Eurasian Journal of Educational Research, Issue 45, Fall 2011, 31-48

Can 'Attitudes toward Biology Course' and 'Learning Strategies' Simultaneously Predict Achievement in Biology?

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Suggested Citation:

Çakıcı, Y., Arıcak, O.T., & Ilgaz, G. (2011). Can 'Attitudes toward Biology Course' and 'Learning Strategies' Simultaneously Predict Achievement in Biology? *Eğitim Araştırmaları-Eurasian Journal of Educational Research*, 45, 31-48

Abstract

Problem Statement: There is much research concerning the relationship between attitude and science achievement or between learning strategies and science achievement but less is known about the simultaneous relationships among attitude, learning strategies and achievement in relation to biology and science. It is difficult to source any research on whether and how attitude and learning strategies predict student success in biology or even general science.

Purpose of Study: The purpose of this study was to investigate the relationship between attitude toward biology course, learning strategies used to study biology and achievement in biology using structural equation modelling (SEM).

Methods: The participants consisted of a total of 890 students (429 ninth and 461 tenth grade) from seven different high schools in the city of Edirne located in the North Eastern part of Turkey. 507 students were males and 383 were females, ranging from 14 to 18 (M = 15.79, SD = .82). Data were collected through the use of two instruments. One measure assessed students' attitudes toward the biology course. The other measure assessed learning strategies used by students in learning biology. Data for achievement in Biology course was obtained from their grade point average (GPA) in Biology at the end of 2006-2007 academic year. The path analysis in terms of structural equation modeling (SEM) was performed to

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examine the relationship and interaction between attitudes toward the biology course, learning strategies in biology and achievement in biology.

Findings and Results: The path model revealed that students' attitude toward biology and the use of learning strategies on the biology course significantly predicted students' achievement in biology (β = .17, p < .001 and β = .17, p < .001, respectively). In addition, there is a significant correlation between students' attitude toward biology and use of learning strategies in biology course (r = .60, p<.05). Thirty-six percent of the use of learning strategies in biology course can be explained by attitude toward the biology course.

Conclusions and Recommendations: This research found that both student attitude toward biology and learning strategies were significant predictors of achievement in biology and underlines their importance in enhancing the effectiveness of science education and as predictors of student future success. In this context, the attitudes and learning strategies of high school students seem to be equally related to their performance in biology. Future studies should explore these relationships in different cultural contexts and extend the scope to other disciplines such as physics and chemistry.

Keywords: Attitudes, learning strategies, biology achievement, biology learning

Over the past three decades, both students' attitudes toward science and learning strategies have been a constituent of science education and are increasingly a subject of concern (Osborne, Simon, & Collins, 2003; Trumper, 2006). One of the key factors in learning science is student attitude (George, 2006), and a great deal of research has accumulated concerning the importance of this and the relationship between attitude and science achievement (Papanastasiou & Zembylas, 2004). Data reveal that attitudes towards science may have a significant effect on science achievement (Osborne et al., 2003; Prokop, Tuncer, Chuda, 2007).

Learning strategies also play a considerable role in learning science. Mayer (1988, p. 11) points out the importance of understanding the learning processes in order to be aware of "what goes on in the learner's head during learning". Similarly, Dickinson (1987) emphasises the significance of learning strategies that encourages students to take responsibility for their learning. Many studies have been conducted investigating the association between learning strategies and positive academic outcome and have shown a positive correlation between learning strategies and achievement (Elliot, McGregor, & Gable, 1999; Pintrich & DeGroot, 1990). It is reasonable to infer that some students are more successful than others in learning science and this may be due to differences in the way students learn (Chin & Brown, 2000).

There is a great deal of research concerning the relationship between attitude and science achievement or between learning strategies and science achievement, but less is known about the simultaneous relationships among attitude, learning strategies, and achievement in relation to biology and science. It is difficult to source any research on whether and how attitude and learning strategies predict student success

in biology or even general science. This study investigates quantitatively the structural relationship among student attitude, learning strategy, and achievement within biology and may subsequently offer a further understanding of learning biology.

