iojes
www.iojes.net

International Online Journal of Educational Sciences

ISSN: 1309-2707

The Effect of Teaching Sequence Subject with Realistic Mathematics Education on Student Achievement and Opinion

Research Article

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To cite this article: Isik, S., Tutak, T., & Kalkan, M. (2020). The Effect of Teaching Sequence Subject with Realistic Mathematics Education on Student Achievement and Opinion, *International Online Journal of Educational Sciences*, *12* (1), 184-203.

ARTICLE INFO

Article History:

Received: 11.10.2019

Available online: 17.02.2020

ABSTRACT

In this study, the effects of the 11th Grade Sequences unit on Realistic Mathematics Education (RME) activities and the students' RME approach were investigated. It is envisaged that the study will reveal positive or negative student views about RME and increase student achievement in Sequences that is one of the most difficult subjects for students to understand. The study was carried out with 50 students in the 11th grade of a high school in Yeşilyurt, in Malatya in 2015-2016 academic year. In the experimental group (n = 25), the teaching was supported by Realistic Mathematics Education and in the control group (n = 25) the current teaching was applied. . Data were collected by using the equalization test, the pre-post achievement test, the pre-post attitude scale and the thought survey. In the analysis of the distribution normality of the data with SPSS package program, it was seen that the data were not distributed normally. So, the nonparametric test, Mann Whitney U and Wilcoxon Signed Rank Test, were used for the analysis of achievement test and equalization test. Thought survey results were interpreted by giving frequency-percentage distributions. As a result of the findings, it was determined that there was a significant difference between the experimental group students who studying with realistic mathematics education and the control group students who continued their current education in favor of the experimental group. According to the results of the thought questionnaire taken from the RME approach to the experimental group students, it was observed that the opinions of the students were positive.

Keywords:
Realistic Mathematics Education, Sequences, Achievement, Student Opinions

Introduction

Mathematics, which has an important place in our lives, is considered as a difficult lesson and some difficulties are encountered in its teaching. Fears and prejudices developed against mathematics play an

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DOI: https://doi.org/10.15345/iojes.2020.01.011

effective role in the acceptance of mathematics as a difficult lesson. The most important reasons for this fear and prejudice, the students thinks that mathematics is disconnected from everyday life and it is transferred to the student over memorization information by the teachers. Prejudice and fear factor is a problem encountered in other countries as well as in our country and many studies are carried out to eliminate this problem. In order for students to be more successful in mathematics and to learn mathematical thinking, an environment with a student-centered approach that is unique to the field should be created where students can think freely and be able to connect with their usual daily life (Umay, 1996). In the early 20th century, when learning was defined as a change in behavior, and the teaching as a transfer of knowledge to the student by the teacher, it was sorted into disciplines, skills and concepts, from simple to more complex. Changes in behavior are considered when designing reviews. Nowadays, the stages connected with the learning-teaching process have changed as growth, development and interaction. This change has led to the emergence of new learning theories. The theory of Realistic Mathematics Education (RME), which is new in terms of theoretical development but which is new in terms of applications, and which is new in terms of both theoretical development and applications, is worth considering. This change and renewal has been shown in research areas of education. Many studies have been done on how the individual learns, the internal and external factors that affect the learning level and how to improve the quality of learning (Algani & Eshan, 2019; Altun, 2006, cited in Akkaya, 2010). As a result of researches, most countries have changed their education program.

The mathematics program which is revised according to the constructivist approach, introduced many innovations according to the traditional teaching approach. Although the constructivist approach is basically a theory of knowledge, it has evolved into a learning theory over time due to its connection with learning. Because many of the mathematical concepts are related to the cognitive domain, mathematics teaching is more influenced by the constructivist approach than other fields. Due to this interaction, many important mathematical applications were made and analyzed. However, the results of the examinations such as PISA, TIMSS and mathematics Olympics which are conducted in the field as well as internationally, reveal that the innovations brought by the constructivist approach are not enough. In our mathematics teaching program, instead of constructivist approach, RME approach is thought to be the solution of these problems (Akkaya, 2010; Yağcı & Arseven, 2010).

In response to the mechanical approach commonly used in the 1970s, RME was proposed by the Dutch mathematician and educator Freudenthal (Özdemir, 2015: 16). According to RME, the word olan realistic 'means that it exists in real life or it can be defined as everything that is not real but can be embodied mentally. It is important that a mathematical problem is mentally compatible and acceptable (Van den Heuvel-Panhuizen, 2000: 4). Freudenthal points out that mathematization is the main basis of RME. Gravemeijer mentions that this is a level rise in mathematics itself. A level rise occurs with the formation of features such as generalization, certainty, accuracy and briefness (Ibili, 2019). Generalization, similarity and general evidence to be examined structures; certainty, putting the foundation of the concepts into order and testing the assumptions; accuracy, the emergence of a emerging model of elimination emerged; however, the function is translated into symbols and diagrams (Bintaş, Altun and Arslan, 2003). According to RME, mathematization is the most important process of mathematics education. There are two main reasons why this is so important. The first basic reason is that mathematization is a job that every human being can do. Every person can mathematize some things until a certain percentage. In fact, when this process becomes a strategy, the person approaches the events he encounters in his daily life from a mathematical point of view. The other main reason is about the idea of rediscovery (Erdem, 2019). The learning situation should be prepared by simulating the educational process by the mathematician and by creating a working environment where the student can work, make experiments and overlap with daily living environments. In the process of mathematization, the student reaches mathematical knowledge with his own efforts (Gravemeijer, 1994). Students learn how to use this information with real life problems used in RME by seeing the reflections of real-life knowledge in

