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The Effect of Arabic-Supported Educational Game on the Success of 9th-Grade Syrian Students in the Symbolic Language of Chemistry: Example of Turkey

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Abstract

This study was carried out with a total of 75 students attending 9th grade in two high schools affiliated to the Ministry of National Education in Reyhanlı district, which hosted many Syrian refugees in Hatay province in the spring semester of 2018-2019 academic years and lasted for three weeks. A total of 75 students, 43 from two different 9th grade classes taught by the same teacher from the first high school, and 32 from the other high school, participated in the study. Two of these classes were assigned as the control group and one as the experimental group. While the symbolic language of chemistry was taught with the traditional teaching method in the control groups, an educational game with Arabic support was used in the experimental group based on the constructive learning approach. Prior knowledge, attitude-perception towards chemistry, and chemistry achievement tests were applied to all three groups before the implementation in order to control their prior knowledge and attitude and perception towards chemistry; the chemistry success test was applied again after the implementation. ANCOVA analysis was used to evaluate the data obtained from the tests. As a result of the study, it was concluded that High school 9th-grade students studying with the educational game based on constructivist learning approach had significantly higher mean score in the chemistry achievement test on the symbolic language of chemistry than the students studying with traditional teaching method, they relate the concepts more accurately, and performed more meaningful learning.

Keywords: Chemistry Education, Refugee, Elements, Educational Game, Symbol

1. Introduction

In general terms, migration is the movement of people from one place to another with intentions of settling, permanently or temporarily, at a new location due to force majeure such as war or natural disaster. Turkish culture has interacted with many cultures throughout history and has continued on its way by leaving significant traces in the historical process. Turkey could not remain insensitive to the humanitarian crisis occurring in many countries and endeavored to support humanity as much as possible. In 2011, people who were exposed to war

traumas along with physical and psychological violence in their countries in the Middle East, having difficulties in meeting their basic needs, walked away from their homes and countries against their will and took refuge in Turkey. In 2018, among over 4 million asylum seekers in Turkey, mostly Syrian, nearly one million seven hundred forty thousand are children (GİGM, 2018; UNHCR, 2017). As can be understood from the numerical data, half of the individuals who come by immigration are at school age, and the adaptation of these children to the society they live in will only be possible with education. Education services offered to refugee children, who have different characteristics from the social structure of Turkey, have been carried out inside and outside the camps (Temporary Training Centers and public schools) and through private schools owned by Syrians.

Temporary Training Centers (TTC) are educational centers covering primary and secondary education that provide school-age Syrian children and youth with Arabic education by adhering to the Syrian curriculum (MEB, 2014). Turkey has started to work intensively to protect the right to education of children who immigrated from the Middle East since 2014 and tried to establish an institutional structure. The Ministry of National Education works to enroll children of educational age in official schools and aims to fully include children from the Middle East into the Turkish education system. For this reason, the ministry decided that 1st, 5th, and 9th-grade children will not be registered to TTCs instead enrolled in public schools since the 2016-2017 academic years (Tekin & Yüксеker, 2017, MEB, 2013, MEB, 2017). The migration asylum issue is not new for Turkey; however, there is a serious language problem in the education of the children of Syrian refugees. Integration has been quite easy due to the common language in the major migration movements such as Bulgarian immigrants and Meskhetian Turks in previous years (DPT, 1996). However, even if the Syrian students have solved the daily language problem, it is understood from the results of the studies in the literature that there are deficiencies in listening, understanding, expression, and writing skills in the field of education.

It has been stated in studies that language education is important, and problems experienced by refugee students will decrease when they receive education in two languages (Cillia, 2008). When students do not understand the language used in school, even if the language of chemistry is symbolic and universal, they have difficulties in understanding the lesson and learning. It was thought that providing basic chemistry education by using the language used by students for a certain period together with the official language used in the school would affect student success.

Therefore, the main purpose of this study is to investigate the effect of Arabic supported educational games on the symbolic language of chemistry by comparing it with the traditional teaching method at 9th-grade students when the Syrian students' prior knowledge of chemistry and attitude and perception towards the chemistry is brought under control. The research questions of the study are expressed as follows;

1. When the pre-knowledge of chemistry, attitudes, and perceptions towards the chemistry of the Syrian students attending the 9th grade of high schools affiliated to the Ministry of National Education was controlled; Is there a significant difference between the achievements of the students studying with the educational game supported in Arabic and the achievements of the students studying with the traditional teaching method in the elements unit?
2. Do the Syrian students' attitudes and perceptions towards chemistry have a significant effect on their success in the elements unit?
3. Does the Syrian students' prior knowledge in chemistry have a significant effect on their success in the elements unit?

