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ORIGINAL ARTICLE

Relationship among Socioeconomic Status, Attitude Toward Science, School Climate and Students' Science Achievement: A Cross-country Comparison of TIMSS

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ABSTRACT

Students' socioeconomic status (SES), school climate, and students' attitudes stand out as important factors that determine academic achievement. The current study investigated the relationship among SES, attitude toward science, school climate, and academic achievement comparatively in terms of countries. Trends in International Mathematics and Science Study 2019 data from Turkey, United Kingdom, and Singapore were used for comparison. The study adopted a correlation design for each comparison. The participants were eighth grade students from these three countries. The data were analyzed with Pearson product-moment correlation coefficient and hierarchical multiple regression. The Singapore sample had an auto-correlation problem, so it was not included in the regression analysis. SES explained 16.6% and attitude towards science explained 9.8% of the change in the academic achievement in the United Kingdom sample while these values were 21.9% and 14.4% for the Turkey sample, respectively. The sub-dimensions of the independent variable were also examined in the study. One the most important factors associated with students' academic achievement in Turkey is their SES. In this sense, the limitations of students in their access to home resources for learning are reflected negatively to their academic performance.

KEY WORDS: Academic achievement; attitudes; school climate; socioeconomic status; TIMSS analysis

INTRODUCTION

Large-scale assessments provide rich data from various countries regarding students' academic achievement and various factors associated with it. The Trends in International Mathematics and Science Study (TIMSS) held by International Association for the Evaluation of Educational Achievement is one of these assessments. The results may provide road maps for countries for identifying their problem-areas and coping with them to ensure academic achievement as well as other social, psychological, or emotional outputs. Hence, detailed analyses of TIMSS data may be fruitful for countries with lower achievement scores in these assessments such as Turkey. Therefore, this study set out to explore how the independent variables measured in TIMSS 2019 which were socioeconomic status (SES), attitude towards science, and school climate predicted students' academic achievement in science.

Comparing how these variables explain academic achievement in terms of countries may contribute to the understanding of problems in school to decision makers in revealing strategies for offering better educational services. Cross-country comparison studies with Turkey generally include countries with high achievement scores (Kilic and Askin, 2013; Şen and Arican, 2015; Topçu et al., 2016; Uzun et al., 2010). Turkey is a developing country, but England is a developed country. It is noteworthy that the TIMSS results of these two countries are similar. Comparing these two countries can be important. In this study, the United Kingdom was selected for comparison. The reason for this selection was that the United Kingdom had similar mean scores with Turkey in TIMSS 2019. Hence, the variables explaining academic achievement could be examined in the context of two countries with similar achievement scores. The United Kingdom is a developed country and Turkey is a developing country. However, despite the difference in developmental level, an analysis on TIMSS 2015 revealed that Turkey and the United Kingdom were among the countries where there were wide gaps between rich and poor people and the differences in students' academic performances due to SES were more overt in these countries (Caponera and Losito, 2016). Therefore, it was thought that a comparison of Turkey and the United Kingdom could offer interesting results. Singapore was added as the third country for comparison as it was the most successful country in TIMSS 2019. It is an exemplary model for other countries to attain better academic performance. Comparing these two countries with Turkey is significant for identifying the important variables affecting academic achievement. Academic achievement is an output of effective school and classroom management. The results of the current study may contribute to the practices regarding school and classroom management.

The current study investigated the relationship among SES, attitude toward science, school climate, and achievement of students comparatively in with respect to countries. The countries selected in the current study were Turkey, the United Kingdom, and Singapore. The research questions were as follows:

1. What is, if any, the significant relationship SES, attitude towards science, school climate, and science achievement have in the three countries?
2. What is, if any, the significant prediction of academic achievement by SES, attitude towards science, and school climate have in the three countries?

