ORIGINAL ARTICLE

The Effect of Educational Game Method on Learning Achievements of Seventh-grade Students with Different Learning Styles

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ABSTRACT

This research aimed to investigate the effect of the educational game method on the learning achievements of seventh-grade students with different learning styles. A case study was used in the research. The study group of the study consisted of 120 secondary school seventh-grade students studying in the central and rural areas of Erzurum. The Kolb Learning Style Inventory and the achievement test developed by the researcher were used as data collection tools. Descriptive statistics, dependent groups t-test, and one-way ANOVA were used in data analysis. As a result of the research, it was determined that the students in this study have the most diverging, least accommodating learning style. It was determined that the educational game method significantly increased learning achievement in all learning styles. It was determined that there was no statistically significant difference among the learning achievements of students with different learning styles applied educational game method. The effects of the educational game method can be evaluated by applying for a longer period of time in teaching different subjects.

KEY WORDS: achievement; educational game; energy; force; learning style

INTRODUCTION

Kolb's Learning Styles

For the survival of societies in the future, qualified individuals should be raised. The training for qualified individuals depends on the education quality that the society provides. However, the education quality is based on the education policies of each society. Each individual has unique characteristics and these characteristics have a significant impact on their learning. Therefore, societies should consider the characteristics of individuals while determining their educational policies.

As a feature of individuals, learning styles have become widespread everywhere in the last 30 years and have been widely accepted among educators, parents, and the general public at all levels (Cuevas, 2015; Pashler et al., 2009). Learning styles, which are generally common in teacher education and adult education programs (Bishka, 2010), have entered the curriculum of K-12 schools in many countries (Scott, 2010). Learning styles are defined in different ways by many researchers. Keefe (1979) defines learning styles as "characteristic cognitive, affective, and psychological behaviors that serve as relatively stable indicators of how students perceive, interact, and react to the learning environment" (p. 4). According to Pashler et al. (2009), learning styles mean that different individuals prefer to process information in different ways, and therefore they learn more effectively when they receive the information in accordance with their preferences.

Kolb's (1984; 1985) inventories are the most frequently used learning styles models in recently published research (Açışlı, 2016; Can, 2011; Ekici, 2013; Karademir and Tezel, 2010). Kolb bases the learning style model on the experiential learning theory. In this theory, knowledge is formed through the transformation of experiences (Kolb, 1984). Kolb inventory classifies students into two dimensions: A preferred perception mode (concrete or abstract) and a preferred processing mode (active experiment or reflective observation) (Gogus and Gunes, 2011; Zacharis, 2011). Based on these categories, Kolb produced the four learning styles given in Figure 1. He divides students into one of four categories: Divergers prefer feeling and watching (concrete, reflective); assimilators thinking and watching (abstract and reflective); convergers thinking and doing (abstract and active); and accommodators feeling and doing (concrete and active) (Kappe et al., 2009; Martin, 2010):

Diverging is the intersection of concrete experience and reflective observation. Learners in this style prefer watching instead of doing. They tend to gather information and use imagination to solve problems. They take care of individuals and prefer to work in groups. They perform better when they are asked to produce alternative ideas such as brainstorming (Peker, 2003). In educational situations, individuals with diverging learning styles prefer conferences, symposiums, or
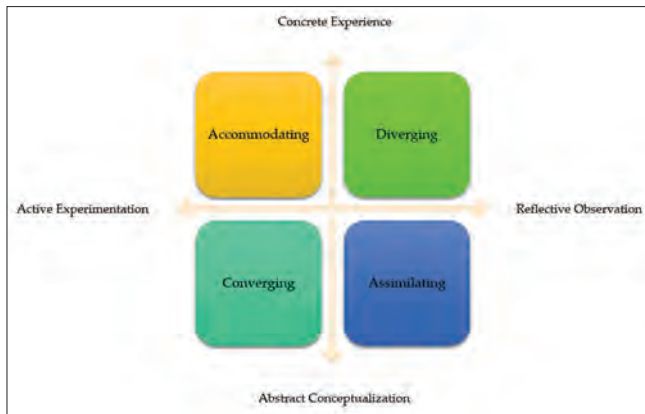
Figure 1: Kolb's learning styles

reading environments that offer them the opportunity to watch, and this allows them to embody examples (Gayle, 2002). Individuals who prefer organizational development, such as social scientists, mostly have this learning style (Aşkar and Akkoyunlu, 1993; Kolb, 1984; McCarthy, 1987).