2. Method

In this section of the study, which aims to empirically determine the effect of Arabic-supported educational game on the success and perceptions of 9th-grade students about the Symbolic Language of Chemistry, their interest and attitude towards chemistry lessons, Table 1 presents the experimental design, sample, variables, measurement tools, assumptions and limitations of the study, and information regarding data analysis.

2.1 Experimental Design

In high schools affiliated to the Ministry of National Education (MoNE), students attend classes determined by their institutions, and the education system does not allow students to be randomly divided into classes. Therefore, the nonequivalent control group design, one of the quasi-experimental design types, was used in the study (Gall, Borg, Gall; 1996).

To eliminate the researcher bias and student interaction that affect the external reliability of the research and to determine the effect of only the teaching method on conceptual achievement and perception, a total of three 9th-grade groups from two high schools were selected. Two of these groups were assigned as the control group and the other as the experimental group.

Since the students could not be randomly divided into groups, the study was planned according to the nonequivalent control group design, the students' prior knowledge, attitude, and perception towards chemistry were required to be controlled; for this purpose, the Prior Knowledge Test, Attitude towards Chemistry and Perception Scale were applied to all three groups as a pretest. In order to reveal the effect of the educational game on students' achievement in the content of symbolic language of chemistry, Chemistry Achievement Test was applied as pre-test and post-test.

After the pre-tests were applied, the teaching methods were randomly selected for the groups, 'the symbolic language of chemistry' unit was taught in the control group with the traditional teaching method and in the experimental group with the Arabic-supported educational game. Since the teachers were not familiar with the method applied, the researchers conducted the lessons in the experimental group and one of the control groups. In this way, it was tried to prevent the difference in knowledge and experience. In the study, lessons in the other control group were taught by the chemistry teacher of the lesson in order to eliminate researcher bias. In order that the concepts explained in all three groups and the examples given are the same, the lessons were prepared in accordance with the curriculum, and the courses were implemented within the framework of these lesson plans. Lessons were taught for three weeks in all three groups. One week after the application ended, the post-tests were applied. The effect of the educational game supported by Arabic on students' achievement and perceptions was tried to determine. For this purpose, the Chemistry Achievement Test related to the subject was applied as a posttest.

Table 1: Research pattern of the study

Groups	Pre-tests	Method	Post-test
Experimental Group	Prior Knowledge Test, Chemistry Achievement Test, Attitude and Perception towards Chemistry Scale	Arabic-Turkish Educational Game	Chemistry Achievement Test
Control Group (1)	Prior Knowledge Test, Chemistry Achievement Test, Attitude and Perception towards Chemistry Scale	Traditional Teaching Method	Chemistry Achievement Test
Control Group (2)	Prior Knowledge Test, Chemistry Achievement Test, Attitude and Perception towards Chemistry Scale	Traditional Teaching Method	Chemistry Achievement Test

2.2 The Sample of the Study

In this study, the criterion sampling method, one of the purposeful sampling methods, was used in determining the participants. The logic and power of purposeful sampling lie in selecting information-rich cases for in-depth study. This condition leads to the selection of situations containing rich information for the depth of the study (Patton, 2014, p. 46). The basic understanding of the criterion sampling method is to study situations that meet a predetermined set of criteria. The criteria mentioned here can be created by the researcher (Yıldırım, Şimşek;

2003). In this study, the criterion taken as a basis in the selection of the participants was determined as the students from the Middle East who had "studied at least one academic year in the institution affiliated to the MoNE." Meetings were made with the MoNE, the institution directly engaged in the education of the students, and the sample was determined as a result of these interviews. The study has started after obtaining the necessary permissions. MoNE was determined the schools in which the study will hold. The sample of this study consists of a total of 75 students, 43 students in two different branches where the same teacher teaches in a high school affiliated to the Hatay National Education Directorate, where Syrian students attend intensively in the 2018-2019 academic year, and 32 students from another high school. The mean age of the sample was 15, and traditional teaching methods were used before starting the implementation. The teaching methods to be used in each of the classes were randomly selected, and there were 32 students in the experimental group where the educational game was used, 18 students in one of the groups where the traditional teaching method was used, and 25 students in the other.

The educational game applied to the experimental group and the traditional teaching methods applied to the control group are independent variables, and the success of the students measured by the chemistry achievement test is the dependent variable. The variables that are taken under control are the students' knowledge before the Symbolic Language of Chemistry, which was measured with the Prior Knowledge Test, and the attitude and perception towards science and chemistry measured by the Attitude and Perception towards Chemistry Scale.