Attitudes and Learning Science

Research into students' attitudes toward science has been an essential part of the work of the science education research community for the past 30-40 years (Osborne et al. 2003). As stated by Koballa and Crawley (1985), attitudes are important for a number of reasons. "First, attitudes toward science are thought to fulfill basic psychological needs, such as the need to know and the need to succeed. Second, attitudes toward science are thought to influence future behaviors, such as interest in working on a science project" (p. 224). In other words, positive attitudes toward science give rise to "a positive commitment to science that influences lifelong interest and learning in science" (Simpson & Oliver, 1990, p. 14). Also, positive attitudes support the critical examination of scientific issues and the application of scientific knowledge in relevant situations (McCormick, 2000).

Several studies have investigated the relationship between attitudes toward science and higher science achievement, and have found a positive correlation between them i.e.. (Cannon & Simpson, 1985; Freedman 1997; Oliver & Simpson, 1988; Schibeci & Riley, 1986; Schibeci, 1989). More recent studies conducted by Kesamang and Taiwo (2002) with junior secondary school students in Botswana; by Cukrowska, Staskun and Schoeman (1999) with the university chemistry students in South Africa; by Tuan, Chin and Shieh (2005) with junior-high school students in Taiwan; by Craker (2006) with students enrolled in general education courses at the University of Wisconsin-La Crosse in USA, all found that students with a more positive attitude toward science were associated with higher science achievement. Another comprehensive study conducted by Weinburgh (1995), based on meta-analysis of 43 studies, revealed that a positive attitude toward science appears to be a predictor of higher achievement. Other research also reported a positive, though weak, association between achievement in science and attitude toward science (Fraser, 1982; Jovanic & King, 1998).

We can conclude that a positive attitude toward science is widely accepted as a predictor of behavior during learning, and those attitudes influence science achievement and ultimately interest in science-related careers (Carey & Shavelson, 1988; Koballa, 1992). However, negative attitudes may result in lack of interest for science and scientific courses. The research supports these views (Weinburgh, 1998).

Attitudes and Learning Biology

Attitudes toward biology and learning are areas of interest to educators past and present (Rogers & Ford, 1997). However, research often concerns attitudes toward science in general. "Only few have studied attitudes toward a particular discipline like biology and physics" (Salta & Tzougraki, 2004, p. 536). There is limited literature concerning the relationship between attitudes and biology.

Prokop et al. (2007) explored Slovak students' attitude toward biology through six dimensions; interest, career, importance, teacher, equipment, and difficulty. They used a 30-item Biology Attitude Questionnaire (BAQ) to measure 655 secondary school students' attitudes toward biology education. The analyses revealed that students, in general terms, have a positive attitude toward biology lessons. There was a negative effect of age for all dimensions whereas the effect of gender was not significant. One of the important findings of the study is that teacher characteristics have a significant role on Slovakian students' attitudes toward biology. In another study, Trumper (2006) as part of the ROSE Project, explored student interest in biology at the end of their compulsory schooling in Israel, and its relation to student views on science classes, out-of-school experiences in biology, and attitude towards science and technology. The findings showed that overall interest in learning biology was relatively positive but not high; with girls showing greater interest than boys. Students' interest in learning biology correlated closely with their negative opinions of science classes.

In summary, the research literature supports the view that there is a positive relationship between attitudes and science/biology achievement, and thereby, being aware of student attitudes toward science/biology can be an important predictor of sience achievement.

Learning Strategies and Science Achievement

The effect of learning strategies on student achievement is currently the subject of much research in science education. Learning strategies guide the student through learning (Jonassen, 1985). Weinstein and Mayer (1986) define learning strategies as behaviors and thoughts in which a student engages and which are intended to influence the learner's encoding process. Similarly, O'Malley and Chamot (1990, p. 1) explain learning strategies as "the special thoughts or behaviors that individuals use to help them comprehend, learn, or retain new information." In essence, learning strategies are steps taken by students to enhance their own learning (Oxford, 1990). They involve internal mental actions but also may involve physical actions (Gass & Selinker, 2001).

Research suggests that the use of strategies enhances student motivation and subsequent achievement (Bandura, 1997 cited in Tuckman, 2003, p. 430). Pintrich and DeGroot (1990) examined the relationship between self-regulated learning and classroom performance among seventh-grade students in science and English classes. They found that self-regulated learning strategies (i.e., comprehension monitoring, goal setting, planning, and effort management) was the best predictor of academic performance.

