students had a higher motivation than non-successful students and that they perceived the class as a construct that focuses on learning and contains activities that are more autonomous. Al-Dhamit and Kreishan [45] found a significant relationship between parental support and internal and external motivation levels. Sakiz [46] found that perceived teacher emotional support can help students achieve positive attitudes and motivation in science classes. Anderson, Hamilton, and Hattie [47] examined the relationship between various motivational variables and school climate and found that school climate was significantly associated with involvement, interest, and task completion variables. Velayutham and Aldridge [48] touched upon the link between learning science and the psychosocial learning environment and found that it is important for student self-regulation and motivation.

There are also studies with different results regarding the effect of parents on motivation. For example, Garn, Matthews, and Jolly [49] noted that parents play an important role in shaping the academic motivation of gifted students and examined their home settings, but determined that their parents are inconsistent in providing academic motivation despite having good intentions.

The peer environment also stands out as an important factor. In fact, Nelson and DeBaker [50] investigated the relationship between achievement motivation and peer influence among science students and found that students who think that they are perceived as valuable and respectable by their peers have more adaptive achievement motivation.

Csikszentmihalyi [51] approached creativity as a consequence of the interaction with the individual's environment. Concerning education, the variables of parents, teachers, and school stand out as the environmental factors. According to Cole, Sugioka and Yamagata-Lynch [52], if education aims to prepare children for a productive life in society, the education system needs to accept responsibility for supporting and

developing creativity. In our study, it was found that academic involvement and school climate, as perceived by gifted students, were significantly correlated with scientific creativity scores. There are different studies that support these results [53, 54]. Isaksen and Akkermans [55] determined that innovative productivity increases in organizational climates that support creativity. Yi, Hu, Plucker, and McWilliams [56] found a significant relationship between creative thinking and school climate. In pedagogical learning environments that support creativity, there seems to be high expectations among students and teachers, and there are relationships that involve flexibility and mutual respect [57]. This envisages the development of creativity within positive teacher and student associations. Moreover, Liu et al. [58] found that parental academic involvement is a mediator between motivation and creative thinking among high school students and determined that together with environmental factors, individual characteristics contribute to the creative thinking of the individual in an interactive manner. Considering all of these, it can be said that environmental factors are important for the development of creativity among the gifted.

Perceived academic support and school climate were found to significantly predict scientific aptitude among gifted learners. However, this predictive power is lower than other variables. This may be due to the effects of several cognitive factors on skill level. It can be seen that this result is well supported in the literature. Fan, Williams, and Corkin [59] stated that the school environment can influence students' learning processes and school experiences through their own perceptions. Cohen, McCabe, Michelli, and Pickeral [26] indicated that school climate has supportive or complicating effects on students' learning skills. In addition to supporting the idea that positive school climate enhances the learning abilities of students, previous studies associate consistently positive school climate with positive child development, student learning and achievement [25].

Further, studies also suggest that social support is related to the level of competence; these studies support this result. For example, Rice, Barth, Guadagno, Smith, and McCallum [60] found that students with social support from parents, teachers, and peers in mathematics and science classes had higher levels of perceived competence. Gerber, Cavallo, and Marek [61] found that school and community activities in which students are actively involved have positive effects on scientific reasoning ability. Beghetto [62] pointed out that the assessments regarding science competence among secondary and high school students are related to the perceived level of support from teachers.

In conclusion, it can be said that besides the involvement of parents and teachers, the school climate, as perceived by children, also contributed significantly to the motivation, talent, and creativity levels in science classes in our study.

Similar to other studies, this study has some limitations. The involvement of parents and teachers and the school climate could only be assessed based on the dimensions in the questionnaires.

It was assumed that all students at the Science and Art Centers were recognized in a valid and reliable way, and all of them had got a score above the IQ coefficient determined by the Ministry of National Education. It is therefore appropriate that some generalizations made in this respect should be considered in the light of the context of the study. In future studies, the effects of environmental, socioeconomic, and cognitive variables on the development of science ability can be examined. Detailed examination of family, teacher, and other school-related factors will pave the way for improvements in the quality of science education offered to gifted students.

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