2.3 Data Collection Tool

The relevant data collection tools were prepared by a translation into Arabic by the professors of Arabic Language and Education, and it was given to the student together with two languages (Arabic and Turkish); so that the students did not experience difficulties due to the language, and if they knew the subjects, they answered them in their language.

Prior Knowledge Test (PKT). The Prior Knowledge Test was prepared to measure the readiness and understanding of Turkish in the subjects that 9th-grade students should know to understand the concepts of the symbolic language of chemistry, consisting of 15 questions. In the preparation of the four-choice multiple-choice test, the questions related to this subject in the high school entrance exam were used. Experts in the field found the content validity of the test was to be high.

The reliability of the test was expressed with α -reliability coefficient; it was found as 0.75 as a result of being applied to 92 high school 9th grade students before the implementation.

Chemistry Achievement Test (CAT): The test developed by the researcher to check whether the students have learned the elements, symbols, and the usage areas of the elements in the Symbolic Language of Chemistry, consists of 24 questions. In the preparation of the test, which is in the form of a single-step chemistry achievement test and has three wrong and one correct option in a way that students can make possible mistakes in each question, the opinions of teachers and faculty members, the textbook approved by MoNE Board of Education and Discipline, sources recommended as supplementary books, and literature was used. The test consists of three sections. The first section includes questions about the usage areas of the elements in our daily life, the second section includes questions on the periodic table, and the third section includes questions about the names of the elements and symbols. The content of the test on the elements is given in Table 2.

Table 2: The Symbolic Language of Chemistry (Elements) Test Contents

Symbolic Language of Chemistry (Elements) Subject Achievement Test	
Question No	Content
Question 1-11	Usage of elements in daily life
Question 12- 18	Periodic table usage
Question 18- 24	Element names and symbols

In the evaluation of the test, the correct answers given to the questions were coded with one (1) point, the wrong answers with zero (0) points and the student who got higher were evaluated as successful.

Content validity refers to the extent to which the items on a test and the test as a whole are fairly representative of the entire domain the test seeks to measure. The content validity of a scale can be examined in two ways, logically and statistically. Investigating the content validity of the scale logically means estimating the validity of the scale without applying. Measurement subject is defined conceptually. Since the defined concept cannot be measured directly, it is investigated whether each item in the scale and their distribution will sample the subject of measurement (Öncü, 1994; Tekin, 1974; Sencer & Sencer, 1978). As a result of the evaluation of the content based on expert opinion, the content validity was evaluated by three expert faculty members and found high. The reliability of the test was applied to 92 high school 9th -grade students before being used in the study, and α reliability coefficient was calculated as 0.77.

Attitude and Perception towards Chemistry Scale (APCS):

The scale developed by Kavak was used in order to determine the attitude of students towards Chemistry lessons and how they perceive chemistry and teaching. This Likert type scale applied to students consists of 18 expressions. Each item contains statements reflecting the students' opinions such as "strongly agree," "agree," "undecided," "disagree," and "strongly disagree." Positive statements were scored as 5, 4, 3, 2, and 1. The interest and attitude scores of the students were determined by adding the points given to each statement. The high scores of the students show that they have a positive attitude towards the chemistry course.

Teaching Methods

This study was conducted with a total of 75 students attending 9th grade in two high schools in Reyhanlı district, which hosted many Syrian refugees in Hatay province in the spring term of 2018-2019 and lasted for three weeks.

Control Group:

The traditional teaching method was used in the control groups. In this teacher-centered method, the teacher's explanations are at the forefront. The teacher continues the lesson by giving examples, introducing the concepts, and making explanations. The teacher answers questions for reinforcement at the end of the lesson and does a general review.

Experimental Group:

In the experimental group, the lessons were taught with an educational game supported by Arabic. This method is student-centered and requires the active participation of students. This method has been prepared in two languages (Turkish and Arabic) on the basis of the students' being multicultural so that students can actively apply the course content.

After the application of this method, students are expected to:

- Knows the symbol when reading or hearing the name of the first 20 (twenty) elements, knows the name of the element when it reads or hears the symbol (in Turkish).
- Makes explanations in Turkish about the usage area of each element.
- Recognizes the periodic table, sorts the elements according to the rule of the periodic table.
- Plays the relevant game according to the rules.

There are five materials within the scope of "educational game supported in Arabic," which is called educational material. For the first 20 elements of the periodic table; a blank template was drawn on cloth.

Figure 1: Periodic table template

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar
K	Ca						

The symbol, atomic number, and element names are written in Turkish and Arabic on the front side, and the entire periodic table is given on the back of the cards.