Assimilating is the intersection of reflective observation and abstract conceptualization. Instead of practicing, this style needs a good and clear explanation. These learners are good at understanding comprehensive information and organizing it logically. While concentrating on abstract concepts and ideas, they focus less on social issues. They attach more importance to the logical validity of a theory than its practical value. Their strengths are in planning, modeling, recognizing problems, and developing theory, whereas their weaknesses are in imagining, practicing, and taking a planned approach. In educational situations, individuals with assimilating learning styles prefer organized and structured teaching; they enjoy reading and developing theory (Gayle, 2002). Researchers and designers often have this learning style (Aşkar and Akkoyunlu, 1993; Kolb, 1984; McCarthy, 1987).

Converging is the intersection of abstract conceptualization and active experimentation. Those with this learning style use what they have learned to solve problems. They are good at finding practical uses for theories and concepts. They are affected by technical tasks. Weaknesses include solving the wrong problem, making quick decisions, missing the focus, not testing thoughts, and having scattered thoughts. Individuals with this style are the best in situations such as traditional intelligence tests where there is only one correct answer or solution for a question or problem (Peker, 2003). Engineers often have this learning style (Aşkar and Akkoyunlu, 1993; Kolb, 1984; McCarthy, 1987).

Accommodating is the intersection of active experimentation and concrete experience. These learners prefer experiences rather than theory. They rely on others for information and use their intuition rather than logical analysis. They like to make new plans and experience new experiences. Their strongest strengths are finishing, leadership, and willingness to take risks. Weaknesses are features such as doing purposeless activities, not finishing work in time, making impractical plans, and not acting purposefully. These individuals are best suited

for situations where they have to adapt themselves to change (Peker, 2003). Marketers and clerks tend to fall into this group (Aşkar and Akkoyunlu, 1993; Kolb, 1984; McCarthy, 1987).

Since learning style taxonomies are intended to be applied in the context of an educational game, taxonomy should be able to include each student in one of its categories. Educational games provide contexts and places that learners learn by doing and experience, so the classification should be based on experimental learning. Kolb's learning styles inventory is based on the concept of experiential learning and a learning cycle (Kolb and Kolb, 2005). Kolb argues that a student can enter this cycle at any point, and learning is a process that cycles these four styles repeatedly. As a student progresses through the experience, they go through these four stages in a unique order and time. It is this uniqueness that depicts their own learning style. Students tend to prefer one stage of the cycle to others, and since there is a negative correlation between the axes, the student who prefers one side of the axis avoids the other (Hamdaoui et al., 2018). For this reason, the use of Kolb's learning styles was preferred in the research.

Research on learning styles in which the Kolb learning style inventory was used has generally focused on examining the relationship between learning style and various variables. Fowler (2002) used learning styles to reveal how radiologists learned, and Pinto et al. (1994) examined changes in university students' learning styles over 3 years in their longitudinal study. Unlike other researchers, Loo (2002) preferred to examine the learning styles of business students with meta-analysis method. Can (2011), Demir (2006), Hasırcı (2006), and Karademir and Tezel (2010) examined the learning styles of teacher candidates in terms of different variables such as age, grade level, gender, type of education, type of high school graduated from, and the number of books read annually. While Ergür (2000) determined the learning styles of university students and faculty members on age and gender variables like the studies mentioned above, and differently by examining the academic title, the university where the doctorate was held, the department they work in, the university entrance score type, Kariuki (1995) examined the relationship between learning style adaptations and class perception. In the literature, there are studies comparing the learning styles of high school and university students as well as faculty member undergraduate student comparisons (Matthews and Hamby, 1995). Açışlı (2016) investigated the relationship between pre-service teachers' learning styles and critical thinking skills, Elmalı and Yıldız (2017), inquiry skills, epistemological beliefs and learning styles, and Köroğlu and Sıvacı (2017) investigated the relationship between special field competencies and learning styles. Demirbaş and Demirkan (2003) examined the effect of learning styles on the design performance of undergraduate students, Lynch et al. (1998) examined the effect of medical students' exam performance and Akkoyunlu (1995) investigated the effects of learning styles on teachers' attitudes toward computers. Başbay et al. (2018) who preferred to work with middle school students instead of working with adults or university students, examined the relationship between students' learning styles and studying habits. There are studies in the