mathematics (Aslan, 2019). For this reason, students' motivation to learn later will be increased. The student remembers his or her personal information by internalizing a problem state associated with his/her real life. This leads to the transformation of mathematics into an activity that is meaningful and real life that helps the student to draw himself into an active thought (Barnes, 2004). According to the RME, instruction starts with the presentation of an activity in which the student can find and experience his / her tracks. This event is not entirely taken from real life. As long as this activity can be realized as real for the student (Olkun and Toluk, 2003). To give an example, it cannot be realistic to use the general term of the sequence as a starting point (2n + 1, 3n + 2, n^2) for a student who has not yet developed the concept of a sequences. However, the course can be started with problems related to or connected to real life in which these general terms arise. For example, r Walnuts will be distributed to 10 students in a class, respectively. In this distribution, only 3 walnuts will be given to the first student then the other students will be given 2 more than the number of walnuts. "How many walnuts does the fifth student take?" He's using the problem for the beginning. After the students create their own solutions, how many walnuts are taken by students in order and how this order occurs is discussed in the class. the result "2n + 1" will only be experientially realistic after the discussions. Because now it has become a mathematical expression to be traded on.

Treffers (1987) divided mathematization into two categories: horizontal and vertical mathematization. In horizontal mathematization, a mathematical tool is produced in solving and arranging a problem involving situations in which students may encounter in real life or in real life. Vertical mathematization is the process of reorganizing the mathematical system by moving only from symbols (Uça, 2014).

Reaching information in the RME approach is not the same as the Bloom Taxonomy hierarchy. The starting point of RME is daily life problems. That is, it starts with the application of Taxonomy steps, then goes down and horizontal mathematization is performed. Then the vertical mathematical stage is completed by going upwards. These transitions can be illustrated in Figure 1.1 on Bloom Taxonomy:

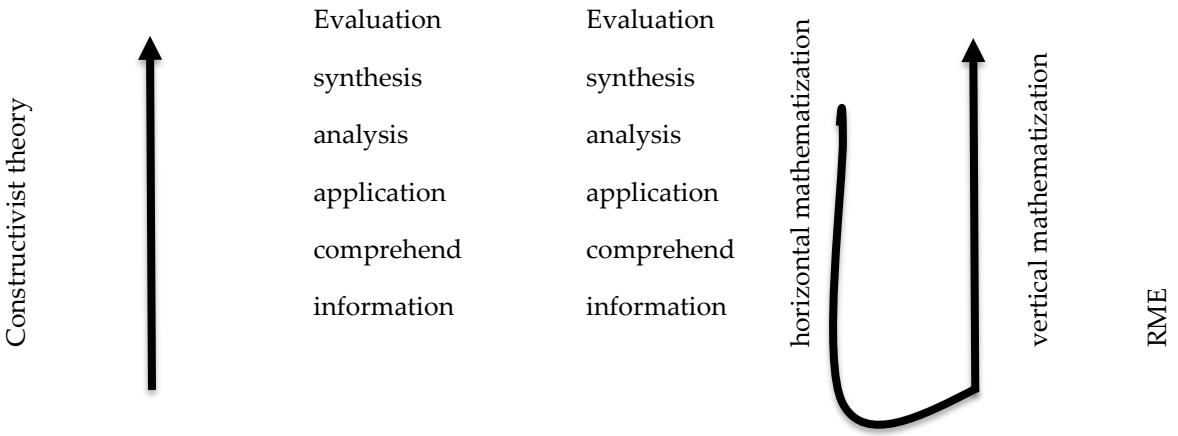

Figure 1.1. Structuralism and stages of RME in Bloom Taxonomy (Üzel, 2007).

When teaching mathematics subjects, a certain sequential rule is observed. The subject of the sequences will be the basis for the next subjects; series, limit, continuity, derivative concepts and integration (Koçak, 2008) (Dereli, 2015). In our country, the index of difficulty of "sequences" in the indexes of difficulty in mathematics subjects is in the first place (Tatar, Okur and Tuna, 2008; Gürbüz, Toprak, Yapıcı and Doğan, 2011). Furthermore, Akgün & Duru (2007), Akbayır (2004) and Alcock & Simpson (2004) concluded that traditional teaching is not sufficient for teaching sequences and series. When the mathematics curriculum is

examined, it is seen that the subject of sequences has been introduced with the help of pattern from the beginning of primary education, while the subject of sequences in the secondary education mathematics curriculum is discussed in more detail.

Studies on realistic mathematics education activities in Turkey have made efforts to comprehend on the issues; Ayvalı (2013), Demirdöğen (2007) and Uygur (2012) 6th grade, Nama Aydın (2014) 3rd grade, Uça (2014) on 4th grade fractions, Aydın Ünal (2008) 7th grade, Çetin (2018) in terms of 6th grade integers, Can (2012) and Kurt (2015) 3rd grade, Çakır (2013) 4th grade, Taş (2018) In the 6th grade on measurement, Altaylı (2012) and Gözkaya (2015) on the 7th grade ratio - proportion, Akkaya (2010) and Ersoy (2013) 7th grade, Cihan (2017) 8th grade probability and statistics, Bıldırcın (2012) Grade 5, Demir (2017) 10th grade, Özdemir (2008) 8th in the area-volume issues, Üzel (2007) 7th grade equations and inequalities, Özçelik (2015) 7th grade percentages and interest, Sezgin Memnun (2011) in 6th grade coordinate system and correct equation, Korkmaz (2017) in the 7th grade transformation and geometry, Gallipoli (2008) on 9th grade logic, Özdemir (2015) on 9th grade clusters, Akyüz (2010) 12th grade integral, Cansız(2015) 12th grade derivativ.