SES and Science Achievement

Since the Coleman Report (Coleman et al., 1966), SES has been on the agenda of the education researchers. This report unearthed the significant effect of SES on students' academic performance. Several empirical research studies and meta-analysis studies have put forth a significant relation between SES and academic achievement at varying degrees, mostly a strong one (Karadağ, 2017; Sirin, 2005; Smeding et al., 2013; Suna et al., 2020). The literature has emphasized that SES is a key variable predicting students' academic achievement; however, its level of association with academic achievement varies among countries.

Mostly measured through income, occupation, and education, SES is defined as "the social standing or class of an individual or group" (APA Dictionary of Psychology [online], 2021). Regarding students, the main indicators for measuring SES include parental income and occupation as well as parental education (Sirin, 2005). A student's SES is not only related to their family's economic capabilities, or their access to physical resources. It is also related to social factors. For instance, TIMSS 2011 results evidenced the association between academic achievement and parents' education or occupation; however, this was also about the high academic expectations of the parents with high SES from their children. TIMSS 2011 report also revealed that home resources such as reading materials at home were strongly associated with achievement (TIMSS, 2011).

There are a number of variables that can be associated with academic achievement. In a current meta-analysis study, Karadağ (2017) examined eighteen variables and reported that SES was the sole variable having a high-level effect on academic achievement. Students coming from low-SES families cannot access educational resources culminating in problems in educational attainments while students coming from high-SES families enjoy the financial and emotional support from their families (OECD, 2019). Beside access to resources, high-SES parents communicate higher academic expectations to their children (Erdem and Kaya, 2020). Despite the compromise on the effect of SES on academic achievement, the degree of this relation may vary across countries. In an analysis on TIMSS 2015 study, the effect of SES on academic achievement was once again evidenced. However, it also revealed that the differences in students' academic performances due to SES were more overt in countries with wide gaps between rich and poor people. These countries were Chile, the United Kingdom, Turkey, Israel, and Malaysia (Caponera and Losito, 2016). In Turkey, for instance, SES has significant effect on academic achievement, and its effects continue throughout the school levels, revealing the failure of schools in compensating for inequalities (Suna et al., 2020).

Attitude Toward Science and Science Achievement

Attitude is a psychological tendency of having favor or disfavor to a certain entity (Eagly and Chaiken, 1993). Attitude cannot be observed directly; however, it affects how people behave regarding the entity of issue. With respect to students, students' attitudes toward a lesson affect their attention, engagement, and achievement in that lesson. In the current study, science achievement was under investigation. Therefore, attitude toward science was selected as a predictor variable. Students' attitudes toward a lesson may be affected by their experiences in their family at the onset of the school life, later school experiences, their interactions with their peers and teachers, or specific activities at school shape their attitudes towards lessons (Afari, 2015). In TIMSS, students' attitudes toward science lessons were measured in four dimensions including whether they like science lesson or not, whether they are confident in this lesson, whether they value science and instructional quality in this lesson.

Attitude toward science has been evidenced to be associated with science achievement (Hong, 2010; Martin et al., 2008; Topçu et al., 2016). When a student values a lesson, their engagement and expected success in that lesson increases (Wigfield and Eccles, 2000). Hence, their academic achievement increases, as well. In addition to directly predicting academic achievement in science, attitude toward science also affects academic achievement through influencing school climate (Tsai and Yang, 2015). Attitudes may also be affected by SES. Parents may communicate positive or negative messages to their children about science. Therefore, attitude toward science is interrelated with SES and school climate.

School Climate and Science Achievement

School climate is the characteristics of the school affecting students, teachers, or other stakeholders in schools, and it varies from one school to another just like the personality of a person (Hoy and Miskel, 1998). It affects students' and teachers' impressions, beliefs, and expectations regarding the school (Chen and Weikart, 2008). Besides, it is the school atmosphere based on the interaction of stakeholders' behaviors, emotions, or attitudes (Cohen et al., 2009; Grazia and Molinari, 2020).