literature that examine the relationship between undergraduate students' learning styles and achievements (Ekici, 2013; Kılıç and Karadeniz, 2004; Mutlu, 2008; Yoon, 2000). Unlike the general studies in the literature, Kılıç (2002) examined the effects of undergraduate students' learning styles on learning activities preferences and academic achievement in web-based learning created with activities suitable for learning styles. As can be seen, the studies in the literature have focused on individuals at undergraduate level and their relationship with very different variables from each other has been examined. In this study, unlike the general studies in the literature, students at secondary school level were studied. Achievement variable was considered, but while doing this, it was aimed to examine the effect of educational games developed in accordance with the learning nature of different learning styles on learning achievement.

Educational Game Method

Games enable students to learn through their own experience as a natural learning tool (Özgür, 2000). Educational games are the design of games to realize learning in a real entertainment environment (Michael and Chen, 2006). Learning is more effective when the learning environment is fun and is also suitable for students with different learning styles, as it includes central elements such as curiosity, adventure, imagination, strategy, role-playing, sports, challenge, visualization, problem solving, discovery, experiment, and creativity (Gros, 2007; Habraken, 2004; Squire and Jenkins, 2003; Stewart, 2013). While designing educational games, details regarding the purpose of the game, the things to be done for the game, the gameplay, evaluation, and development of the game should be meticulously planned (Akandere, 2012; Pehlivan, 2014). Well-designed educational games provide benefits in many ways such as increasing active participation in the lesson, providing motivation, lengthening attention, reducing disciplinary problems, facilitating learning and remembering, developing cognitive, affective and psychomotor skills, increasing awareness and self-confidence, problem solving, critical thinking, creativity, taking words in the group, listening, conveying thoughts, respecting different thoughts, and developing mutual skills (Akandere, 2012; Bilen, 2002; Kirazoğlu, 2000; Pehlivan, 2014; Sel, 1987).

When the literature about games was examined, it was seen that digital games are preferred (Peker, 2018; Barringer et al., 2018; Dong, 2018; Hung et al., 2018; Tsai and Tsai, 2018), and real media games are less likely to be used (Peker, 2018; Kaya and Elgün, 2015; Yıldız et al., 2018). This study preferred to use real environment games instead of digital games, and attention was paid to the use of elements suitable for the nature of learning styles in the design of games. In the literature about games, there are studies examining the effects of games on students' achievement (Bressler, 2014; Clerkin and Gilligan, 2018; Martin, 2012; Peng, 2009), or comparing their effects with the traditional method (Peker, 2018; Demircioğlu and Akdemir, 2019; Little, 2015; Yıldız et al., 2018; Yıldız et al., 2016). There are a limited number of studies in the literature that combine game and learning styles. Çakır and Akbaş (2013) examined the relationship between high school students' learning styles and playing computer games.

Hamdaoui et al. (2018) studied the relationship between high school students' learning and play styles. This research will contribute to the literature due to the use of less preferred game type and the handling of game and learning styles together.

The aim of this research was to investigate the effect of educational game method on the learning success of seventh-grade students with different learning styles. The study was conducted on the topic of "Force and Energy." The problem of the research was determined as: "What is the effect of educational game method on the learning success of seventh-grade students with different learning styles?" In this context, answers to the following research questions were sought:

1. How are the learning styles of the students dispersed?
2. Does the educational game method have an effect on the learning achievement of students with different learning styles?
3. Which learning style is the educational game method more effective in increasing the learning achievement?

METHOD

Case study was used in the research. Case study is the method by which one or more situations, events, groups, or interconnected systems are examined (Glesne, 2011; McMillan, 2000). It has been noted that case studies are suitable for research in the field of education, since the training processes include more than one case or variable (Merriam, 2009). In this research, the most appropriate method for the purpose of the study was case study since it examined how the educational game method affected the learning achievement of students with different learning styles. This research was conducted under the ethical supervision of the host university.