RME studies conducted at international level are; Streefland (1991) concept of fractions and fractions. Gravemeijer & Doorman (1999) analysis, Rasmussen & King (2000) and Kwon (2002) differential equations, an den Heuvel-Panhuizen (2003) percent concept, Widjaja & Heck (2003) graphic drawing and interpretation, Cavey, Whitenack, & Lovin (2006) 7th class of linear functions

In the literature review, there is no study on teaching the subject of sequences at national and international level with RME method. Therefore, this study is thought to be original. Also with this work it is obvious that the real life problems based on the principles of RME and suitable for achievements of sequences have been added in literature. As seen in this study, RME approach builds a bridge between school and real life, shows that the education he/she received was not unnecessary and also increases self-confidence.

The Purpose of Research

The general aim of this research is to examine the effects of realistic mathematics education activities on the success of students and the views of students about RME. In order to achieve this aim, the answers to the following questions are examined:

1) Is there a significant difference between the experimental group in which the RME approach is applied and the control group in terms of the academic achievement level of the students?

2) What are the opinions of experimental group students about RME supported teaching?

Method

Research Model

In this study, a quasi-experimental model with pre-test and post-test control group was used. While the independent variable is mathematics teaching with RME approach, as the dependent variable is the results of the success test and the results of the survey about RME for the study. Group selection was not made randomly, and was made according to their equivalence. The difference between experimental design and quasi-experimental design is to determine experimental and control groups with measurements rather than random selection (Ekiz, 2003; Karasar, 2006). According to Campbell and Stanley (1963), if a random assignment cannot be made during the selection of groups, the method used is not experimental but a quasi-experimental method.

Working Group

The study group consisted of 50 students in the 11th grade of a high school in the Yeşilyurt district of Malatya province in the 2015-2016 academic year. In order to be able to perform the study equally, Both classes (11F and 11G) of mathematics teachers has been noted to be the same person. According to Kocakaya'ya (2012), the same teacher telling the subject to both groups will prevent the John Henry effect. The John Henry effect is that the control group teacher is competing against the experimental group and shows an increase in performance (Korkmaz, 2017). In order for the study to give accurate results, the students of the experimental and control groups should be equivalent. In case of not being equal, two different groups should be compensated. Before the application, equivalence between the groups was obtained by examining the students' previous grade report notes and the equivalence test results prepared by the researcher.

In order to be able to balance the classes, first of all the grades taken from the first semester mathematics course were analyzed in SPSS program and then equalization test was applied to both classes. The equivalence test was formed by selecting 25 of the previous YGS (National University Entrance Exam) questions that included the subjects previously learned by the students. As the data obtained were not statistically distributed, the non-parametric Mann Whitney U test of the SPSS package program was used for the analysis. The analysis results are shown in Table 2.1 and Table 2.2.

Table 2. 1. Experimental Group and Control Group Academic Semester Score Analysis Results

Group	n	Row Avarege	Row Total	U	*p
Experimental	25	28.06	701.50	248.50	0.214
Control	25	22.94	573.50		

*p> 0.05

As it seen in Table 2.1 (U = 248,50; p = 0.214> 0.05), it was observed that the difference between the grades of the experimental group and the control group students was not significant. Therefore, it can be said that the control group students and the experimental group students are equal in terms of the first semester grades.

Table 2.2. Experimental Group and Control Group Equalization Test Analysis Results

Group	n	Row Avarege	Row Total	U	*p
Experimental	25	25.68	642	308	0.929
Control	25	25.32	633		

*p> 0.05

As seen in Table 2.2 (U = 308; p = 0.929> 0.05), there was no significant difference between the experimental group and the control group mean score of the control group. Therefore, it was found that the experimental group and the control group were equivalent to each other in terms of mathematics achievement.

Data Collection Tools

The equalization test developed by the researcher, The achievement test developed by the researcher and the thought questionnaire developed by Taylor, Fraser and White (1994) were used in the study.

Equalization Test

The equivalence test established by the researcher 25 questions were selected from the YGS (2010-2015) first semester topics. The questions were prepared from YGS exam questions which are applied throughout the country and the scope validity is provided. However, the scope validity of this test has been obtained by

obtaining expert opinion from two faculty and two high school mathematics teachers. For the reliability of the test, 123 students studying in the 11th grade were piloted. As a result of the reliability analysis, the KR20 value was 0.89 and the scale was found to be reliable.

Achievement test

The pre-post achievement test used in the study was developed by the researcher (taking into account the gains of sequence unit) as 20 questions. The scope validity was provided by four experts consisting of faculty and mathematics teachers. A total of 113 12nd grade students were piloted for the validity and reliability of the test. The scores of the students were listed in order of success. The upper parts of 27% and lower parts of 27% were taken out. The results were analyzed in Table 2.3.

Table 2.3. Item Analysis Indexes

Item No	Difficulty Index (p_j)	Discrimination Index (r_j)
1	0.58	0.51
2	0.72	0.35
3	0.56	0.48
4	0.53	0.61
5	0.43	0.41
6	0.58	0.70
7	0.62	0.48
8	0.56	0.35
9	0.50	0.54
10	0.74	0.45
11	0.59	0.74
12	0.61	0.38
13	0.66	0.54
14	0.66	0.48
15	0.62	0.67
16	0.56	0.74
17	0.64	0.64
18	0.53	0.54
19	0.67	0.58
20	0.59	0.67

The item difficulty index, which is one of the important factors in the item analysis, expected range is around 0.50. Another important factor is that the discriminant index value is higher than 0.30 means it is a good substance and it is a very good substance if it is higher than 0.40 (Büyüköztürk, 2008). As seen in Table 2.3, the difficulty indexes were between 0.43 and 0.74 and the discrimination of each item was higher than 0.30. For the reliability of the test, the results of the pilot application were analyzed and the KR20 value was calculated as 0.79.