Tuan, Chin, and Shieh (2005) developed a questionnaire that measures students' motivation toward science learning (SMTSL) based on six scales: self-efficacy, active learning strategies, science learning value, performance goal, achievement goal, and learning environment stimulation, with 1407 junior high school students from Taiwan. The SMTSL questionnaire revealed significant correlations with science attitude and achievement scores. Among the six scales, self-efficacy and active learning strategies showed higher correlation with achievement scores. Students

using active learning strategies tended to gain better scores on the tests. Similarly, McManus, Dunn, and Denig (2003), in their study of biology students, found that students who use active learning materials have higher science achievement and science attitude scores than students who learn using traditional lecture activities.

It is evident from the literature that several learning strategies are related to science/biology achievement. However, there is no coherent classification of learning strategies in the literature. According to McKeachie et al. (1986), there are many learning strategies and a variety of taxonomies for describing and classifying them, including those developed by Dansereau (1985) i.e. primary and support strategies; by Pressley (1986) i.e. goal-specific, monitoring, and higher order learning strategies; by Weinstein and Mayer (1986) i.e. cognitive, metacognitive, and affective strategies; by McKeachie et al. (1986) i.e. cognitive, metacognitive, and resource management strategies, etc.

The main reason for this variety is that students vary in their approaches to learning, usually from subject to subject (Tomanek & Montplaisier, 2004). As Weinstein and Mayer (1986) point out, learning strategies appropriate for one type of learning situation may not be appropriate for another. Thus, this study investigates learning strategies within biology rather than general science and can be considered more informative and valid.

To sum up, prior research suggests that students' attitudes and learning strategies are important predictors of achievement. In order for students to be willing to learn about science and achieve more, they require positive attitudes toward science. To develop positive attitudes, students may need good learning strategies to better understand science topics, leading to the development of these positive attitudes. Good learning strategies and a positive attitude can ease learning and ultimately lead to higher achievement.

Importance of the Study

In the literature, many studies have investigated several factors to clarify their relationship with students' attitudes toward science, and also the relationship between attitudes and science achievement. However, research was often focussed on general science and less attention was given to particular disciplines such as biology, physics, or chemistry (Prokop et al. 2007). Similarly, although there has been considerable research on students' knowledge/awareness of learning strategies and the relationship between learning strategies and achievement, there has been little attention as to how learning strategies and students' attitudes affects achievement in biology.

The extensive literature about attitudes or learning strategies includes little research about relationship between attitude, learning strategy, and achievement. Although studies into attitude or learning strategies have been informative, they do not consider the question of possible causal relations between student attitude toward science and science learning strategies. It is difficult to find any research which has studied the joint effects of attitude toward biology and learning strategies on achievement in biology.We assume that a better understanding of student

achievement in biology may be found in investigating the causal relations between student attitude toward biology and learning strategies used in learning biology.

The purpose of this study was to determine the best-fitting structural equation model of the causal relatinonships between attitude toward biology, learning strategies used in learning biology and achievement in biology for high school students. In this study, we explore:

- Can students' attitudes toward biology predict their biology achievement?
- Can learning strategies students used predict their biology achievement?
- Is there any relationship between attitudes toward biology and learning strategies?

Method

Participants

The participants consisted of a total of 890 students (429 ninth and 461 tenth grade) from seven different high schools in the city of Edirne located in the North Eastern part of Turkey. 507 students were males and 383 were females, ranging from 14 to 18 (M = 15.79, SD = .82).

Measures

Data were collected through the use of two instruments. One measure assessed students' attitudes toward the biology course. The other measure assessed learning strategies used by students in learning biology. Data for achievement in Biology courses was obtained from their grade point average (GPA) in Biology at the end of 2006-2007 academic year.

Scale of Attitude toward Biology Course. Students' attitudes toward biology course were measured through the use of a 5-point Likert scale developed by Aricak and Ilgaz (2007), and ranging from *strongly agree* to *strongly disagree.* A total of 238 students rated each of 19 statements describing their affective stance toward the biology course. For example, Item 3 "I like solving biology questions", Item 14 "I enjoy studying biology". Validity and reliability of the survey were explored using exploratory and confirmatory factor analyses, and it was found that scale was unidimensional. All factors were loaded between .39 and .84. The Cronbach alpha coefficient of the scale' reliability is .94.