The elements constituting school climate are related to students' educational attainment, in nature. These elements can be grouped into domains of order, safety and discipline, social relations, academic outcomes, school connectedness, and school facilities (Slee and Skrzypiec, 2016; Zullig et al., 2010). Therefore, school climate affects students in various

aspects such as self-esteem or academic adjustment (Brand et al., 2003; Way et al., 2007). School climate is also among the factors that are associated with academic achievement. Several studies have evidenced this association at varying degrees (Bektas et al., 2015; Berkowitz et al., 2017; Karadağ et al., 2016; Konold et al., 2018; Scheerens et al., 2013). Feeling safe in school and inoculating teachers with high expectations from students are two aspects of school climate associated with academic achievement (Karadağ et al., 2016; Urick and Bowers, 2014). It may also affect academic achievement through influencing other factors such as school participation (Wang and Holcombe, 2010).

In TIMSS, school climate is measured with the dimensions of school belonging and bullying. School belonging affects academic achievement in various ways. School belonging is defined as "the extent to which students feel personally accepted, respected, included, and supported by others in the school social environment" (Goodenow and Grady, 1993, pp. 60). School belonging is associated with school engagement and other related factors, hence playing an important role in a students' academic life (Korpershoek et al., 2020). Being bullied dispels feeling safe in schools. Being bullied has been associated with the lower educational performance (Strøm et al., 2013).

Besides being a predictor of academic achievement on its own, school climate is also related to the other variables in the current study predicting academic achievement. For instance, it is evidenced that students with low-SES are more affected by the school climate (Adelman and Taylor, 2005). So these students are more vulnerable to school climate elements, and their academic achievement may be affected negatively. On the other hand, school climate may influence students' attitudes toward lesson. The learning environment affects students' attitudes. In addition, in a school climate positing higher expectations from students, the school climate may encourage teachers to act in a way to promote positive students attitudes toward the lessons.

METHODS

The study adopted a correlational survey design. This type of research examines the associations between two or more variables (Tutar and Erdem, 2020). In this study, socio-economic level, attitude toward science, and school climate variables were considered as independent variables. Academic achievement was designed as the dependent variable. Whether the independent variables predicted the dependent variable was tested with the hierarchical regression model. In addition, the relationship between independent variables and dependent variables was compared according to countries. Three different countries were selected for comparison. The first of these countries is Singapore, the country with the highest TIMSS success. The other two were Turkey and the United Kingdom. While the United Kingdom is a developed country, Turkey is a developing country their TIMSS success scores were about the same. For these purposes, the above countries have been selected.

Participants

This study used three different samples Turkey, the United Kingdom, and Singapore. Each sample consisted of eight grade students who participated in TIMSS 2019. Descriptive statistics regarding the samples are presented in Table 1. As is shown in Table 1, there were no noteworthy differences among the countries in terms of age and gender. The mean scores of the United Kingdom and Turkey were very close to each other. While, Singapore had the highest mean score.

Variables

In this study, the independent variables were students' SES levels, school climate, and students' attitude toward lesson, while the dependent variable was academic achievement. The variables were coded in reference to Fishbein et al. (2021).

SES

Student socio-economic level was used with questionnaire items containing socio-economic indicators used by TIMSS. Students' SES levels were measured with the variables of parents' level of education, and home resources for learning. Home resources was measured with questions such as "Do you have any of these things at your home? (a) Your own room (b) Internet connection." The question of "What is the highest level of education completed by the child's <parents/guardians>?" was about their parents' level of education. TIMSS categorized the highest education levels into university or higher, post-secondary education, secondary education, and primary education. The education levels in this study were re-arranged with dummy coding. Levels below university were coded as 0 and university and higher levels were coded as 1.

