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The effects of academic motivations of secondary school students on their attitudes towards the chemistry course

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Abstract

This study aimed to analyze the effect of secondary school students' academic motivations on their attitudes towards the chemistry course. The sampling consisted of Grade 9, 10, 11 and 12 students studying at the secondary schools in Ankara. The data were collected through the "Academic Motivation Scale" developed by Bozanoglu (2004) and "The Scale of Attitudes towards Chemistry" developed by Kan & Akbas (2005). The Cronbach alpha reliability coefficient of the Academic Motivation Scale was found to be 0.88 and the reliability coefficient value for The Scale of Attitudes towards Chemistry was 0.92.

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1. Introduction

It has been a common topic for various research studies whether affective characteristics played roles in determining students' fields of interest as well as their preferences, social activities, achievements or failures. There are proven effects of affective characteristics related to the school subjects on the learning at school (Bloom, 1979). Students' attitudes towards the school subjects are directly or indirectly related to various issues, one of which is motivation as an affective characteristic.

Attitudes are one of the major determiners of human behavior. Attitudes of individuals strongly affect their love, hatred and behaviors (Morgan, 1991). Therefore, it is a requirement for many fields to assess the attitudes and find out the degrees of attitudes towards an item or situation (Erkus, 2003). Attitude is a phenomenon that is attained through learning, which guides the behaviors of an individual and causes subjectivity. Having positive attitudes towards a school subject would involve behaviors such as willingness to participate in a lesson, satisfaction by responding to questions, accepting one's own value and agreeing one's value to be recognized (Ozcelik, 1998). Attitude is a psychological structure perceived to be a critical and important commentator of individual behaviors in terms of their cognitive, affective and behavioral aspect (Fisbein & Ajzen, 1975).

Motivation is an essential factor for many fields, especially in education. It is an important dimension to be considered especially in subjects that are challenging for the students to understand. Although the importance of motivation in learning is well-known and accepted it is usually failed to understand its meaning and know how to use it in a teaching pattern. The reasons for this are as follows:

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- a) Motivation is a factor that could not be observed directly and therefore cannot be assessed,
- b) There is a generally accepted opinion that it is easier to assess the attainment levels of cognitive targets than the attainment levels of motivational targets (Spitzer, 1996; Seah & Bishop, 2000).

Motivation is a process rather than being a conclusion, therefore it cannot be observed directly. Some assumptions could be made about the motivation levels through observing the activities that individuals prefer, how much they insist on participating in these activities or their verbal reactions on these activities (Pintrich & Schunk, 1996). In this respect, the internal and external forces that make the organism to move, guide the behaviors and provide the continuity of the behaviors create motivation. Academic motivation could shortly be defined as the production of the required energy for academic activities; however, opinions about the source of this energy vary according to theories.

Academic motivation is an important factor to be considered in science subjects, which are challenging for the students to comprehend. Chemistry, as a subject, in which there are abstract topics such as atom, molecules, molecule structures and inter molecular bonds as well as concrete topics, is one of the most challenging subjects for students. The motivations of students are essential in determining their attitudes towards chemistry classes.

1.1. The purpose of the study

Chemistry is one of the fields of science involving abstract topics and concepts that students sometimes find challenging to comprehend. One of the affective characteristics closely related to the attitudes of students towards this school subject is the academic motivation. This study aims to analyze the effects of secondary school students' academic motivation on their attitudes towards chemistry.

2. Method

2.1. Sampling

Sampling of the study consisted of 500 students studying at Grades 9, 10, 11 and 12 at the secondary schools in Ankara.

2.2. Data collection tools

The scales used as data collection tools in the study are listed below:

2.2.1. Academic motivation scale (AMS)

The data collection tool for determining secondary school students' academic motivations is the Academic Motivation Scale developed by Bozanoglu (2004). The Scale consists of 20 statements and is in 5-point Likert-type. The reliability coefficient of the scale was calculated as 0.88.

2.2.2. The scale of attitudes towards chemistry (SATC)

In order to determine secondary school students' attitudes towards chemistry, "The Scale of Attitudes Towards Chemistry" developed by Kan & Akbas (2005) was used. The 5-point Likert-type scale consisted of 22 statements. The reliability coefficient of the scale was calculated as 0.92. the test-repetition test consistency was found to be 0.92.

3. Findings

3.1. Findings about the attitudes of secondary school students towards chemistry

In order to analyze the academic motivations of students according to their grade levels, the average scores of students obtained from the Scale of Attitudes Towards Chemistry and their standard deviations were calculated. The results are displayed on Table 1.