Figure 2: Element cards (front side)

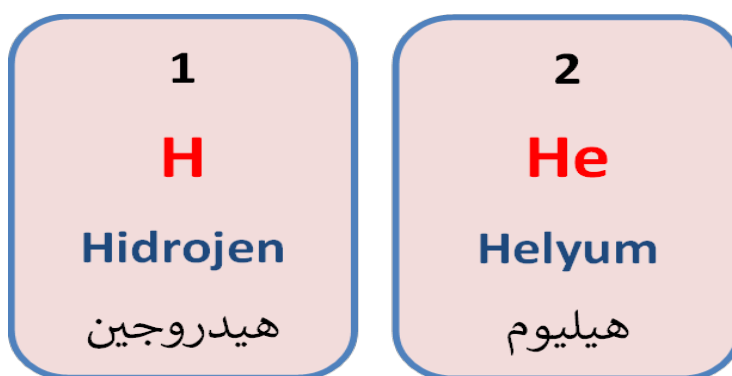


Figure 3: Element cards (backside)



- 1- Information Cards in Turkish and Arabic about the properties of the elements. There are images on the backside. Both sides of the material are used in the game.

Figure 4: Turkish and Arabic information card on the properties of the elements



Figure 5: Visual card of the usage areas of the elements (backside)



- 2- In the educational game in which the names of the elements are voiced in Turkish and Arabic, students have the opportunity to control their own actions while improving their listening comprehension in Turkish.

The application of the study took place in five steps. Details of the steps are as follows:

In the first step, the lesson was given to the experimental group students within the plan given to the teacher. In order to achieve the outcome of “matching the symbols of the elements frequently encountered in daily life with their names,” informational cards that are expected to be learned were prepared in Turkish and Arabic. Three-dimensional world and human figures were presented at the beginning of the lesson to attract students' attention; the teacher asked questions that prompted students to think. Some examples of these questions are given below.

Did you know that we humans and the world we live in contain the same elements? What elements can you have

in your body? What elements are present in the soil?

This step aims to introduce the name and symbol of the element to students with the visual cards. After the introduction of 20 elements, the teacher showed a random element symbol to students. Students were expected to remember the element name. Likewise, when the element name was displayed, it was expected to remember the symbol. When this step was completed, the teacher asked students to write the names and symbols of the elements they remember on a blank paper, using whatever language they preferred.

In the second step, the direction of lying was specified by showing the material number one (cloth) to explain how the elements are placed in the periodic table. The way of placing material number 2 (Element cards) on the periodic table template was shown. Each symbol / inscription on the element cards was explained in order. The element cards were placed on the blank periodic table template by reading the name, number, and symbol of the element. *It is placed saying: "Name of the element Hydrogen; symbol capital letter H; number 1".* Then move on to the box on the template opposite the hydrogen and the name of the Element Helium, symbol He, number 2, Lithium and Beryllium, etc., are shown in order until the element number 20. In this way, the order of the elements in the periodic table was applied individually by the students and the educational game process started. In the third step, the rules of the game were explained. The cards (from left to right) with the element name and symbol not visible were aligned by the players, with 20 cards face down, without breaking this rule (periodic table image on top, face down). It was started according to the preference of the first students to play. The game starts by opening the card where the element number 1 Hydrogen is located. The student who opens the card reads the element name, number, and symbol aloud and places it where that element should be on the periodic table. For example; the first card is opened, the element name, number, and symbol on it are read in order, and the "Beryllium, number 4, symbol Be" is placed on the template. While placing the beryllium card in the place where it should be, the student takes the closed card there, introduces it in the same way, and puts it in the appropriate place he/she thinks it should be.

The game continues until this student makes a mistake or until the card he/she opens is in the place where it should be on the periodic table. For example, if the first card he/she opens is the one that introduces the Hydrogen element, the game will pass to the opponent before he/she can start the game. Another possibility is that if the element card is in the correct place on the periodic table, the game to pass to the opponent.

The other reason for the game to pass to the opponent is that the student puts the element card in the periodic table without introducing it loudly. Since the aim is to enable students to use the scientific language, it is ensured that they vocalize in a way that they can hear their own voices.

The student who puts the last card on the periodic table template wins the game.

In the fourth step of the course, the usage areas of the elements were explained to the students. Items and images (three-dimensional) explaining the usage areas of the 20 elements were prepared and put into a previously prepared box. The usage areas of the elements were explained by supporting them with visuals. The student groups were given a box containing the items that symbolize the usage areas of the elements, and the students were asked to verbally express the element in the content of the material they choose randomly. The prerequisite of this stage is to make sure that all students speak. The most important factor here was that the researcher in the field of Arabic Language Education guided the course. Especially when there is a person who understands their language, the students' hesitancy disappears, and they sincerely participate in all activities.