School climate

TIMSS measured school climate in two dimensions. The first was students' sense of school belonging, and the second was student bullying. Sense of school belonging was measured with a 4-point Likert-type scale. Students could answer the

Table 1: Descriptive statistics for countries

TIMSS	X	SD	Rank
Singapore	608	3.9	1
United Kingdom	517	4.8	14
Turkey	515	3.7	15
Age			
Singapore	14.35	0.43	
United Kingdom	14.03	0.37	
Turkey	13.92	0.44	
Gender	Female (%)	Male (%)	Total
Singapore	937 (50.1)	934 (49.9)	1871
United Kingdom	784 (49.2)	808 (50.8)	1592
Turkey	935 (51.4)	884 (48.6)	1819

TIMSS: Trends in international mathematics and science study, SD: Standard deviation

questions with the responses "agree a lot," "agree little," "disagree little," and "disagree a lot." A sample item from the scale is "I feel like I belong at this school." Student bullying scale was also in 4-point Likert-type. The responses included "never," "a few times a year," "once or more a month," and "at least once a week." This was considered in the interpretation of student bullying. A positive correlation was interpreted as not being exposed to bullying. Student bullying scale included item sets such as "Threatened me."

Attitude toward science

Students' attitudes toward science lesson were measured in four dimensions. These were (i) students such as learning science, (ii) instructional clarity in science lessons, (iii) student confident in science, and (iv) students value science. These scales were also on a 4-point Likert-type. The students could respond the items with agree a lot, agree little, disagree little, and disagree a lot. Sample items include "I enjoy learning science" (student like learning dimension); "My teacher has clear answers to my questions" (instructional clarity dimension). The Cronbach alpha reliability coefficients for scale calculated are presented in Table 2.

Science achievement

TIMSS measures students' academic achievement in mathematics and science. This study referenced science achievement as academic achievement. Five different plausible values are calculated for science. This study used "1st Plausible Value Science."

Data Analysis

This study used three separate data sets. The first data set represents Turkey sample, the second the United Kingdom sample, and the third Singapore. The analyses of the data sets were performed independently. The findings regarding the data sets were compared. The below analyses were performed for each data set.

Test of normality was performed for set of data. Skewness and Kurtosis values of the continuous variables were examined for checking normal distribution. These values for the Turkey sample ranged between −0.97 and 0.76. They ranged between −0.48 and 1.25 for the United Kingdom sample. Finally, the values ranged between −0.56 and 1.42 for Singapore sample. Values ranging between −1.5 and 1.5 refer to normal distribution (Tabachnick and Fidell, 2013). Therefore, it was decided that the data sets showed normal distribution.

Table 2: The Cronbach alpha reliability coefficients for scale

Scale	Turkey	United Kingdom	Singapore
Cronbach alpha reliability coefficients	Alpha	Alpha	Alpha
School climate			
School belonging	0.76	0.82	0.83
Student bullying	0.84	0.90	0.89
Attitude towards science			
Students like learning science	0.87	0.93	0.91
Instructional clarity in science lessons	0.93	0.91	0.90
Student confident in science	0.81	0.84	0.85
Students value science	0.90	0.93	0.91
SES			
Home educational resources	0.64	0.44	0.43

SES: Socioeconomic status

Whether the problem of multi-collinearity existed among the independent variables in the data set was tested. Multi-collinearity among the independent variables was tested using variance inflation factor (VIF). The VIF values of the independent variables ranged between "1.10 and 2.21," "1.08 and 2.92," and "1.66 and 2.93" for Turkey, the United Kingdom and Singapore samples, respectively. VIF values below 10 showed that there was no problem of multi-collinearity (Field, 2013), indicating no such problem in the current study.

Auto-correlation problem between the dependent variable and the independent variables was also tested with Durbin-Watson coefficient (d). It was calculated as d = 1.62 between academic achievement (dependent variable) and the independent variables for Turkey sample. The coefficient was d = 1.55 for the United Kingdom sample, and d = 3.19 for Singapore sample. A value of Durbin-Watson coefficient between 1.5 and 2.5 means that there is not an auto-correlation problem (Kalaycı, 2010; Tabachnick and Fidell, 2013). Hence, there was not an auto-correlation problem in the Turkey and the United Kingdom data set.