Table 1. The analysis of students' scores obtained from the scale of attitudes towards chemistry according to their grade levels

Grade	N	Average	sd	Average Diagram
9	136	3.27	.811	
10	130	3.17	.857	
11	122	3.56	.861	
12	112	3.21	.787	
Total	500	3.30	.841	

As Table 1 displays, the positive attitude scores of the Grade 11 students were the highest, whereas that of the Grade 10 students were the lowest. In order to determine a potential significant difference between the attitudes of students towards chemistry, Variance Analysis was applied. The results are shown on Table 2.

Table 2. Variance analysis results of the scores of students obtained from the the scale of attitudes towards chemistry according to their grade levels

Source of the variance	Sum of squares	sd	Average of squares	F	p
Intergroup	11.33	3	3.77	5.47	.001
Intragroup	342.15	496	.69		
Total	353.48	499			

Table 2 shows that the variance analysis applied to the scores of students regarding their attitudes towards chemistry resulted with a finding of significant difference with an F value of 5.47 at the level of $p < 0.005$. In other words, there are significant differences between the attitudes of secondary school students towards chemistry according to the types of high schools they attend. In order to define the source of these differences, the Scheffe test was administered. According to the results, there are significant difference between the average scores of Grade 11 students and the students from Grades 10 and 12.

3.2. Findings related to the academic motivations of students

With the aim of analyzing the potential differences of students' academic motivations according to their grade levels, the averages of scores obtained from the Academic Motivation Scale and their standard deviations were calculated. The results are displayed on Table 3.

Table 3. The Analysis of Academic Motivation Scale scores according to students' grade levels

Grade	N	Average	sd	Average Diagram
9	136	3.80	.554	
10	130	3.66	.571	
11	122	3.92	.521	
12	112	3.69	.586	
Total	500	3.77	.565	

According to Table 3, the academic motivation score averages of Grade 11 students were the highest, whereas that of the students from Grade 10 the lowest. In order to determine whether these differences were significant, ANOVA analysis was done. The results are displayed on Table 4.

Table 4. The variance analysis results of students' academic motivation score averages according to their grade levels

Source of the variance	Sum of squares	sd	Average of squares	F	p
Intergroup	5.07	3	1.690	5.41	0.01
Intragroup	154.75	496	.312		
Total	159.82	499			

The single-directional variance analysis results as displayed on Table 4 show that the difference between the academic motivation averages of students according to their grade levels is significant [$F_{(3,496)} = 5.41, p < .05$]. In other words, the average academic motivation scores of students differed significantly according to their grade levels. Scheffe Test was administered in order to determine the grade levels that display differences. According to the test results, students of Grade 11 received average scores that are significantly different from Grade 10 and 12 students.

Using the correlation analysis and Pearson Correlation Coefficient calculation, potential relationship between the averages of the Scale of attitudes towards Chemistry and the Academic Motivation Scale were analyzed. Descriptive statistical methods were used before the correlation analysis and it was found that the Skewness and Kurtosis values were between (-1 – 1) values. In other words, the statistical analysis showed that the parameters displayed normal distribution and Pearson Correlation test was applied in order to determine the relationship between the variables. The findings are displayed on Table 5.

Table 5. Pearson multiplication moment correlation analysis results regarding the determination of the relationship between the scores of the scale of attitudes towards chemistry and the academic motivation scale scores

Grade			The Scale of Attitudes towards Chemistry (SATC)	Academic Motivation Scale (AMS)
9	SATC	r	1	.381**
	AMS	r	.381**	1
10	SATC	r	1	.560**
	AMS	r	.560**	1
11	SATC	r	1	.458**
	AMS	r	.458**	1
12	SATC	r	1	.425**
	AMS	r	.425**	1
General	SATC	r	1	.429**
	AMS	r	.429**	1

** significant $p < .01$

Table 5 displays that the participating Grade 9, 10, 11 and 12 students received scores from the Scale of Attitudes towards Chemistry and Academic Motivation Scale that are positive and significant ($r=0.381$; $r=0.560$, $r=0.458$, $r=0.425$, $r=0.429$, $p < .01$).

4. Conclusion and Discussion

As a result of the study, the analysis on the scores of Grade 11 students obtained from the Scale of Attitudes towards Chemistry showed that they had the highest positive attitude scores. The further studies on these students diagnosed some uncertainties regarding their future expectations and understandings of their current environment. There are findings supporting that this stems from the age period they experience (Klein, 1980; Yavuzer, 2002). Therefore, Grade 11 students show a cognitive approach to attending the university entrance test by participating and achieving in the school subjects. The intensive exam preparation period in Grade 12 prevents us from receiving accurate results regarding their attitudes. Grade 11 students displayed the highest level of academic motivation in

the analysis of the academic motivations according to the grade levels. Looking at the relationship between the attitudes towards chemistry and the academic motivation levels, it could be stated that students with more positive attitudes towards chemistry had higher levels of academic motivation. These results are in line with the research listed in the literature (Cukrowska, Staskun & Schoeman, 1999; Yucel, 2007).

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