Study Group

The study group of the research consisted of 120 students studying in the central and rural areas of Erzurum in the 2019–2020 academic years. The necessary permissions were obtained from the parents of the students, provided that the identities of the students are kept confidential and the data obtained from them are used only for scientific purposes. First, schools, and classes were determined by considering the structure of the school, class sizes, gender distribution of students in the classes, distribution of achievement status, and the fact that students used the educational game method in their previous lessons. For this purpose, the criterion sampling method was used and classes meeting the mentioned criteria were selected. Criterion sampling is determining the criteria related to the situations/individuals that the researcher will work in and determining the situations/individuals that meet this criterion and working on them (Büyüköztürk et al., 2015). It determined two secondary schools with a medium socioeconomic structure and practices were carried out in two classes in these schools. Selected classes size ranged from 28 to 32. The distribution of male and female students in the classes is close to each other and the distribution in all classes is similar. Achievement of the students was obtained from the school management, and

because of the analysis, it was determined that the classes had a similar structure. This is not a new and different application for students in the classes in which the application was made, as the educational game was applied in the science lessons before.

Data Collection Tools

Learning achievement test

The learning achievement test used in the research was prepared by the researcher. The table of specifications was prepared by considering the unit learning outcomes determined by the Ministry of National Education. Considering the learning outcomes, a draft form of 28 questions was created by taking questions from various sources. Together with the draft expert evaluation form prepared, it was presented to the opinion of two science education experts, one assessment and evaluation expert, and two science teachers. According to the experts' opinions, it was determined that the test was prepared to measure a single feature, the items provided the scope of the learning outcomes fully, and in a few questions, formal arrangement was required. Pilot scheme was made with 120 seventh-grade students selected from rural and central regions by making formal arrangements requested by experts. As a result of the analysis of the data obtained from the pilot scheme, two questions with an item discrimination index below 0.20 and one question with item difficulty index 0.1 were removed from the test. Since other questions measuring the gains measured by the excluded questions were included in the test, there was no problem in terms of content validity. The discriminative indexes of the remaining questions range from 0.31 to 0.64. Difficulty indexes were found to vary between 0.22 and 0.83, and the average difficulty index was 0.51. The KR-20 reliability coefficient of the test was calculated as 0.79. Since the assessments are made over 100 points at the secondary school level, the achievement points were calculated by giving the correct answers 4 points and the mistakes 0 points.

Kolb learning style inventory

The learning style inventory used in the research was developed by Kolb (1984) and adapted to Turkish by Aşkar and Akkoyunlu (1993). The inventory consists of 12 items and each question contains items covering four situations. Those who answered the inventory rank these four items in each question by scoring between 4 and 1 according to their suitability level. Four points reflect the most suitable situation for them, and 1 point reflects the least suitable situation for them. Each item represents one of the Concrete Experience,

Reflective Observation, Abstract Conceptualization, or Active Experience learning format in the Kolb learning style model. As a result of the points given by the respondents to each item, a score between 12 and 48 is obtained and based on these scores, combined scores are obtained. The point where the score obtained from the combined points intersects gives the most appropriate learning style to the individual. In this way, it is determined which one of the learning styles that the individual has diverging, assimilating, converging, or accommodating.

Analysis of data

Data suitability for parametric tests was tested according to the assumptions of making observations independently of each other, obtaining them in an evenly spaced or proportional scale, showing normal distribution, and homogeneity of variances (Field, 2013). The data obtained from the learning achievement test are equally spaced and the data were obtained independently from each other. Normality values of the data were analyzed by Shapiro–Wilk normality test, skewness-kurtosis coefficients, and central tendency measures. Homogeneity of variances was analyzed by Levene test. As a result of the examinations, the suitability of the data to parametric tests was determined, dependent groups t-test and one-way ANOVA were used in the analysis. Analyzes were made through the SPSS 21 program and the significance value in statistical analysis was accepted as 0.05. The effect size value was calculated in terms of eta-square (Cohen, 1988). The normality values of the data are given in Table 1.

Application

The research was carried out in the seventh-grade "Force and Energy" unit in the 2019–2020 academic years. Since the time suggested by Ministry of Education for this unit is 20 lessons, the method application was completed in 20 lesson hours. The research was completed in 23 lesson hours including the pretest, Kolb Learning Style Inventory, and the post-test application. In the research process, the learning outcomes given in Figure 2 were studied.