Yet, there was an auto-correlation problem in Singapore sample. The auto-correlation problem for Singapore sample was not fixed. Due to this problem, hierarchical regression analysis was not used with the Singapore sample data. The literature offers some reasons for auto-correlation problem (Yavuz, 2009). The reason for this auto-correlation problem revealed that SES, school climate and attitudes toward science could not explain academic achievement as predictor variables in Singapore context. This may mean that there are different variables that predict academic achievement in Singapore sample. In other words, some variables predicting academic achievement in Singapore sample was not included in the current study.

Pearson product-moment correlation coefficient technique was used for identifying the relations among academic achievement, SES, attitudes toward science and school climate. Besides, hierarchical multiple regression technique was used to identify the variables predicting academic achievement. The reason for selecting this analysis technique was to be able to interpret the variables predicting the dependent variable in blocks.

FINDINGS

Pearson product-moment correlation coefficients for the sample groups (Singapore, United Kingdom, and Turkey, respectively) are provided in this section. In addition, some

noteworthy findings for the samples are also presented. The results for Singapore sample are presented in Table 3.

As is shown in Table 3, there was a medium-level statistically significant relationship between academic achievement and home resources and parents' education level. The relationship between academic achievement and some dimensions of attitude such as like learning science, confident in science and valuing the lesson were medium-level and statistically significant. The results for the United Kingdom and Turkey sample are presented in Table 4.

Regarding the United Kingdom sample, there was a medium-level statistically significant relation between academic achievement and home resources. A medium-level significant relation was also present between academic achievement and the dimensions of liking learning science and "confident in science." With respect to Turkey sample, there was a medium-level statistically significant relation between academic achievement and home resources and parents' education levels. A medium-level significant relation was also present between academic achievement and "confident in science." On the other hand, there was a negative small relation between academic achievement and belonging to school.

Hierarchical multiple regression analysis was performed for United Kingdom and Turkey samples, respectively. It was not used for Singapore sample due to auto-correlation problem. The results of the analysis are presented in Tables 5 and 6.

Model 1 included variables comprising students' demographic characteristics. The students' demographic characteristics (age and gender concomitantly) did not predict academic achievement significantly. The contribution of SES variables to academic achievement was inspected in Model 2. These variables predicted 16.6% of the change in academic achievement scores ($\Delta R2 = 0.166$). Model 3 investigated the variable of students' attitudes towards science. The students' attitudes toward science explained 9.8% of the change in their academic achievement scores ($\Delta R2 = 0.098$). The contribution of learning environment in schools to academic achievement was investigated in Model 4. School climate explained 1.8% of the change in academic achievement scores ($\Delta R2 = 0.018$). Regarding the United Kingdom sample, the variables that significantly predicted academic achievement were home resources for learning, like learning science, confident in science, and not being exposed to bullying.

Model 1 included the variables comprising students' demographic characteristics. The students' demographic characteristics concomitantly did not predict academic achievement significantly. The contribution of socio-academic variables to academic achievement was inspected in Model 2. These variables predicted 21.9% of the change in academic achievement scores ($\Delta R2 = 0.219$). Model 3 investigated the variable of students' attitudes towards science. The students' attitudes toward science explained 14.4% of the change in their academic achievement scores ($\Delta R2 = 0.144$). The contribution

Table 3: The correlation coefficients among the variables regarding Singapore sample

Variable	1	2.	3	4	5	6	7	8	9
1. Home resource	1								
2. Parent education	0.625**	1							
3. Belonging to school	0.117**	0.097**	1						
4. Student bullying	0.045	0.066*	0.223**	1					
5. Like learning science	0.139**	0.107**	0.305**	0.067**	1				
6. Instructional clarity	0.068**	0.040	0.312**	0.096**	0.563**	1			
7. Confident in Science	0.171**	0.160**	0.201**	0.078**	0.702**	0.455**	1		
8. Valuing the lesson	0.187**	0.185**	0.247**	0.037	0.652**	0.423**	0.500**	1	
9. Science achievement	0.388**	0.335**	0.178**	0.137**	0.326**	0.157**	0.317**	0.332**	1