Thought Survey

The thought questionnaire which is used in Üzel's (2007) doctoral thesis developed by Taylor, Fraser and White (1994) was used as a thought questionnaire in this study. The questionnaire consisted of 51 items in five-point Likert-type. It consists of six topics: Learning the World, Learning Mathematics, Learning to

Learn, Learning to Communicate, Learning Interest in Mathematics, and Teacher Support in Learning Mathematics. Üzel (2007) applied this survey in the 7th grade.

In this study, a total of 260 11th grade students were piloted in four different schools to test the suitability of the questionnaire to 11th grade. Exploratory Factor Analysis (AFA) was applied to the scale with the data obtained.

Kaiser-Meyer-Olkin (KMO) and Bartlett tests were performed to evaluate the suitability of the data set for factor analysis. If the KMO value is between 0.80 and 0.90, conformity is considered very good (Field, 2005). The KMO value of the pilot application was 0.893 and the result of the Bartlett test (p) was 0.000. So we can say that the data is suitable for factor analysis. The results of AFA are shown in Table 2.4.

Table 2.4. Results of Exploratory Factor Analysis

Item	1.Fac Load	2.Fac Load	3.Fac Load	4.Fac Load	5.Fac Load	6.Fac Load
24	0.736					
25	0.716					
23	0.710					
31	0.651					
28	0.589					
26	0.580					
29	0.573					
27	0.559					
21	0.529					
22	0.509					
30	0.480					
20	0.424					
48		0.819				
49		0.799				
44		0.784				
45		0.764				
51		0.726				
46		0.691				
50		0.677				
47		0.582				
37			0.727			
42			0.662			
33			0.659			
32			0.646			
43			0.645			
41			0.642			
39			0.595			
34			0.592			
35			0.578			
36			0.523			

38			0.427			
40			0.414			
15				0.712		
17				0.708		
16				0.701		
12				0.672		
14				0.662		
13				0.657		
19				0.596		
18				0.577		
10					0.709	
9					0.686	
8					0.661	
11					0.502	
4					0.491	
7					0.460	
6					0.429	
5					0.418	
1						0.681
3						0.611
2						0.556
Cronbach Alfa	0.882	0.902	0.898	0.843	0.791	0.80
Variance description rate	31.009	6.816	6.044	4.587	3.664	2.984
Extract Value	15.815	3.476	3.082	2.340	1.869	1.522
Total disclosed Variance Ratio = %55.105 KMO = 0.893 Bartlett Test Value = 6067.263, p = 0,000						

As seen in Table 2.4, the survey has a six-factor structure. The factor loadings of the items ranged from 0.414 to 0.819 and the total variance explained was 55.105%.

As a result, our questionnaire is a six-factor questionnaire consisting of 51 items and no change was needed. The Cronbach Alpha reliability coefficient of the questionnaire was 0.953. According to the results obtained, the validity and reliability of the scale were obtained and it was found that there was a questionnaire suitable for 11th grade.

In the survey Never - Rarely - Occasionally - Often - Always expressions were used. For the positive items (No = 1, Rarely = 2, Occasional = 3, Frequently = 4 and Always = 5) points were given. In negative items, the scoring was calculated as the opposite.

Transaction Process

The achievement test was applied as pre-test to the experimental and control groups before application. Then, the same instructor taught the experimental group with the help of the RME activities prepared according to the gains of the sequence ünit and taugh the control group with the current education system in 3 week (18 lesson hour). In the study applied to the experimental group, the aim of the activities is to discover the student's own solution by using the old knowledge and to obtain the general solution. Students realizes the horizontal mathematization by providing transition from real life to symbols at the solution stage and realizes vertical mathematization by reaching the formulas from the mathematical expression of the obtained symbols. Before the application, the students in the experimental group were asked to be divided into groups for two in each group and the activities were replicated to be given to each group. Before giving the activities to the groups, it was explained that they would not be given extra information to solve the problems related to the Sequences issue, they would learn this topic with the help of activities and the teacher would only answer the questions asked during the course. Students can access information and solutions themselves and then they were allowed to collaborate with the group and then the individual to reach the conceptual level by sharing the information they obtaine, attention was given to each student to speak and ask for help to the teacher.

An example of the course with activities; the lesson start with giging 10th Activity: " Red Snake". This activity has been prepared in accordance with the teaching gain that is the properties of the arithmetic and geometric sequences and finds the sum of the first n terms of the sequence. In the activity, the image of "ringed snake" was used. The number of black and red rings formed on the skin of the snake was given in a monthly order. The students were asked to find the number of rings to be formed according to their color within the first six months. It was intended to establish the general term for two separate sequences of ring terms and to show whether the ratio between the terms was constant. It is expected that the students will achieve mathematical knowledge from the model in this activity and achieve the concept of geometrical sequence, ie horizontal mathematics. Then it is expected to go into symbolization independently of the model to achieve the definition of geometric sequence, ie to perform vertical mathematics.

After the three-week activities, the success test was applied as a final test for both groups. In addition, after the application, the experimental group's opinions on the thought questionnaire and the RME approach were taken.