In the research, educational games of "Reader," "Knowledge Tree," and "Hands Up" developed by Yıldız (2019) were revised to the learning outcomes stated in Figure 2. The unit is presented entirely with educational games. At the beginning of each game, the game was introduced to the students, the rules of the game were explained, and a sample game application was made. When the students understood the game, games were

Table 1: Normality values of the data

Test	Groups	Kurtosis	Skewness	Min	Max	Median	Mean	Std dev	Shapiro-Wilk*
Pre-test	Diverging	−0.309	0.065	7.00	64.00	30.00	31.89	12.78	0.699
	Converging	−0.456	−0.163	7.00	59.00	33.00	32.03	12.81	0.555
	Assimilating	−1.095	0.065	7.00	56.00	28.00	29.57	14.58	0.476
	Accommodating	−1.179	−0.192	7.00	50.00	30.00	30.67	14.76	0.097
Post-test	Diverging	−1.008	−0.469	48.00	96.00	80.00	75.32	13.85	0.052
	Converging	−0.796	−0.561	36.00	100.00	80.00	72.74	18.65	0.047
	Assimilating	−0.466	−0.551	28.00	96.00	72.00	69.93	18.56	0.049
	Accommodating	1.788	−1.474	28.00	96.00	84.00	76.83	20.67	0.106

*$\rho > 0.05$
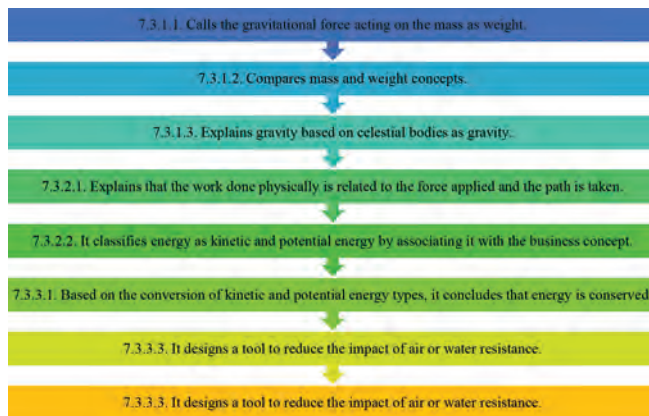
Figure 2: Force and ENERGY UNIT LEARNING OUTCOMES (Ministry of Education, 2018)

played with the participation of all students. When each round of the game was completed, the researcher both evaluated the game and tried to focus the attention of the students on these concepts by repeating the concepts in the game. It has been explained that to keep the competition between students at a positive level, as there is a winner-loser situation in games; evaluation will be made by examining their performances in all games and their positive and negative behaviors during the games. In the formation of playgroups, care was taken to distribute timid and confident students, unsuccessful and successful students to the groups. The group or groups that lost in the game were encouraged to win the next games to motivate them. The losing reasons of the losing groups were analyzed, feedbacks were given to the groups at the end of the game, and they were made to complete their deficiencies. In the games, it was tried to make students concentrate on learning and entertainment rather than winning. The activities to be done in this method were played out in accordance with the method. Each homework was evaluated with the participation of all students in the first lesson hour after the assignment.

The Reader Educational Game for Mass and Weight, the first part of the unit, was played for four lesson hours. At the end of this section, Homework-1 was given. For the Force, Work, and Energy department, the Reader Educational Game was played for four lesson hours. "Kinetic Energy Depend on? And What does the potential energy of attraction depend on?" Experiments were carried out by gamification. At the end of the activities, Homework-2 was given. For the Energy Conversions section, the Reader Educational Game was also played for four lesson hours. At the end of the second hour, Homework-3 was given.