**Correlation is significant at the 0.01 level (two-tailed), *Correlation is significant at the 0.05 level (two-tailed)

Table 4: The correlation coefficients among the variables regarding United Kingdom and Turkey sample

Variable	1	2	3	4	5	6	7	8	9
1. Home resource	1	0.582**	−0.146**	0.001	−0.051*	−0.022	0.184**	−0.027	0.475**
2. Parent education	0.687**	1	−0.129**	−0.009	−0.036	−0.056*	0.137**	0.028	0.314**
3. Belonging to school	0.176**	0.119**	1	0.300**	0.297**	0.345**	0.172**	0.270**	−0.043
4. Student bullying	0.010	0.088*	0.316**	1	0.083**	0.118**	0.111**	0.038	0.129**
5. Like learning science	0.206**	0.146**	0.355**	0.063*	1	0.580**	0.582**	0.528**	0.147**
6. Instructional clarity	0.064*	0.028	0.325**	0.120**	0.548**	1	0.377**	0.496**	0.133**
7. Confident in the lesson	0.199**	0.130**	0.267**	0.107**	0.719**	0.455**	1	0.350**	0.441**
8. Valuing the lesson	0.175**	0.132**	0.258**	0.031	0.611**	0.399**	0.469**	1	0.030
9. Science achievement	0.412**	0.279**	0.217**	0.124**	0.369**	0.165**	0.369**	0.257**	1

**Correlation is significant at the 0.01 level (two−tailed), *Correlation is significant at the 0.05 level (two-tailed). Light-colored part belongs to United Kingdom sample and bold part belongs to Turkey sample

Table 5: Hierarchical multiple regression analysis for academic achievement (the United Kingdom)

Predictors	R	R^2	ΔR^2	F	ΔF	B	SE	β
Model 1	0.083	0.007	0.007	2.64	2.64			
Constant						286.54	117.22	
Gender						2.03	6.12	0.01
Age						19.01	8.33	0.08*
Model 2	0.415	0.173	0.166	39.25*	75.34*			
Constant						42.98	110.13	
Gender						3.20	5.62	0.02
Age						18.55	7.62	0.08*
Home resources						22.37	2.59	0.39*
Parents education						3.14	7.69	0.02
Model 3	0.520	0.270	0.098	34.69*	25.10*			
Constant						−9.98	104.60	
Gender						−6.98	5.41	−0.04
Age						16.30	7.20	0.07*
Home resources						17.74	2.50	0.31*
Parents education						4.35	7.26	0.03
Like learning science						7.22	2.23	0.17*
Instructional clarity						−0.54	1.44	−0.01
Confident in the lesson						6.84	1.85	0.17*
Valuing the lesson						1.02	1.90	0.02
Model 4	0.537	0.289	0.018	30.30*	9.564*			
Constant						−61.60	104,10	
Gender						−5.34	5.38	−0.03
Age						15.50	7.12	0.07*
Home resources						18.15	2.48	0.32*
Parents education						1.52	7.21	0.01
Like learning science						7.24	2.24	0.17*
Instructional clarity						−0.86	1.44	−0.02
Confident in the lesson						5.93	1.85	0.15*
Valuing the lesson						1.16	1.88	0.02
Belonging to school						1.47	1.69	0.03
Student bullying						5.73	1.51	0.13*

SE: Standard error, *ρ<.05

of learning environment in schools to academic achievement was investigated in Model 4. School climate explained 1.4% of the change in academic achievement scores ($\Delta R2 = 0.014$).

Regarding Turkey sample, the variables that significantly predicted academic achievement were home resources for learning, parents' education level, like learning science, confident in science, valuing the lesson, belonging to school, and not being exposed to bullying. It was expected that students' valuing the lesson and levels of belonging to school were positively associated with academic achievement. A noteworthy finding was that students' academic achievement scores decreased as their scores of valuing the lesson increased, indicating a negative relation. Similarly, a negative relation was evidenced between academic achievement and belonging to school.