Data Analysis

SPSS software was used in the analysis of the data obtained from the study. Shapiro-Wilk test was used for data distribution. Since the data were not normally distributed, the MannWhitney U and Wilcoxon Signed Ranks Tests, which are nonparametric tests, were used. The data of the thought questionnaire applied to the experimental group students were interpreted on the basis of frequency and percentage distributions.

Results

In this section, the achievement test which are applied before and after the application and the results of the analysis of the data obtained in the thought survey conducted after the application were given to the experimental group students.

Findings of Success Test

The results of the achievement test before the application to the Experimental and Control Groups were analyzed in SPSS package program. Mann Whitney U test which is a nonparametric test was used. The data obtained from the test results are given in Table 3.1.

Table 3.1. Pre-Test Analysis Results of Experimental and Control Groups

Group	n	Rank Avarege	Rank Total	U	*p
Experimental	25	26.80	670	280	0.520
Control	25	24.20	605		

*p> 0.05

As it seen in Table 3.1 that, there was no significant difference between the pre-test achievement scores (U = 280.00; p = 0.520> 0.05), and it was observed that the mean values of the two groups were close to each other. That is, it can be said that the experimental and control groups were identical before the application.

Wilcoxon Signed Ranks Test was used to see whether the change in the pretest and posttest scores of the experimental group made a significant difference. The data obtained from the test results are given in Table 3.2.

Table 3.2. Experimental Group Pre Test – Post Test Analysis Results

Posttest-Pretest		n	Rank Avarege	Rank Total	z	*p
Experimental Group	**Negative Rank**	0	0	0	-4.379	0.000
	Positive Rank	25	13	325		
	Equal	0				

Based on Negative Rank

As seen in Table 3.2, there is a significant difference between the pre-test and post-test scores of the experimental group (z = -4.379; p = 0.0 <0.05). When the average of the rankings is taken into consideration, there is a significant difference in favor of the last test.

Wilcoxon Signed Ranks Test was used to see whether the change in the pre-test and post-test scores of the control group made a significant difference. The data obtained from the test results are given in Table 3.3.

Table 3.3. Control Group PreTest - PostTest Analysis Results

Posttest-Pretest		n	Rank Avarege	Rank Total	z	*p
Control Group	**Negative Rank**	0	0	0	-4.205	0.000
	Positive Rank	23	12	276		
	Equal	2				

Based on Negative Rank.

As seen in Table 3.3, there is a significant difference between the pre-test and post-test scores of the control group (z = -4.205; p = 0.0 <0.05). When the average of the rankings is taken into consideration, there is a significant difference in favor of the last test.

The results of the test after the application to the experimental and control groups were analyzed in SPSS package program. Mann Whitney U test which is a nonparametric test was used. The data obtained from the test results are given in Table 3.4.

Table 3.4. Post-Test Analysis Results of Experimental and Control Groups

Group	n	Rank Avarege	Rank Total	U	*p
Experimental	25	33.34	833.50	116.50	0.000
Control	25	17.66	441.50		

*p<0.05

As seen in Table 3.4, there was a significant difference between post-test achievement scores (U = 116.50; p = 0.0 <0.05). When the mean of the groups (D.G. = 33.34; K.G. = 17.66) it can be said that this difference is in favor of the experimental group.

Findings of the Thought Questionnaire

After 3 weeks of application, the results of the thought questionnaire were analyzed with SPSS package program and frequency percentage distributions were given to the experimental group.

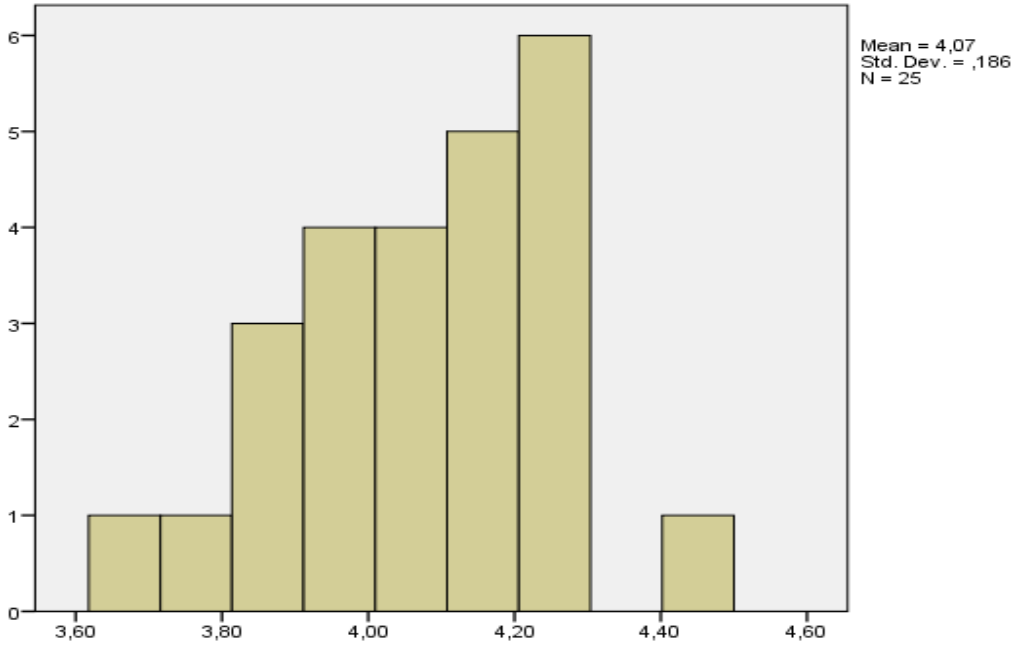

Figure 3.1. Average scores of students

Figure 3.1 shows the scores of the experimental group students' views on the RME approach applied for three weeks. In the evaluation of the opinion survey, the lowest score is one and the highest score is five. As seen in the figure, the majority of students gave a score of 4 or more to the RME approach. In general, the average score of 4.07 was calculated. According to this average value, it can be concluded that students expressed positive opinion about RME approach.