Scale of learning strategy. The reported use of learning strategies was measured with the Scale for the Use of Strategies for Learning Biology Course, which was developed by Sucuoglu (2007). The construct validity of scale was examined with exploratory factor analysis. Cronbach Alpha and Split Half Coefficients were calculated for reliability of scale. The Cronbach Alpha Coefficient for the Scale of the Use of Learning Strategies in Biology is .89. The students were instructed to indicate their frequency of use of the stated learning strategy with the following symbols: 5 for always use, 4 for usually use, 3 for sometimes use, 2 for seldom use, 1 for never use, and 0 for undecided.

This scale included five subscales and was assessed with 29 items. The content of the five subscales and some examples of the items are as follows:

1. *Basic elaboration strategies* (α = .89) include making comparison, classiffying, finding similarities and differences, analysing and reasoning, etc. For example, Item 2 "I make comparisons between concepts or topics."
2. *Complex elaboration strategies* (α = .72) involve underlining, note taking and simplifying, etc. For example, Item 1 "When studying I underline important points."
3. *Learning strategies based on the support of the others* (α = .76) concern behaviours and actions which involve searching books, cooperating with others, and seeking help from peers, the teacher or other people to learn biology, etc. For example, Item 8 "For difficult contents I ask other people (teacher, parent etc.) for the answer."
4. *Comprehension monitoring strategies"* (α = .72) involve composing questions and answering these to him/her self, reading repeatedly and explaining loudly, etc. For example, Item 9 "In order to better understand the topic I compose questions about what I read."
5. *Complex rehearsal strategies* (α = .62) include activities which involve studying by writing and preparing work papers, etc. For example, Item 21 "I study by writing the topic to be learnt."

Data Analysis

In this study, the path analysis in terms of structural equation modeling (SEM) was performed to examine the relationship and interaction between attitudes toward the biology course, learning strategies in biology, and achievement in biology. SPSS 15 for Windows and AMOS 7.0 (Arbuckle, 2006) were used to analyze the data. In recent years, the use of SEM in social sciences has been quite popular to explain social phenomena (George & Kaplan, 1998; Hox & Bechger, 1998; Lee, Johanson, & Tsai, 2007). The interest in SEM is often on theoretical constructs, which are represented by the latent factors (Hox & Bechger, 1998). One of the main advantages of SEM is that it can be used to study the relationships among latent constructs that are indicated by multiple measures. SEM takes a confirmatory approach to the multivariate analysis of a structural theory, one that stipulates causal relations among multiple variables. The goal is to determine whether a hypothesized theoretical model is consistent with the data collected to reflect this theory (Lei & Wu, 2007). In this study, latent variable of the scale for learning strategies was explored by using observed variables. Our aim was to simultaneously examine how learning strategies as well as attitudes toward the biology course predicted achievement, and also to examine whether these two constructs are related to each other.

Findings and Results

Descriptive statistics for age, achievement in Biology course, attitude towards Biology course and learning strategies were calculated and are displayed in Table 1. As seen in Table 1, the number of participants shows differences due to missing data

in students' responses. The mean of achievement in the Biology course is 70.46 (SD = 16.87), for attitude toward Biology is 71.12 (SD = 14.87). The means of subscales of learning strategies are changing between 10.93 (SD = 3.16) and 28.70 (SD = 7.74).

Table 1
Descriptive Analyses of Variables

Variables	*N*	*M*	*SD*
Age	888	15.78	.82
Achievement in Biology Course*	886	70.46	16.87
Attitude toward Biology Course	817	71.12	14.87
Basic Elaboration Strategies	855	28.70	7.74
Complex Elaboration Strategies	875	23.91	4.98
Learning Strategies Based on Support of	869	20.04	5.19
Comprehension Monitoring Strategies	865	16.60	4.68
Complex Rehearsal Strategies	884	10.93	3.16

* Grade Point Average in Biology Course

Correlations among achievement in biology course, attitude toward biology course, and learning strategies were calculated and are displayed in Table 1

Table 2
Correlations Among Achievement in Biology Course, Attitude Toward Biology Course, and Learning Strategies