In the fifth step, the educational game cards (element - location) with the element usage area or the substance content were introduced, and the students played the game in a way that the same game rules as the second set cards (3rd material).

Assumptions and Limitations of the Study

The professional experience of chemistry teachers working in the high schools where the study was conducted

varies between 5 and 12 years. Teachers were considered equivalent to each other in terms of knowledge and experience. The selected sample reflects the 9th-grade students who migrated from Syria. This study is limited to the 'elements' unit and 9th-grade students attending a high school in the region receiving immigration.

These students receive education in mixed classes formed with Turkish students in their schools. Another purpose of expressing this situation is that some classes are all Syrian students due to the high number of Syrian students attending MoNE schools in the region. For the equivalence of the sample taken in the study, it was preferred to have mixed classes in which Syrian and Turkish students are receiving education together.

3. Data Analysis

In order to apply parametric tests to the data obtained in the study, the data must show a normal distribution. In this case, the "Kolmogorov - Smirnov Test" was used to check whether the obtained data showed normal distribution or not. In the study, in which quasi-experimental nonequivalent control group design was used and there were two control groups and one experimental group, analysis of variance (ANOVA) was applied to the pre-test results to determine whether the groups were equal before starting the study. As a result of the application, it was understood that there was a difference between the groups, and an analysis was made to determine the difference between the groups.

After the studies were completed and the pre-test results were taken under control, ANCOVA (Analysis of Covariance) was applied to determine whether there is a significant difference between the posttest results of the experimental group and the post-test results of the control groups. The analysis was performed using the SPSS (Statistical Package for the Social Sciences) software, and the results were evaluated at a significance level of 0.05.

4. Findings

In this study, the nonequivalent control group design, one of the quasi-experimental design types, was used to determine the effect of the Arabic-supported educational game, the variables that were considered to affect the success were controlled, and the prior knowledge test, the chemistry achievement test and the attitude and perception towards the chemistry scale were applied as a pre-test. Since it is necessary to investigate whether the test results show a normal distribution in order to apply statistical analysis to the pre-test results, the data obtained were evaluated using the "single group Kolmogorov-Smirnov Test." The results obtained are summarized in Table 3.

Table 3: Single Group Kolmogorov-Smirnov Test Results

	Control Group-1				Control Group-2				Experimental Group			
	N	X	SD	p	N	X	SD	p	N	X	SD	P
PKT	18	9,27	1,98	0,998	25	7,17	3,17	0,570	32	9,98	2,78	0,717
CAT	18	6,17	1,63	0,990	25	5,36	1,79	0,362	32	5,90	2,38	0,389
APCS	18	61,17	6,18	0,554	25	50,43	9,28	0,983	32	53,97	9,16	0,843

As can be seen in Table 3, test results showed normal distribution in all three groups ($p > 0.05$). The normal distribution of the pre-test results means that parametric tests can be applied to the data. When the table is examined for which groups the difference in PCT results is advantageous, it can be seen that the average of the control group number 2 is lower than the other groups. Whether there is a significant difference between the groups was investigated by one-way ANOVA and is given in Table 4.

Table 4: ANOVA Analysis Result Summary

		ΣX^2	df	MS	F	P
PKT	Between groups	120,143	2	60,071	9,257	0,000
	In-group	408,842	63	6,490		
	Total	528,985	65			
CAT	Between groups	8,280	2	4,140	1,092	0,342
	In-group	238,811	63	3,791		
	Total	247,091	65			
APCS	Between groups	908,577	2	454,289	4,088	0,021
	In-group	7000,287	63	111,116		
	Total	7908,864	65			

As can be seen in Table 4, there was no significant difference between the control group and the experimental group in terms of chemistry achievement $p > 0.05$; There was a significant difference in terms of prior knowledge, and attitude and perception towards chemistry $p < 0.05$. In this study, in which there were three different groups, the Scheffé test was used to determine which groups differ in prior knowledge and attitude and perception towards chemistry, and the results are presented in Table 5.

Table 5: Evaluation of the PCT, APCS CAT pretest score averages of the Experimental Group and the Control Groups

		PKT		CAT		APCS	
		Control Group (2)	Experimental Group	Control Group (2)	Experimental Group	Control Group (2)	Experimental Group
Control Group (1)		0,017*	0,865	0,481	0,974	0,021*	0,152
			0,002*		0,484		0,484

*At the 0.05 significance level, the means are different from each other.