For the Reader Educational Game, the students were divided into groups of four. Concepts in the unit were written on colored papers and hung on the classroom walls in a mixed way. The playgroup was in front of the classroom board. Two students from different groups took their places to read the information on Reader. While one student in Reader was reading the information, the other one followed the information read. When the information was read, the game group determined among themselves which concept the information belongs to. The

playgroup quickly went under the paper on which the name of the concept was written. Meanwhile, other groups in their turn classified the information on a piece of paper. In this way, it was ensured that the whole class participated in the game at the same time. Meanwhile, the researcher took note of the rights and wrongs of the playgroup but did not give feedback until all the playgroups were completed. When all groups were completed, the researcher gave explanatory feedback about the performances of all groups and the concepts. The game was played in this way for two rounds. In the second part of the game, the concepts in the parts of the unit were written on the classroom board. Images related to each concept were placed on the teacher's table. In this round, the game groups were asked to find the visual about the concept in the information read and stick it to the relevant place on the board. Again, the researcher took notes of right and wrong and gave explanatory feedback when all groups were completed. Similar to the first part, the game continued for two rounds.

The Knowledge Tree Educational Game was played individually for six lesson hours. A student was selected from the class list. The student came to the tree of knowledge and plucked information from the tree. He read the information aloud to his friends. After reading the information, they took the ball and threw it to a friend they chose from the class. The student who took the ball tried to find the concept of knowledge on the ball within 30 s. If they could not find the correct concept, they threw the ball back to their friend who read the information and got a minus. The student reading the information threw the ball to another friend they chose from the class. When the student who received the ball gave the correct answer, they were entitled to come to the information tree and extract information. Each student had the right to receive 1 minus. The student who got minus for the 2nd time was excluded from the game. In this way, the student or students who reached to the end won the game. The game was played repeatedly throughout the duration.

For the Hands Up Educational Game, each student was given a correct and a false stick. The researcher read one of the information created for the game and counted it backwards from three. As soon as they said zero, all students removed the bar they chose. Students should raise the correct bar if the information read by the researcher is correct and the wrong bar if it is incorrect. Students who lifted the correct stick got a plus, while those who lifted the wrong stick got a minus. At the end of the game, the student or students who got the least minus number won the game. At the end of the game, the whole process was evaluated, and the students were awarded according to their achievement.

RESULTS
Results of the First Research Question
The distribution of the learning styles of the students participating in the research is given in Table 2.

According to the analysis results given in Table 2, most of the students had the diverging learning style ($n = 47$, 39.2%), while a small number of students had the accommodating learning style ($n = 12$, 10.0%).

Table 2: Distribution of students' learning styles

Learning styles	n	%
Diverging	47	39.2
Converging	31	25.8
Assimilating	30	25.0
Accommodating	12	10.0
Total	120	100

Results of the Second Research Question

The results of dependent group's t-test analysis conducted to determine the effect of educational game method on the learning achievement of students with different learning styles are given in Table 3.

When the analysis results given in Table 3 are examined, it is seen that educational game applications increase the learning achievement of students with diverging ($t_{(46)} = -14.787$, $\rho < 0.05$, $\eta^2 = 0.83$), converging ($t_{(30)} = -9.790$, $\rho < 0.05$, $\eta^2 = 0.76$), assimilating ($t_{(29)} = -8.957$, $\rho < 0.05$, $\eta^2 = 0.73$), and accommodating ($t_{(11)} = -8.125$, $\rho < 0.05$, $\eta^2 = 0.86$) learning styles statistically significantly. Calculated eta-square effect size values are classified by Cohen (1988) as a very large effect. Accordingly, it can be said that the variability observed in students'' learning achievement is due to the educational game method applied by 83% for the diverging, 76% for the converging, 73% for the assimilating, and 86% for the accommodating.

Results of the Third Research Question

The results of the analysis conducted to determine which learning style of the educational game method is more effective in increasing the success of the students are given below.

Descriptive statistics results of the students at the beginning of the application to determine the prior knowledge levels of the "Force and Energy" unit are given in Table 4.

As can be seen from the analysis results given in Table 4, there were differences in the prior knowledge levels of students with different learning styles. One-way ANOVA results to determine whether these differences are significant are given in Table 5.

According to the analysis results given in Table 5, it was determined that there was no statistically significant difference between the students' prior knowledge levels of the students with different learning styles; ($F_{(3,116)} = 0.235$, $\rho > 0.05$). Descriptive statistics results of students' learning achievement with different learning styles are given in Table 6.

As can be seen from the analysis results given in Table 6, there were differences in the learning success of students with different learning styles. One-way ANOVA results to determine whether these differences are significant are given in Table 7.

According to the analysis results given in Table 7, it was determined that there was no statistically significant difference between the learning achievements of students with different learning styles; ($F_{(3,116)} = 0.784$, $\rho > 0.05$).