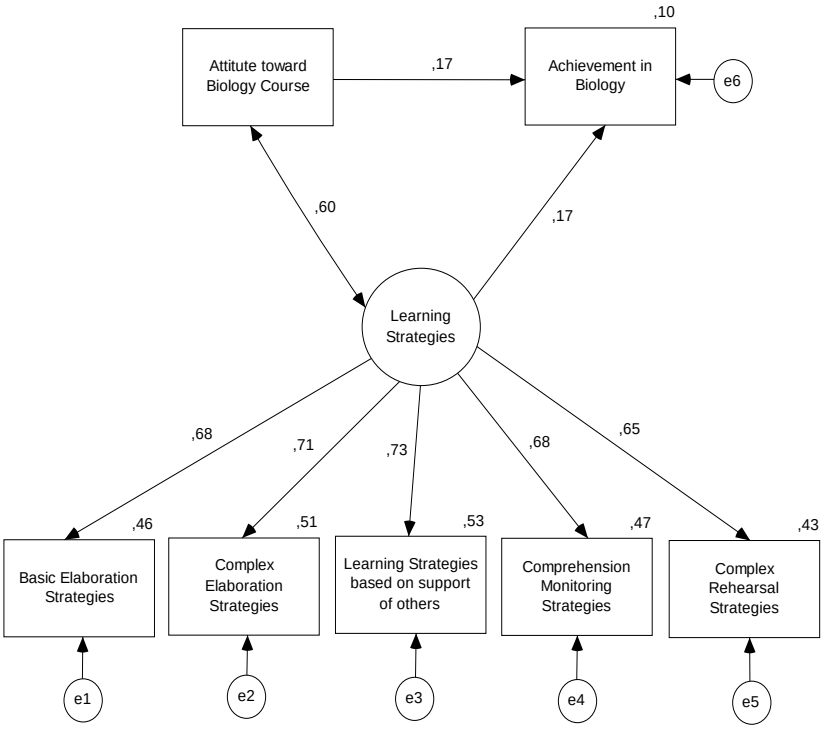
Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Achievement (GPA) in Biology Course	1.00	.27**	.23**	.18**	.23**	.17**	.16**
Attitude toward Biology		1.00	.50**	.39**	.44**	.38**	.34**
Basic Elaboration			1.00	.46**	.50**	.45**	.43**
Complex Elaboration				1.00	.52**	.50**	.52**
Learning Strategies Based on Support of Others					1.00	.50**	.46**
Comprehension Monitoring Strategies						1.00	.46**
Complex Rehearsal							1.00

** $p < .001$

Significant correlations emerged between .16 and .52. Correlation coefficients among all scales are reported in Table 2. Findings from the path analysis of relationships between attitudes toward biology, learning strategies, and achievement in biology test scores for students in Turkey are presented in Figure 1. We have

constituted our model according to current science education literature (Shibeci, 1989; McManus et al., 2003). We hypothesized that attitude towards biology and learning strategies correlated reciprocally as well as both having an effect on achievement in biology.

As seen in the Figure 1, there are seven observed variables and one latent variable. Five Subscales of the Learning Strategies (*Basic elaboration strategies, Complex elaboration strategies, Learning strategies based on the support of the others, Comprehension monitoring strategies, and Complex rehearsal strategies)* are presented with one latent variable in the model. In the model, single-headed arrows in the path diagram illustrate the direction of the effect of one variable on another; the number associated with each of the single-headed arrows is the path coefficient. The curved two-headed arrow connecting two variables is the correlation coefficient between independent variables. Circles represent errors in the prediction of the endogenous variables



(Kline, 2005; Loehlin, 2004).

Figure 1. Relationships between attitudes toward biology, learning strategies, and biology achievement scores

As Hu and Bentler (1999) and Tabachnick and Fidell (2007) suggested, chi-square, RMSEA, NFI, TLI, and CFI were selected to test the model's fit. The model fit indices

all demonstrated an excellent fit, indicating that there was sufficient power in the sample size (χ^2 = 47,249, df = 13, p = .00; RMSEA = .054; NFI = .973; TLI = .957; CFI = .98). Maximum Likelihood method was used in the path analysis.