As can be seen in Table 5, when the values were examined in order to determine whether there was a significant difference between the students in the control group number 1 and the experimental group students who had the same chemistry teacher before the study, it was determined that they differ in terms of attitude and perception towards chemistry. When the general averages were examined (Table 3), it can be seen that the mean of control group no.2 was lower than the others with 50,43. Another result obtained from this table is that the pre-test results of CAT of all three groups were close to each other. The data obtained show that there was no significant difference between the three groups in terms of CAT results. In other words, all the students participating in the study have the same level of prior knowledge about the names, symbols, and usage areas of the elements. This situation is important for the internal validity of the study. Also, prior knowledge of the students in the control group no. 2 was significantly different from the students in the control group no. 1 and the experimental group. As can be seen in Table 3, the low average belongs to the control group no.2 with 7.17.

As a result of the analysis, it was concluded that when the pre-test results have controlled the effect of the educational game would emerge.

The Effects of Arabic-Supported Educational Game and Other Variables on the Success of Syrian Students in the Symbolic Language of Chemistry

In order to determine the effect of Arabic supported educational games by comparing with the traditional teaching method, relevant studies on the symbols, names, and usage areas of the elements unit were conducted for three weeks with Syrian students attending 9th grade, after the pre-test results are received. After the application was completed, CAT was applied as a posttest and the results obtained were evaluated.

ANCOVA analysis was used to determine whether there is a significant difference between the success of the 9th-grade students studying with the Arabic-supported educational game and the achievements of the students studying with the traditional method, when their prior knowledge about chemistry, basic knowledge about elements, and their attitudes and perceptions towards chemistry is controlled. ANCOVA results are given in Table 6.

As can be seen in Table 6, according to ANCOVA analysis, the model applied was found to be significant ($p = 0.000$ for the model), the interference between the variables was not statistically significant ($p = 0.0087$ for the intervention), and the applied model was found to be $R^2 = 0.587$. Accordingly, it was decided that it could be used to test the hypotheses.

Table 6: ANCOVA analysis

Source	Type III ΣX^2	X^2	F	P	Ψ^2
Model	510,839	58,691	11,896	0,000	0,587
Attempt	14,773	14,773	2,994	0,087	0,049
PKT	2,061	2,061	0,418	0,521	0,007
CAT	49,267	49,267	7,959	0,007	0,121
APCS	7,047	7,047	1,428	0,237	0,024
Group	237,436	118,668	24,053	0,000	0,453
Error	286,246	4,934			
Total	5297,000				

When Table 6 is examined to evaluate whether the CAT results of the groups are statistically different from each other, it can be seen that there was a significant difference between the groups. ($P < 0.05$ for the group). Bonferroni test was used in ANCOVA analysis to determine among which groups this difference exists, and the results are summarized in Table 7.

Table 7: Evaluation of the CAT posttest mean scores of the experimental group and control groups with the Bonferroni test

	Control Group(2)	Experimental Group
Control Group (1)	1,000	0,000
Control Group (2)		0,000

As can be seen in Table 7, it was determined that the mean of the CAT post-test results of the experimental group students studying with the Arabic-supported elements-themed educational game was significantly different from the CAT post-test results mean of both control group students studying with the traditional teaching method. Another result obtained is that the CAT post-test success averages of control group no.1 and control group no.2 were not different.

According to these results, when the prior knowledge and attitudes and perceptions towards chemistry were taken under control, a significant difference was found between the success of the 9th-grade students studying with the Arabic supported elements-themed educational game and the success of the students studying with the traditional teaching method. It was concluded that in the elements unit, the students who were taught with the Arabic-supported elements-themed educational game ($X=19,92$; $sd:2,64$) were more successful than the control group students ($X_1=11,357$ $sd=1,83$ & $X_2= 10,62$; $sd=2,10$) who were taught with the traditional teaching method. In the study, it is understood from the success they show in the CBT results that the experimental group students use the scientific language in the field of chemistry in Turkish, orally and in writing, thanks to the educational game.

In the study, ANCOVA analysis results were examined to determine the effect of the Syrian students' attitude and perception towards chemistry on their achievement in chemistry, and it was concluded that the students' attitude and perception towards chemistry did not have a significant effect on their success in chemistry.

It was also investigated whether Syrian students' prior knowledge in chemistry had a significant effect on their success on elements. The results of ANCOVA analysis applied to determine the effect of prior knowledge on students' achievement were examined, and it was concluded that the prior knowledge did not affect the conceptual success ($p = 0.521$).

5. Results

This study was carried out with a total of 75 students attending 9th grade in two high schools affiliated to the Ministry of National Education in Reyhanlı district, which hosted many Syrian refugees in Hatay province in the spring semester of 2018-2019 academic years and lasted for three weeks.

In this study, the nonequivalent control group design, one of the quasi-experimental design types, was used to determine the effect of the Arabic-supported educational game, the variables that considered to affect the success were controlled, and the prior knowledge test, the chemistry achievement test and the attitude and perception towards the chemistry scale were applied as a pre-test.