DISCUSSION

This study investigated the relationship among SES, attitude toward science, school climate, and academic achievement comparatively in terms of three countries Turkey, the United Kingdom, and Singapore. This study identified an auto-correlation problem among the variables in Singapore sample data. This meant that the variables of SES, attitude toward science and school climate that were measured in TIMSS 2019 were inadequate in accounting for the change in academic achievement in science for Singapore. It could be assumed that there were other variables than these variables for explaining the change in academic achievement in Singapore. Different variables should be measured to better understand what makes Singapore very successful in TIMSS practices.

The first independent variable was SES. It explained 16.6% of the change in science academic achievement in the United Kingdom sample while this was 21.9% for Turkey sample. Therefore, SES had a stronger association with academic achievement in Turkey. It is well-established that SES is associated with academic achievement one (Karadağ, 2017; Sirin, 2005; Smeding et al., 2013). Although Turkey and the United Kingdom were also similar in terms of gaps between rich and poor people (Caponera and Losito, 2016), SES was a

Table 6: Hierarchical multiple regression analysis for academic achievement (Turkey)

Predictors	R	R^2	ΔR^2	F	ΔF	B	SE	β
Model 1	0.054	0.003	0.003	2.39	2.39			
Constant						634.50	76.43	
Gender						−7.50	4.81	−0.04
Age						−7.87	5.50	−0.04
Model 2	0.471	0.221	0.219	117.76*	232.47*			
Constant						259.67	70.98	
Gender						−2.65	4.26	−0.01
Age						2.70	4.90	0.01
Home resources						23.68	1.48	0.43*
Parents education						16.76	7.40	0.06*
Model 3	0.604	0.365	0.144	118.75*	93.44*			
Constant						180.79	65.07	
Gender						−5.92	3.88	−0.03
Age						0.38	4.44	0.001
Home resources						19.38	1.37	0.35*
Parents education						15.02	6.73	0.05*
Like learning science						−2.26	1.55	−0.04
Instructional clarity						3.13	1.40	0.06*
Confidence in the lesson						19.53	1.18	0.42*
Valuing the lesson						−6.62	1.35	−0.12*
Model 4	0.616	0.379	0.014	100.73*	18.58*			
Constant						158.29	65.38	
Gender						−5.89	3.90	−0.03
Age						0.30	4.39	0.001
Home resources						18.89	1.36	0.34*
Parents education						13.95	6.67	0.05*
Like learning science						−1.82	1.53	−0.03
Instructional clarity						3.56	1.41	0.06*
Confidence in the lesson						19.13	1.18	0.41*
Valuing the lesson						−5.79	1.34	−0.10*
Belonging to school						−4.42	1.11	−0.09*
Student bullying						6.13	1.11	0.11*

SE: Standard error, *ρ<.05

stronger predictor of academic achievement for Turkey. The results of studies that have focused on Turkey lend their support to the finding in the current study (Arifoğlu, 2019; Ersan and Rodriguez, 2020; Geesa et al., 2019; Gustafsson et al., 2018). It could be interpreted that the schools in the United Kingdom were more successful in compensating for socioeconomic inequalities than the schools in Turkey. The results of both this study and many other studies in the literature reveal the need for Turkey to take precautions in making up for the socioeconomic inequalities in schools.

The dimensions of SES were examined in the current study. TIMSS 2019 measured home resources for learning and parents' education level for SES. With respect to the United Kingdom sample, the current study revealed a positive significant relation between academic achievement and home resources for learning. For Turkey, academic achievement was positively associated with both home resources and parents' education level. This result is supported by the findings of other studies focusing on Turkey (Filiz and Öz, 2020; Güven, 2019; Yetisir, 2014; Yıldırım, 2019). Regarding the finding on parents' education level, it is important for Turkey. This may be related to the fact that average period of education is lower in Turkey. While the average period of education is 8.1 years in Turkey, it is 13.2 in the United Kingdom (United Nations Development Programme, 2020). The shorter period of education in Turkey may be reflected in students' academic achievement.