Table 3: Dependent groups t-test analysis results for learning achievement

Learning styles	Measurement	n	X	SD	df	t	ρ*
Diverging	Pre-test	31.89	47	12.78	46	−14.787	0.000
	Post-test	75.32	47	13.84			
Converging	Pre-test	32.03	31	12.81	30	−9.790	0.000
	Post-test	72.74	31	18.65			
Assimilating	Pre-test	29.57	30	14.58	29	−8.957	0.000
	Post-test	69.93	30	18.56			
Accommodating	Pre-test	30.67	12	14.76	11	−8.125	0.000
	Post-test	76.83	12	20.67			

*$\rho < 0.05$

Table 4: Descriptive statistics results of students' prior knowledge levels

Learning styles	n	X	SD
Diverging	47	31.89	12.78
Converging	31	32.03	12.81
Assimilating	30	29.57	14.58
Accommodating	12	30.67	14.76
Total	120	31.22	13.32

Table 5: One-way ANOVA results of students' prior knowledge levels

Groups	Sum of squares	df	Mean square	F	ρ
Between groups	127.456	3	42.485	0.235	0.872
Within groups	20991.469	116	180.961		
Total	21118.925	119			

Table 6: Descriptive statistics results of students' learning achievements

Learning styles	n	X	SD
Diverging	47	75.32	18.65
Converging	31	72.74	18.65
Assimilating	30	69.93	18.56
Accommodating	12	76.83	20.67
Total	120	73.46	17.06

Table 7: One-way ANOVA results of students' learning achievements

Groups	Sum of squares	df	Mean square	F	ρ
Between groups	688.110	3	229.370	0.784	0.505
Within groups	33941.682	116	292.601		
Total	34629.792	119			

CONCLUSIONS AND RECOMMENDATIONS

As a result of the findings of the first research question examining the distribution of the learning styles, it was determined that the most students have the diverging learning

style, and the least number of students has the accommodating learning style. It is stated that in societies where uncertainty avoidance, self-confidence, and social collectivism are at the forefront diverging learning style, which is a component of concrete life and reflective observation is seen more (Joy and Kolb, 2009).

Students with the diverging learning style usually want their teacher to be motivating, have the ability to organize relationships, and consider their own feelings and thoughts when shaping thoughts. Students who have the accommodation learning style that embeds the information want the presentation of learning activities that they can structure themselves. It can be said that it is common for students in our society to be in the audience rather than actively learning and learning by living, and because the teacher needs to encourage them to learn while learning, the majority have a changing learning style. Studied with secondary school students, Kaya (2007), studied with high school students Peker (2003), similarly reached the conclusion that students have the most diverging and least accommodation learning styles, and Çakır and Akbaş (2013), who also studied with high school students, reached the conclusion that students have the most diverging and least converging learning style.

After the educational game application, it was determined that there was a significant increase in the learning achievement of the students for all learning styles. The educational games played during the application consisted of actions performed by doing, watching, thinking, and feeling (Aşkar and Akkoyunlu, 1993; Veznedaroğlu and Özgür, 2005) make the games suitable for all learning styles. Similarly, Kılıç (2002) found that in web-based learning created with activities suitable for learning styles, activities significantly increased achievement in all learning styles.

It was determined that there was no statistically significant difference among the learning achievement of students with different learning styles. The situation of thinking, reviewing concrete situations, and recognizing relationships for individuals with diverging learning styles; decision-making and logical analysis of ideas for the converging; focus on concepts and ideas for assimilating; planning, implementing decisions; and entering new experiences for the accommodating (Aşkar and Akkoyunlu, 1993; Peker, 2003; Veznedaroğlu and Özgür, 2005) since providing educational games used significantly increases learning success in all learning styles, there may not be a significant difference between different learning styles.

In this research, the applications performed during 20 lesson hours can be applied in different units for a longer time and their effects can be examined. Similarly, educational games can be applied at different grade levels and the effect of learning styles on their success can be examined at these grade levels. The effects of educational games on the affective characteristics of students with different learning styles such as motivation, anxiety, and attitude can be examined. Similar research can be done by considering learning styles created by different researchers instead of Kolb learning styles.

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