Prior knowledge and attitudes and perceptions towards the chemistry course of Syrian students attending the 9th grade of high schools affiliated to MoNE have been controlled, and it was investigated whether there is a significant difference between the achievements of the students studying with the Arabic-supported educational game and the achievements of the students studying with the traditional teaching method. This study also examined the effect of Syrian students' prior knowledge of chemistry on their success in the elements unit.

While there was no significant difference between the pre-test scores of the experiment and control groups, there was a significant difference between the post-test scores in favor of the experimental group.

It was concluded that all the students participating in the study had the same level of prior knowledge about the names, symbols and usage areas of the elements. The data obtained show that there was no significant difference between the three groups in terms of CAT results. However, when students' prior knowledge, attitudes, and perceptions towards chemistry were taken under control, a significant difference was found between the chemistry achievements of the 9th-grade students studying with the Arabic supported elements-themed educational game and the success of the students studying with the traditional teaching method. Therefore, it was concluded that the Arabic-supported educational game is more effective than the traditional teaching method in increasing the conceptual achievement of Syrian 9th-grade students on the elements unit. Another result that we reached is that the prior knowledge of Syrian 9th-grade students did not have a significant effect on their success in the symbolic language of chemistry. In this context, it has been concluded that the method chosen will enable students to learn better when there is no difference between students' prior knowledge. It is understood from the results obtained in other studies (Aycan, Türkoğuz, Arı and Kaynar, 2002; Şaşmaz Ören and Erduran Avcı, 2004; Saracaloğlu and Aldan Karademir, 2009; Duvarcı, 2010; Karamustafaoglu and Kaya, 2013; Bayat, Kılıçaslan and Şentürk, 2014; Kaya and Elgün, 2015; Haneci, Cerrah Özsevgeç and Demircioğlu, 2016; Yıldız, Şimşek and Araz, 2016; Pamuk, 2018; Boz, 2018) that teaching supported by educational games increases the success of

students. In summary, the results of our study support the previous literature. However, as the educational game was studied with Syrian students in the study in question, it differs from other studies. A similar educational game study on the elements unit was conducted by Duvarcı in 2010. Duvarcı examined the effect of teaching the names and symbols of elements with games on the achievement of 9th-grade students in the chemistry lesson. In Duvarcı's study, students found the activities as entertaining and helpful to remember subjects. The results obtained from the related study are in line with the results of our study. However, as stated before, no such study has been found on teaching chemistry with Arabic-supported educational games on immigrant students. Based on this, it has been reported that the teaching supported by educational games affects the academic success of immigrant students according to the current teaching method.

The effect of Syrian students' attitudes and perceptions towards chemistry on their success in the elements unit was investigated. In the group we studied, there was no significant effect of the Syrian 9th-grade students' attitude and perception towards chemistry on their achievement in the elements unit. In addition, it was found that the attitudes and perceptions of the groups we studied did not affect the learning. However, at the end of the study, it was observed by the researchers that there was a difference between the interests and attitudes of the students studying with educational games towards the learning environment compared to the students studying with the traditional method.

It is considered that transferring the quantitative findings obtained from the study as well as observational determinations will be suitable for future studies. During the implementation of the study, it was observed by the researcher, who participates in all sessions with all groups, that there was a positive change in the students' interest in the lesson. It was observed that the students were quite active, enthusiastic, and curious in the chemistry course, in which the educational games were used to teach the elements unit. The students studying with the educational game made fewer mistakes when matching elements and symbols and were able to indicate the areas where the elements were found and used more easily than the students studying with the traditional method. In addition, students who study with educational games use the language of chemistry more than it should be, while students studying with traditional teaching methods prefer daily speaking language. This situation can clearly be noticed when the students consider the verbal and written expressions during the game.

Based on the findings of the study, it can be easily stated that the use of educational games in learning the symbolic language of chemistry is more successful and effective than the traditional teaching method. Students studying with traditional teaching methods could not participate actively in the course. Information stays in temporary memory when not associated with other information; and can be easily forgotten when not used (Atasoy, 1998). Since the traditional method is generally based on this system and leads to learning by rote, it is forgotten after a while. The permanence of knowledge is a result of meaningful learning. When learning is associated with the previous learning, it will become meaningful and remain in the memory (Ausubel, 1968). When it comes to a class with immigrant students, the language problem comes into play, and students cannot participate in the lesson. Therefore, even if Syrian students read the information about the symbolic language of chemistry or listen to the teacher, they cannot associate the basic symbols they need to learn and their areas of use, and they cannot create a link between symbols, elements, and the areas of use of elements.