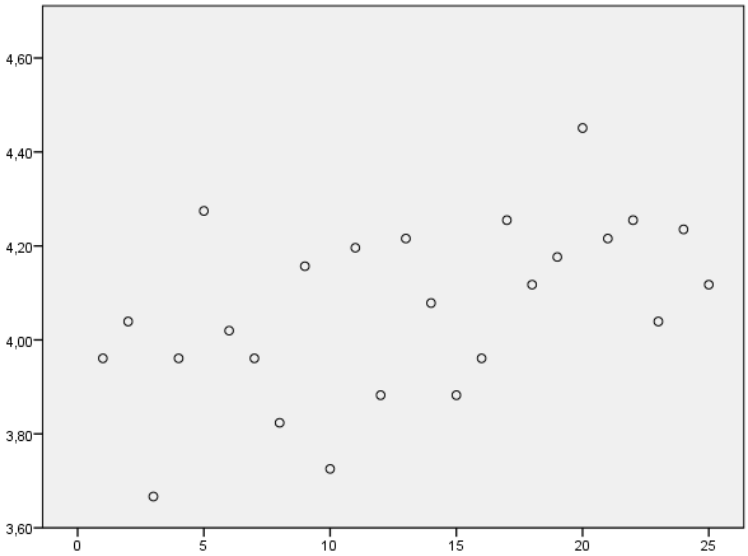

Figure 3.2. Distribution of average scores given by each student

Figure 3.2 shows the distribution of the average scores of each student in the experimental group regarding the RME approach applied for three weeks. As can be seen in the figure, the distribution is between 3.60 and 4.60 and it is concentrated in regions above 4.00 points.

The thought questionnaire applied to the experimental group consists of 51 sentences that are collected under six titles: Learning the World, Learning Mathematics, Learning to Learn, Learning to Communicate, Learning to Mathematics and Teacher Support in Learning Mathematics.

The opinions of the students given to the three sentences under the title Learning to the World are 92%, 92% and 92%, respectively, and 4 point and over were found to be positive. The opinions of students given to eight sentences under the title of Learning Mathematics are 84%, 92%, 92%, 92%, 92%, 96%, 88%, 88% respectively, and 4 point and above were found to be positive. The opinions of students given to eight sentences under the title of Learning to Learn were found to be positive of 4 points and above, as 80%, 80%, 84%, 88%, 76%, 80%, 76%, 92% respectively. Students' opinions given to 12 sentences under the title of Learning to Communicate are 76%, 84%, 76%, 84%, 92%, 84%, 84%, 92%, 92%, 84%, 88%, 80% respectively and 4 point and over were found to be positive. Students' opinions given to 12 sentences under the heading of Learning Mathematics are 72%, 88%, 96%, 88%, 92%, 84%, 80%, 76%, 92%, 84%, 92%, 80% and 4 points respectively. and above. The opinions of the students given to the eight sentences under the title of Teacher Support in Learning Mathematics were found to be positive as 88%, 88%, 88%, 92%, 84%, 96%, 92%, 92% respectively, and 4 point and over were found to be positive.

Discussion Results and Recommendations

Discussion and Conclusion

In this study, it is aimed to reveal the effect of using RME approach in teaching 11th grade sequences subject on student achievement and students' opinions about RME. For this purpose, the experimental group students were informed about the sequences according to the current education system with the help of the activities prepared in accordance with the principles of RME. As a result of the analysis of the tests performed before and after the application, it was determined that the experimental group students were more successful and had positive thoughts about RME.

In this section, the results of the achievement test, thought questionnaire and the comparison of these results with the literature are given.

Achievement Test Results

In order to examine the effect of teaching according to the RME approach on student achievement, achievement test was applied to the experimental and control groups as pre and post test. As a result of the pre-test analysis, there was no significant difference between the pre-achievement test scores of the experimental group in which realistic mathematics education was applied and the control group in which the current education system was applied.

As a result of the analysis of the last achievement test data applied to both groups, it was seen that there was a significant difference in favor of the experimental group between the last achievement test scores of the experimental group in which realistic mathematics education was applied and the control group in which the current education system was applied. This means that the education provided by RME approach is more effective than the current education system in increasing student achievement. In his study, Demir (2017) examined the effect of RME-supported teaching on academic achievement in the surface areas and volumes of 10th grade solids and concluded that RME-supported teaching was more effective than current teaching. Özdemir (2015) examined the effect of RME supported instruction on academic achievement in the 9th grade

sets and concluded that RME supported instruction is more effective than the current education system. Likewise, Akyüz (2010) examined 12th grade integration, Erdoğan (2018) 6th grade numbers and operations, algebra, Özçelik (2015) examined the students' achievements in 7th grade percentages and interest and concluded that RME teaching was more effective than the current education system. These results coincide with the results of our study. On the other hand, Can (2012) examined the effect of RME on student achievement in measuring 3rd grade fluids and lengths in the study and concluded that RME did not make a significant difference in improving the course achievement according to the current education system.

