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The Effect of Tenth Graders' Learning Style Preferences on Their Biology Achievement

Onuncu Sınıf Öğrencilerinin Tercih Ettikleri Öğrenme Stillerinin Biyoloji Başarılarına Etkisi

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Abstract

This study aimed to investigate the effect of learning styles on tenth grade Turkish students' biology achievement. In order to investigate the specified purpose of the study, 980 tenth grade students were administered the Turkish version of the Learning Style Inventory and a Biology Achievement Test. One-way analysis of variance indicated statistically significant mean differences across learning styles with respect to biology achievement. The results of the study revealed that majority of high school students had the assimilating type learning style. Assimilator students were found to be more successful than accommodators, divergers, and convergers.

Key words: Learning styles, biology achievement, high school students.

Öz

Bu çalışmanın amacı tercih edilen öğrenme stillerinin lise 2. sınıf öğrencilerinin biyoloji başarısına olan etkisini araştırmaktır. Bu amaç doğrultusunda 980 lise 2. sınıf öğrencisine Öğrenme Stilleri Envanteri ve Biyoloji Başarı Testi uygulanmıştır. Tek yönlü varyans analizi sonuçları öğrencilerin tercih ettikleri öğrenme stilleri ile biyoloji başarıları arasında anlamlı bir fark olduğunu göstermiştir. Ayrıca, özümseyen öğrenme stiline sahip öğrenciler, ayrıştıran, değiştiren ve yerleştiren öğrenme stilene sahip olan öğrencilere göre daha başarılı bulunmuştur.

Anahtar Sözcükler: Öğrenme stilleri, biyoloji başarısı, lise öğrencileri.ory.

Introduction

The state of biology education in Turkish high schools has been very poor for many years (Özcan, 2004). Learning biology without fully understanding has been a common outcome of biology instruction. Students are often not sure what they know about biology and when or how to use what they know. The results of such learning are evident in the number of biology questions answered correctly in the university entrance examinations in Turkey over the last few years. When the importance of science education in the development of critical, informed and productive citizens in a rapidly changing technological society is considered, there is a great need for improvement of biology education in Turkish high schools. Determining the reasons of poor biology performance in Turkish high schools would be the first step in attempting to increase the level of biology achievement and to lead possible instructional innovations. One of the prevailing problems of Turkish students is that they do not know how to learn the material presented meaningfully in the classroom (Özcan, 2004). Educational research has shown us that what students learn is significantly influenced by their learning styles. Learning style can be defined as the way each learner perceives and processes new information for storage and retrieval (Williams, 2001). Students

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have different learning style preferences for taking in and processing information (Felder, 1996). It is known that learning styles are identifiable, and greater academic achievement results when students' learning styles are considered in the selection of instructional methods (Shaughnessy, 1998). Therefore, in this study, we aimed to examine the effect of learning styles on Turkish students' Biology achievement and provide suggestions for teachers to match their teaching styles with students' learning styles in order to increase the level of Biology achievement.

There has always been great interest in the analysis of individual variation in educational psychology. Educational psychologists have understood that an important key to facilitate individuals' learning is to deal with the differences in their cognitive functions (Cano-Garcia and Hewitt-Hughes, 2000). All people show differences in how they perceive and acquire information, conceptualize, form ideas, process and memorize, form value judgments, and in the way they behave (Hickson and Baltimore, 1996). A substantial amount of research in education and psychology has been directed toward identifying the effects of those individual differences in learning styles (Collinson, 2000). Educators are becoming increasingly aware that an essential element in improving the academic success of learners is recognizing the way in which they learn. As Brandt (1990) has indicated, the last ten years have witnessed considerable experimentation with learning styles and their relation to student learning. Proponents of this approach believe that, by exploring learning styles, positive effects upon student motivation and achievement are produced (Matthews, 1996).

Today a number of learning style models exists. For the purpose of this study, however, Kolb's model for learning style was utilized. His model was developed from a specific learning theory called 'experiential learning'. Experiential learning theory (ELT) defines learning as the process whereby knowledge is created through the transformation of experience. In the ELT model, learning is conceived as a four-stage cycle. Kolb (1985) believes that people learn through experience, and as they learn they move through this four-stage cycle. The stages are Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC) and Active Experimentation (AE). Concrete Experience emphasizes experiential learning, as opposed to abstract conceptualization, which defines a preference for development of analytic theories and concepts to explain events. Active Experimentation describes a preference for action and risk taking and contrasts with reflective observation, which is marked by a propensity to view problems from multiple perspectives before committing to an action.

In 1976, David Kolb developed the Learning Style Inventory (LSI) in order to measure the learning style preferences defined by his theory of experiential learning (Atkinson, 1991). In 1985, Kolb and his associates revised the LSI. With the revision, Kolb started a new phase of research in an attempt to measure learning styles effectively according to experiential learning theory. While people tested on the LSI show many different patterns of scores, research on the instrument has identified four statistically prevailing learning styles: Diverger, Assimilator, Converger, and Accommodator. In his manual, Kolb (1985) describes individuals who fall into these four basic learning style categories. Brief descriptions of the four basic learning styles are presented below.

Diverger: The Diverging style's dominant learning abilities are concrete experience (CE) and reflective observation (RO). People with this learning style grasp the experience through concrete experience and transform the experience through reflective observation.

Assimilator: The Assimilating style's dominant learning abilities are abstract conceptualization (AC) and reflective observation (RO). People with this learning style grasp the experience through abstract conceptualization and transform it through reflective observations.

Converger: The Converging style's dominant learning abilities are abstract conceptualization (AC) and active experimentation (AE). People with this learning style grasp experience through abstract conceptualization and transform it through active experimentation.