In addition, during the study, it was observed that the educational game activity increased the communication and interaction of students from different cultures with each other in obeying the game rules. In other studies conducted with Turkish students in the domestic literature (Demircioğlu and Akdemir (2019), Yıldız, Şimşek, and Araz (2017), Çavuş and Balçın (2017), it was stated that educational games were useful in adopting rules, communicating and trying to understand each other.

6. Recommendations

Considering the results of the study, some recommendations have been made in order to contribute to future studies. While immigrating students are placed in schools and classes, the orientation of students to the education system should be ensured, a certain level should be set as a target for the languages of education, and placement of students in schools based on a certain level of Turkish education by MEB is recommended within the scope of

the study. Also, learning Turkish should be perceived not as a foreign language but as a second language parallel to their mother tongue. Unless students from the Middle East can understand the language, it will not be possible to get the result of the education provided and the investment made. If sufficient effort is not spent on this issue, cultural gaps will inevitably occur in our society. It is also very important to reveal the potential of individuals of educational age, not only with language teaching. The country will be without problems in the future depending on the changes that improve the education made today. In this context, it is also essential to create suitable environments to give science lessons in the best way.

In the related study, it was stated that Syrian students have difficulty in communicating with host student groups, and they have difficulty understanding the subject of the lesson. Chemistry teaching is important in high schools as it plays an important role in understanding everyday life. Uzuntiryaki and Boz (2007) stated the role of chemistry courses in their studies as follows: *"...to think in a scientific way. Later, they can use these thinking skills, which they have gained in chemistry class, for any problem of their life. Also, students' critical thinking ability can be improved with chemistry. Therefore, chemistry must be taught."* In this context, understanding science education in general and chemistry education in particular, and providing students with relevant materials in order to conduct the curriculum more efficiently, providing appropriate materials in mixed classes with students from Turkish and the Middle East where students can study together and reinforce the course subjects and scientific language based on educational games, and creating extracurricular activities will enable students to learn more efficiently.

In the study, a general evaluation was made by taking the number of students more in the sample. Based on this study, more in-depth analysis can be made on chemistry topics and concepts using the interview method with a smaller number of students to examine students' views.

In the study, it was determined that most of the students were directed to vocational education. This situation leads us to the conclusion that students do not prefer science. It can be determined why these students do not prefer other high school types by conducting studies that these students will form the sample of the study, and recommendations can be made by determining the reasons for failure.

Due to changes in the education system, the methods of evaluating students in science lessons also differ. Studies can be conducted for the use of alternative assessment and evaluation techniques instead of traditional methods. Increasing the number of courses organized in Turkish and Foreign Language Application and Research Centers, making intensive language supplements with Public Education Centers and other relevant organizations, and encouraging families of Middle Eastern children to go to school should be ensured.

The course contents, teaching approaches, and methods should be prepared in a way to develop students' intelligence and comprehension skills. In the teacher-centered approach, teachers consider themselves to be the center of all activities, the main source of information, and an expert in their field. Students remain in the position of passive listeners, receiving the information given by the teacher. When the students, who come through immigration, do not understand the language, they move away from the field of education and training, and this causes them to encounter different problems. It is therefore reasonable to assume that this lack of interest can hinder students' motivation in getting involved in science studies (Mamlok-Naaman, Ben-Zvi, Hofstein, Menis, Erduran; 2005). For this reason, teachers should conduct their lessons by supporting them with activities that will enable students to actively participate in the lesson for effective teaching. In this case, having ready-made activities for each subject will enable teachers to work efficiently in the lesson. The teacher should help the immigrated students to make progress at the cognitive level and try to ensure the participation of the students in the lesson by doing the activities.

In this study, the effect of teaching with educational games on the success of Syrian students in the chemistry course about the symbolic language of chemistry was investigated. In addition to academic success, studies on different variables such as gender, attitude, motivation, and scientific language development can also be conducted.

In addition, we would like to include another sentence as a suggestion and conclusion that teachers who teach Syrian students at their schools should be supported. The teacher should feel supported in all matters and monitoring and support services should be developed. We also observed that attention should be paid to the balance between Turkish students and Syrian students.

With the migration that started in 2011, teachers working in some regions have encountered a change in their teaching process and have started to teach in multilingual and multicultural classes. In this process, there were situations that teachers encountered for the first time, and these special situations were beyond the competence of teachers. Therefore, to have a more efficient teaching system, to create a more peaceful education and training environment with students, in-service training is needed to facilitate the adaptation of teachers to this situation. This situation should be supported by the Ministry of Education, and it is recommended to organize Guidance training to provide education for different cultures.

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