The path model revealed that students' attitude toward biology and the use of learning strategies on the biology course significantly predicted students' achievement in biology (β = .17, p < .001 and β = .17, p < .001). In other words, when students' attitude toward biology and the use of learning strategies in biology course increased by one standard deviation, achievement in biology increased by .17 standard deviations (in terms of unstandardized regression weights). Likewise, when students' attitude toward the biology course increased by one point, achievement in biology increased .19 points, and when the use of learning strategies increased by one point, achievement in biology increased .56 points. In addition, there is a significant correlation between students' attitude toward biology and use of learning strategies in a biology course (r = .60, p<.05). Thirty-six percent of the use of learning strategies in a biology course can be explained by attitude towards the biology course.

Conclusions and Recommendations

The results from the structural equation modeling indicated that students' attitudes toward biology and student learning strategies were associated with higher achievement in biology. In the model, the scores of attitude toward biology and learning strategy used to study biology for the first term significantly predict the achievement scores obtained at the end of the year. In this context, the attitudes and learning strategies of high school students seem to be equally related to their performance in biology. Also, they can be thought of as two of the most important factors predicting student achievement in biology. These results have significant implications in terms of improving learning in biology.

Students naturally tend to focus on the content of the biology course in the classroom rather than other aspects of the teaching and learning process. Teachers should pay particular attention to both students' attitudes and learning strategies during biology lessons. Koballa (1992, p. 63) stresses that improving students' attitudes toward science is a major part of the work of science teachers. Teaching strategies should be designed in ways that enhance students' positive attitudes and effective learning strategies during the biology lesson. We know that although some students seem to be able to acquire and use learning strategies by themselves, most students do not acquire such strategies or do not use the strategies in the most effective manner (McKeachie et al. 1986). According to O'Malley et al. (1985), learning strategies have the potential to be an effective learning tool. Hence, teachers should help students become aware of alternative ways of learning (McKeachie, 1988). As Christen and Murphy (1985) emphasise, teachers should not assume students know how to learn or what is important to learn. These skills and strategies must be taught in an organized manner. However, Osborne and Collins (2000) point out that the science curriculum continues to place an emphasis on the comprehension and recall of basic concepts. Biology in many high classes is still primarily taught by

lecturing which only increases students' reluctance even more. Teachers need to make the curriculum as relevant and as exciting for students as possible (Trumper, 2006), and discover which learning strategies their students tend to use (Belzer, Miller & Shoemake, 2003). The goal of science courses should go beyond transmitting knowledge to enhancing students' awareness of strategies for learning and improving positive attitudes toward science. Teaching processes should facilitate the development of both learning strategies (McKeachie et al. 1986, p. 1) and of positive attitudes (Fraser, 1982). Teachers must be willing to accept the responsibility of teaching students more than biology and the responsibility of teaching students how to learn better (Tomanek & Montplaisir, 2004). The competent use of learning strategies might contribute toward a deeper understanding of biology.

Finally, the message emerging from the results of this study is the importance of simultaneously considering student attitudes toward biology and learning strategies used to study biology when assessing factors related to achievement in biology. Teachers should focus on ways to develop both positive attitudes toward biology and effective learning strategies so that achievement in biology can be enhanced and improved.

Future studies should explore these relationships in different cultural contexts and extend the scope to other disciplines such as physics and chemistry. From studies covering different subjects and ranges of student ages, different models may be obtained (Mattern & Schau, 2002). This may help to obtain an accurate and whole picture of the complex causal relationships between attitude, learning strategies, and achievement, etc. We suggest that observing students and interviewing a sample of them may contribute toward obtaining more information regarding attitudes and learning strategies.

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'Biyoloji Dersine Yönelik Tutum' ve 'Öğrenme Stratejileri' Birlikte Başarıyı Tahmin Edebilir mi?

(Özet)

Problem Durumu

Biyolojiye ve öğrenmeye yönelik tutumlar geçmişte olduğu gibi günümüzde de eğitimcilerin önemli ilgi alanları arasındadır. Tutumlarla ilgili literatür incelendiğinde, yapılan araştırmaların daha çok genel fene (fen eğitimine) yönelik tutumları kapsadığı görülmektedir. Biyoloji ve fizik gibi özel alana yönelik tutumlarla ilgili çalışmalar az sayıdadır. Bununla birlikte, tutum ve biyoloji başarısı arasındaki ilişkiyi inceleyen az sayıdaki araştırma (Prokop ve diğ., 2007), tutum ve fen başarısı arasındaki ilişkiyi inceleyen diğer araştırmalarda olduğu gibi tutum ve başarı arasında pozitif bir ilişki olduğunu ortaya koymuşlardır.