The second independent variable was students' attitude towards science. This explained 9.8% of the change in their academic achievement for the United Kingdom sample while this ratio was 14.4% for Turkey. There was a stronger association between students' attitudes toward science and academic achievement in Turkey. This finding is in line with other Turkish studies (Arifoğlu, 2019; Ersan and Rodriguez, 2020; Geesa et al. 2019; Yetisir, 2014). In a similar study, Kartianom and Retnawati (2018) could not find a significant relation between academic achievement and attitudes toward mathematics in Turkey. In this study, academic achievement was represented with achievement in science. This difference may stem from the difference in lessons.

The dimensions of attitude towards science were "like learning science," "instructional clarity in science lessons," "confidence in science," and "valuing science." In the United Kingdom sample, there was a positive significant association between academic achievements and "like learning science" and "confidence in science." In Turkey, academic achievement was positively and significantly associated with "confidence in science," and "instructional clarity in science," which is in line with some other studies on Turkey (Filiz and Öz, 2020; Yıldırım, 2019). On the other hand, Akıllı (2015) reported a negative relation between academic achievement and confident in science. There was a negative correlation between academic achievement and valuing lesson in the current study, which was reported as a positive relation by Akıllı (2015). Theoretically, it is expected that students' confidence in a lesson as well as valuing a lesson should have a positive association with academic achievement. This contradiction with regard to confidence in science and valuing science is noteworthy. These conflicts may stem from the radical reforms undertaken in the Turkish curricula that happened to coincide with the periods when TIMSS 2015 and 2019 were proctored. During this period, students' course load increased significantly. This increase may have affected their attitudes toward lessons negatively.

As for the school climate, the last independent variable, it explained a slight portion of the change in academic achievement both in the United Kingdom and Turkey (1.8% and 1.4%, respectively). A meta-analysis study revealed a small relation between school climate factors and academic achievement (Scheerens et al., 2013). However, it was still higher than these findings. Studies in Turkey support this level of relation (Arifoğlu, 2019; Ersan and Rodriguez, 2020; Kartianom and Retnawati, 2018). This may be related to the fact that TIMSS measures only school belonging and not being bullied for school climate.

With regard to dimensions of school climate, the study revealed a positive significant relation between academic achievement and not being exposed to bullying both in Turkey and the United Kingdom. This finding is line with the literature (Lee and Chen, 2019), and it is an expected result. A bullied student cannot feel safe in the classroom and in the school and cannot engage with academic duties. In addition, there was a negative significant relation between academic achievement and school belonging, which contradicts the findings by Lee and Chen (2019). Theoretically, it is assumed that there should be a positive relationship between school belonging and academic achievement. This may again be accounted for with the educational reforms in Turkey carried out during TIMSS 2015 and 2019 application times. During that period, the school levels changed. Formerly, there was an 8-year elementary education (5-year primary school and 3-year lower secondary school) which then changed into 4-year primary school and 4-year lower secondary school. In addition, a new type of lower secondary schools was opened across the country, named as a religious lower secondary school. These radical changes experienced in education institutions may have affected students negatively.

CONCLUSION

One the most important factors associated with students' academic achievement in Turkey is their SES. In this sense, the limitations of students in their access to home resources for learning are reflected negatively to their academic performance. Considering also the pandemic conditions, students' access to the internet and information technologies should be expedited in areas where students' socio-economic levels are low. Besides, in these areas, students' access to the internet and information technologies could be provided through setting up related environments in schools.

Recommendations

Turkish students' academic achievement levels were closely related with their attitudes toward lessons. The students should be encouraged to feel confident in lessons to enable positive attitudes. This feeling of confidence appears to be associated with teachers' supportive behaviors. Teachers should urge students to actively participate in the lesson to enhance their confidence. Feeling safe in the classroom is also important for urging student engagement. Hence, teachers should put in effort to create a safe climate in the classroom.

ETHICAL STATEMENT

Since this study was taken from the data of studies previously published in scientific journals, ethics committee approval was not required.

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