Results of Thought Questionnaire

As a result of the analysis of the thought questionnaire applied in order to learn the opinions of the experimental group students about the RME approach, it is seen that the students' opinions about the RME are positive. Üzel (2007) examined the students' views on the RME approach in the first grade unknown equations and inequalities in the 7th grade and concluded that the views were positive. Yorulmaz (2018) concluded that RME's research on the effect of elementary school 4th grade students on eliminating errors in four processing skills concluded that students' views on RME were positive. Likewise, Altaylı (2012) has reached the same conclusion in their studies on 7th grade ratio-ratio, Çilingir (2015) on 4th grade geometric shapes and Ersoy (2013) on 7th grade probability and statistics. These results are in parallel with the results of our study.

As a result, in the analysis of the data obtained from the research, it was seen that teaching with RME was more effective than the current teaching method in increasing the students' success and that students expressed positive opinion about teaching with RME approach.

Suggestions

In this study, the effects of high school 11th grade sequences unit using RME approach on students' success and the opinions of experimental group students about RME were examined and positive results were obtained in both. The use of the RME approach makes them easier to grasp. In the literature, it was seen that most of the researches about RME have a result in parallel with this study. One of the important factors in the selection of sequences in this study is that it is difficult to understand by the students. According to the results of the difficulty index research of mathematics subjects, the issue of sequences is one of the subjects with high difficulty index. When the results of this research are taken into consideration, some suggestions have been made in order to improve the quality and success of mathematics education.

Suggestions for Research Results

1. Transferring the sequences subject, which is in the first place of the difficulty indexes, to the student by intertwining with real life has enabled the students to increase their success and to have positive thoughts about the teaching done with RME approach. Therefore, the application of RME on the patterns that form the basis of the subject of the sequences may lead to the last ranking of this issue in the difficulty indexes and increase the academic achievement of the students.

2. This study is limited to a small number of students in a short period of time. and in a long time, with a large group of students and studies involving multiple topics in mathematics, the effect of RME approach on success, attitude and permanence can be examined.

3. In the studies conducted on RME, the opinions and thoughts of the students are taken as well as similar study could be done on the opinions and thoughts of the teachers.

Recommendations for RME

1. Most of the national studies on RME have been limited to secondary schools. Studies can be increased at primary, high school and university level.

2. One part of RME is composed of students and the other part is teachers. Therefore, more studies can be included in the studies, including mathematics teachers, who teach the students with the application of the RME approach.

3. A teacher should not have difficulty in transferring mathematics to real life. Therefore, RME can be taught as a course to undergraduate mathematics teacher candidates.

GENİŞLETİLMİŞ ÖZET

Diziler Konusunun Gerçekçi Matematik Eğitimi ile Öğretilmesinin Öğrenci Başarısına ve Görüşlerine Etkisi

Giriş

Öğrenmenin davranıştaki değişiklik, öğretmenin ise öğretmen tarafından öğrenciye bilgi aktarımı olarak tanımlandığı 20. yüzyılın başlarında disiplinler, beceri ve kavramlara ayrılarak basitten daha karmaşık olana doğru sıralanmıştır. Değerlendirmeler ise tasarlanırken davranıştaki değişmeler dikkate alınmıştır. Günümüzde ise öğrenme-öğretme sürecinin bağlı olduğu aşamalar büyüme, gelişme ve etkileşim olarak değişmiştir. Bu değişim yeni öğrenim kuramlarının ortaya çıkmasına sebebiyet vermiştir. Bu kuramların başında, kuramsal gelişimi yönünden eski olan fakat uygulamalar yönünden yeni olan yapılandırmacılık kuramının yanında hem kuramsal gelişimi hem de uygulamaları yeni olan Gerçekçi Matematik Eğitimi (GME) kuramı dikkate değerdir. (Altun, 2006'dan aktaran Akkaya, 2010). 1970'li yıllarda yaygın olarak kullanılan mekanik yaklaşıma tepki olarak GME, Hollandalı matematikçi ve eğitimci Freudenthal tarafından ortaya atılmıştır (Özdemir, 2015:16). GME'ye göre "gerçekçi" kelimesi gerçek hayatta var olan anlamına geldiği kadar gerçek hayatta olmayıp zihinsel olarak somutlaştırılabilen durumlar olarak da tanımlanabilir. Önemli olan matematiksel bir problemin zihinsel yönden uyumlu ve kabul edilebilir olmasıdır (Van den Heuvel-Panhuizen, 2000: 4).

Bu araştırmanın genel amacı, diziler konusunun gerçekçi matematik eğitimi (GME) etkinlikleriyle öğretiminin öğrenci başarısına etkisini ve öğrencilerin GME ile ilgili görüşlerini incelemektir. Bu amacı gerçekleştirmek için aşağıdaki sorulara cevap aranmıştır:

1. GME yaklaşımı uygulanan deney grubu ile mevcut eğitim sistemiyle eğitim gören kontrol grubu arasında öğrencilerin akademik başarı düzeyleri açısından anlamlı bir fark var mıdır?
2. GME yaklaşımı uygulanan deney grubu öğrencilerinin GME destekli öğretime ilişkin görüşleri nelerdir?

Yöntem

Bu çalışmada, ön test ve son test kontrol gruplu yarı deneysel model kullanılmıştır. Bu çalışmada bağımsız değişken GME yaklaşımı ile yapılan matematik öğretimi, bağımlı değişken ise başarı testi sonuçları ve GME hakkındaki görüşlerinin alındığı anket sonuçlarıdır. Gruplardaki öğrenciler belirlenirken rastgele atama yapılmayıp denkliklerine bakılmıştır. Deneysel desen ile yarı deneysel desen arasındaki fark deney ve kontrol gruplarının rastgele seçim yerine ölçümlerle belirlenmesidir (Ekiz, 2003; Karasar, 2006). Campell ve Stanley'e (1963) göre grupların seçimi esnasında rastgele atama yapılamıyorsa kullanılan yöntem deneysel değil yarı deneysel bir yöntemdir.