Öğrencilerin fen öğrenmesini ya da fen başarısını etkileyen faktörlerden bir tanesi de öğrenme stratejileridir. Literatürde pek çok çalışmada öğrenme stratejileri ile olumlu akademik kazanımlar arasındaki ilişki araştırılmış ve aralarında pozitif ilişki olduğu belirlenmiştir. Öğrenme stratejileri ile ilgili dikkat edilmesi gereken önemli bir husus, Weinstein ve Mayer (1986)'in belirttiği gibi, bir bireyin öğrenme stratejisi kullanımı öğrenme durumlarının tümü için geçerli olmayabilir. Birey farklı öğrenme durumlarında farklı öğrenme stratejisi kullanabilir. Birey, fen dersi kapsamında fizikle ilgili bir konuyu öğrenirken farklı, biyoloji ile ilgili bir konuyu öğrenirken farklı öğrenme stratejisi kullanabilir. Bu nedenle, genel olarak öğrenme stratejisi ve fen başarısı arasındaki ilişkiyi inceleyen çalışmalardan farklı olarak, bu çalışmada biyoloji başarısı ve biyoloji öğrenme stratejisi arasındaki ilişkiyi incelemek daha geçerli ve bilgilendirici olabilir. Özetlemek gerekirse, mevcut literatür incelendiğinde hem tutum ve başarı hem de öğrenme stratejisi ile başarı arasında olumlu bir ilişki olduğu ortaya çıkmaktadır. Bununla birlikte, öğrencilerin fene karşı tutumu ve fen başarısı ile öğrencilerin öğrenme stratejileri ve başarıları arasındaki ilişki konusunda çok sayıda araştırma olmasına rağmen, mevcut literatürde öğrencilerin biyolojiye karşı tutumları ile biyoloji öğrenirken kullandıkları öğrenme stratejilerinin birlikte biyoloji dersindeki başarıyı nasıl etkilediği ya da tahmin ettiği konusunda herhangi bir çalışmaya rastlamak zordur.

Araştırmanın Amacı

Bu çalışmanın amacı, öğrencilerin biyoloji dersine yönelik tutumlarının ve biyoloji öğrenme stratejilerinin, onların biyoloji dersindeki başarılarını birlikte nasıl tahmin ettiğini belirlemektir. Bu ilişkiyi gösteren en iyi yapı belirlenmeye çalışılmıştır.

Araştırmanın Yöntemi

Tarama modelindeki bu araştırma, 2006-2007 öğretim yılı II. yarıyılında Edirne İli Merkez İlçedeki yedi lisede öğrenim görmekte olan 890 (507 erkek, 383 kız) öğrencini katılımı ile gerçekleştirilmiştir. Araştırma verileri Arıcak ve Ilgaz (2007) tarafından geliştirilen "Biyoloji Dersine Yönelik Tutum Ölçeği" ile Sucuoğlu (2006) tarafından geliştirilen "Biyoloji Dersinde Kullanılan Öğrenme Stratejileri Ölçeği" (BKÖSÖ) ile toplanmıştır. Ayrıca öğrencilerin 2006-2007 öğretim yılı yılsonu akademik başarı ortalamaları okullarından alınmıştır. Araştırmanın verilerinin analizinde betimsel

istatistikler yanı sıra biyoloji dersine yönelik yapısal eşitlik model tutumun ve öğrenme stratejilerinin başarısı üzerindeki etkisi yapısal eşitlik modeli bağlamında yol analizi ile incelenmiştir. Yol analizinde Maximum Likelihood yöntemi kullanılmıştır. Analiz işlemleri için SPSS 15.0, model oluşturmak için AMOS 7.0 programları kullanılmıştır.