Accommodator: The Accommodating style's dominant learning abilities are concrete experience (CE) and

active experimentation (AE). People with this learning style grasp the experience through concrete experience and transform it through active experimentation.

Method

Sample

In this study students attending science-mathematics classes were selected because this study would provide information about the relationship between student learning style and achievement in biology. Accordingly, a total of 980 tenth-grade students (54.5% boys, 45.5%girls) with a mean age of 16.5 years, from science and mathematics classes of a total of 11 public and Anatolian high schools from the two large districts of Ankara participated in the study. Cluster random sampling integrated with convenience sampling was used to obtain the sample. The two districts from which the sample was chosen were selected through convenience sampling. Schools, which were thought of as clusters, were randomly selected from each of these districts.

Instruments

Learning Style Inventory (LSI)

The Learning Style Inventory (Kolb, 1985) is a 12-item self-reporting instrument in which individuals attempt to describe their learning styles. The items consist of short statements concerning learning situations and each of the items asks respondents to rank four sentence endings that correspond to the four learning modes- Concrete Experience (whose characteristic word is feeling), Reflective Observation (watching), Abstract Conceptualization (thinking), and Active Experimentation (doing). The raw scores for each of the four learning modes range from 12 to 48. Higher scores indicate greater emphasis on a particular learning mode. The inventory also measures an individual's relative emphasis across two dimensions, CE versus AC and AE versus RO. These two dimensions bisect on a learning style grid to form four quadrants reflecting four learning styles; accommodator, diverger, assimilator, and converger. In order to find the dominant learning style of an individual, the scores from four learning modes are combined and subtracted. The combination score (AC-CE) reflects the extent to which the respondent emphasizes abstractness over concreteness. The score (AE-RO) indicates the extent to which the respondent emphasizes action over reflection. The score of AC-CE and AE-RO are then plotted on the learning style grid to determine the learner's dominant learning style is accommodating, diverging, converging or assimilating. In this study, Turkish version of LSI was used (Aşkar and Akkoyunlu, 1993).

Biology Achievement Test (BAT)

A 20-item multiple-choice Biology Achievement Test was designed on the basis of the ninth grade biology curriculum, which is the same in all schools due to the requirements of Ministry of Education. The content validity of the test was established by a group of experts in biology education; and measurement and evaluation together with biology teachers. The internal consistency reliability (Cronbach's alpha coefficient) of the test was found to be .70.

A one-way analysis of variance was conducted to examine the effect of learning styles on biology achievement.

Results

The study was conducted to investigate the effect of learning styles on students' biology achievement in Turkish high schools. Additionally, learning style patterns of the students were identified at the end of the study. According to the results of LSI, the distribution of the students in the four learning styles was determined. A majority (50.2%) were assimilators, followed by convergers (26.2%), divergers (15.1%) and accommodator (8.5%).

In Table 1, the biology achievement test mean scores of students with different learning style types were presented. According to the findings of the study, students with an assimilating learning style had the highest mean value of 10.10, which means that assimilators had a greater success in biology achievement test than the others.

As mentioned before, one-way analysis of variance was conducted to investigate the effect of learning styles on biology achievement. The independent variable, learning styles, included four levels: accommodator,

Table 1.
Biology Achievement Test Mean Scores of Students Having Different Learning Styles

Learning Styles	BAT Mean Scores
Accommodator	9.59
Diverger	8.90
Converger	9.85
Assimilator	10.10

diverger, converger, and assimilator. The dependent variable was biology achievement. The significance level was set at 0.05. As Table 2 indicates, there were statistically significant mean differences across learning styles with respect to biology achievement $F(3,976)= 4.32$, $p=0.005$, $\eta^2= 0.013$.

Table 2.
Results of the One-Way Analysis of Variance

Source	*df*	*F*	*p*
Learning Styles	3	4.32	.005
Error	976		
Total	980		

Follow-up tests (Scheffe test) were conducted to evaluate pairwise differences among the means. The results indicated that there was a statistically significant mean difference between diverger and assimilator students in biology achievement (p=0.006). There was no significant mean difference between students with other learning styles. Assimilator students, as indicated by mean biology achievement scores, were the most successful students in this sample.

Educational Importance

Learning style emerged as a factor affecting biology achievement at the end of current study. Our findings showed that assimilators' biology achievement mean scores were higher than that of convergers, divergers, and accommodators. Since higher scores mean greater biology achievement, it can be concluded that assimilators were more successful in biology than the others for this population.

One possible reason for this result may be the teaching methods generally preferred by Turkish biology teachers. The most commonly used teaching method is lecturing in Turkish schools (Özcan, 2004). People with the assimilator learning style prefer mostly reading and lectures (Kolb, 1985). Therefore, the match between teaching and learning style may lead to higher achievement by students with an assimilator learning style. This finding supports the expectations of Sternberg and Grigorenko (1997) who stated that the level of performance would be higher when there was a congruence of preferred learning style and teaching method. Assessment techniques preferred by many teachers, such as paper-and-pencil tests that emphasize memorization of factual knowledge, can be another factor leading to greater success of assimilators.

Assimilators have emerged as the most frequent learning style in our population. Kolb (1985), stated that mathematics and science attracts individuals who are assimilators and the findings of this research supported that view. Since our population included only students attending mathematics and science groups, these results are not surprising.

It seems possible that the Kolb Learning Style Inventory can be used to identify students' learning styles. Teachers then may use the information gathered to design classroom environments, teaching strategies, and classroom activities that may potentially enhance the biology learning of most of the students.

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