Araştırmanın Bulguları

Sırasıyla öğrencilerin biyoloji dersi başarı ortalaması 70.46, standart sapma 16.87; derse yönelik tutum ortalaması 71.12, standart sapması 14.87'dir. Öğrenme stratejilerinin alt boyutlarının ortalamaları 10.93 ile 28.70 arasında değişirken standart sapmaları 3.16 ile 7.74 arasında değişmektedir. Bu değişkenlerin birbirleriyle olan korelasyonu .16 ile .52 arasında değişmekte olup anlamlıdır. Bu değişkenlerin birlikte nasıl bir ilişkide olduğunu gösteren modelde tutum ile öğrenme stratejileri ilişkili olup ($r = .60$, $p<.05$) ikisi birlikte başarıyı tahmin etmektedirler ($\beta = .17$, $p < .001$ and $\beta = .17$, $p < .001$). Oluşturulan modelin uyum indeksleri $\chi^2 = 47{,}249$, $df = 13$, $p = .00$; RMSEA = .054; NFI = .973; TLI = .957; CFI = .98 olarak elde edilmiştir.

Araştırmanın Sonuçları

Yapısal eşitlik modelinden elde edilen sonuçlar, öğrencilerin biyolojiye yönelik tutumlarının ve öğrenme stratejilerinin biyoloji dersindeki başarıları ile ilişkili olduğunu göstermektedir. Modelde, biyolojiye yönelik tutum puanları ile biyoloji öğrenme stratejileri puanları öğrencilerin yılsonu başarı puanlarını anlamlı bir biçimde tahmin etmektedir. Bu bağlamda, lise öğrencilerinin tutum ve öğrenme stratejileri kullanımının onların performanslarını eşit bir biçimde etkilediği görülmektedir. Ayrıca, bu iki değişken biyoloji dersindeki başarıyı tahmin eden önemli faktörlerden iki tanesi olarak da düşünülebilir. Bu sonuçlar etkili biyoloji öğrenimi açısından önemli vurgulara sahiptir.

Öğrenciler okulda öğrenme sürecini etkileyen önemli faktörleri gözardı ederek, daha çok biyoloji dersinin içeriğine odaklanma eğilimindedirler. Bu nedenle, öğretmenler biyoloji derslerinde hem öğrencilerin strateji kullanımlarına hem de biyolojiye yönelik tutumlarına özel önem vermelidirler. Koballa (1992)'ya göre, öğrencilerin fene yönelik olumlu tutumlarının geliştirilmesi fen öğretmenlerinin görevlerinin önemli bir parçasıdır.

Biyoloji derslerinde uygulanan öğretim faaliyetleri, öğrencilere biyoloji dersine yönelik olumlu tutum ve etkili öğrenme stratejileri kazandıracak şekilde tasarlanmalıdır. McKeachie ve diğerlerine (1986) göre, bazı öğrenciler kendi kendine öğrenme stratejileri geliştirip kullanabilseler de, pek çoğu öğrenme stratejilerini geliştiremez ya da bunları etkili bir biçimde kullanamaz. Bundan dolayı öğretmenler, öğrenme stratejilerinin etkili öğrenme bakımından önemli bir role sahip olduğunu göz önünde bulundurarak, öğrencilere alternatif öğrenme biçimleri hakında yardımcı olmalıdırlar. Öğretmenler, öğrencilerin nasıl öğrenildiğini ya da öğrenmek için neyin önemli olduğu konusunda bilgili ve bilinçli olduklarını varsaymamalıdırlar. Bu beceri ve stratejileri planlı bir biçimde öğrencilere kazandırmaya çalışmalıdırlar.

Öneriler

Gelecek çalışmalar bu çalışmada yer alan ilişikleri farklı kültür ve disiplinlerde araştırabilirler. Farklı konu, yaş dağılımı ve modelle çalışılabilir (Mattern ve Schau, 2002). Böyle kapsamlı çalışmalardan elde edilecek sonuçlar, tutum, öğrenme stratejileri ve başarı vb. değişkenler arasındaki karmaşık nedensel ilişkileri daha doğru ve bütüncül bir şekilde görmemize ve yorumlamamıza katkıda bulunabilir. Ayrıca, veri toplama sürecine gözlem ve görüşmenin dahil edilmesi öğrenme stratejileri ve tutumlar ile ilgili daha güvenilir bilgi edinilmesini sağlayabilir.

Anahtar Sözcükler: Tutumlar, öğrenme stratejileri, biyoloji başarısı, biyoloji öğrenme