Araştırmanın çalışma grubunu 2015-2016 eğitim öğretim yılında Malatya ili Yeşilyurt ilçesinde bulunan bir lisenin 11. sınıfında okuyan ve biri deney grubu (n=25) diğeri kontrol grubu (n=25) olarak belirlenen toplam 50 öğrenci oluşturmaktadır. Uygulama öncesinde gruplar arasındaki denklik, öğrencilerin bir önceki dönem karne notları ve araştırmacı tarafından hazırlanan denkleştirme testi sonuçlarına bakılarak sağlanmıştır.

Çalışmada veri toplama aracı olarak araştırmacı tarafından geliştirilen denkleştirme testi, yine araştırmacı tarafından geliştirilen başarı testi ve Taylor, Fraser ve White (1994) tarafından geliştirilen düşünce anketi kullanılmıştır. Çalışma sonucunda elde edilen verilerin analizinde SPSS paket programı kullanılmıştır. Verilerin Shapiro-Wilk testi ile dağılımları incelenmiştir. Veriler normal dağılım göstermediğinden dolayı nonparametrik test olan MannWhitney U ve Wilcoxon İşaretli Sıralar Testleri kullanılmıştır. Deney grubu

öğrencilerine uygulanmış olan düşünce anketinin verileri ise frekans ve yüzde dağılımları üzerinden yorumlanmıştır.

Bulgular

Uygulama yapılmadan önce her iki gruba da yapılan ön test başarı puanları arasında istatiksel olarak anlamlı bir farkın olmadığı görülmüş ($U = 280.00$; $p = 0.520 > 0.05$) ve her iki grubun ortalama değerlerinin birbirine yakın olduğu gözlendi. Yani deney ve kontrol gruplarının uygulamadan önce aynı olduğu söylenebilir. Ancak son test başarı puanları arasında istatiksel olarak anlamlı bir farkın olduğu görülmüştür ($U = 116.50$; $p = 0.0 < 0.05$). Grupların ortalaması incelendiğinde (D.G. = 33.34; K.G. = 17.66), bu farkın deney grubu lehine olduğu söylenebilir.

Görüş anketinin değerlendirilmesinde en düşük puan bir en yüksek puan beştir. Anket sonuçları incelendiğinde öğrencilerin çoğunluğunun GME yaklaşımına 4 ve üzerinde puan verdikleri görülmüştür. Genel olarak verilen puanların ortalaması 4,07 olarak hesaplanmıştır. Bu ortalama değerine göre öğrencilerin GME yaklaşımı hakkında olumlu görüş bildirdikleri sonucuna varılabilir. Deney grubundaki her bir öğrencinin üç hafta boyunca uygulanan GME yaklaşımına ilişkin vermiş oldukları ortalama puanların dağılımı 3.60 ile 4.60 arasında olduğu ve 4.00 puanın üzerindeki bölgelerde yoğunlaştığı görülmüştür.

Sonuç ve Tartışma

GME yaklaşımına göre yapılan öğretimin öğrenci başarısına etkisini incelemek için deney ve kontrol gruplarına başarı testi ön ve son test olarak uygulanmıştır. Ön test analizi sonucunda gerçekçi matematik eğitiminin uygulandığı deney grubu ile mevcut eğitim sisteminin uygulandığı kontrol grubunun ön başarı testi puanları arasında anlamlı bir farkın olmadığı görülmüştür. Her iki gruba da uygulanan son başarı testi verilerinin analizi sonucunda ise, gerçekçi matematik eğitiminin uygulandığı deney grubu ile mevcut eğitim sisteminin uygulandığı kontrol grubunun son başarı testi puanları arasında deney grubu lehine anlamlı bir farkın olduğu görülmüştür. Bu demektir ki GME yaklaşımı ile yapılan eğitimin öğrenci başarısını arttırmada mevcut eğitim sistemine göre daha çok etkili olduğu söylenebilir.

Deney grubu öğrencilerinin GME yaklaşımı hakkındaki görüşlerini öğrenebilmek için uygulanan düşünce anketinin analizi sonucunda, öğrencilerin GME hakkındaki görüşlerinin olumlu yönde olduğu görülmektedir. Üzel (2007) çalışmasında 7. sınıf birinci dereceden bir bilinmeyenli denklemler ve eşitsizlikler konusunda öğrencilerin GME yaklaşımı hakkındaki görüşlerini incelemiş ve görüşlerin olumlu yönde olduğu sonucuna varmıştır.

Sonuç olarak araştırmadan elde edilen verilerin analizinde öğrencilerin başarısını arttırmada, GME ile gerçekleştirilen öğretimin mevcut öğretim yönteminden daha etkili olduğu ve öğrencilerin GME yaklaşımı ile yapılan öğretim hakkında olumlu görüş belirttiği görülmüştür.

Öneriler

GME hakkında yapılan çalışmalarda sürece ait öğrenci görüş ve düşünceleri alındığı gibi öğretmenlerin de görüş ve düşünceleri alınabilir.

GME hakkında ulusal alanda yapılan çalışmaların birçoğu ortaokullarla sınırlı kalmıştır. İlkokul, lise ve üniversite düzeyinde çalışmalar arttırılabilir.

GME'nin bir ayağını öğrenciler diğer ayağını öğretmenler oluşturmaktadır. Bundan dolayı çalışmalarda matematik öğretmenlerini de kapsayan, onlara GME yaklaşımının uygulanışını öğreten çalışmalara daha fazla yer verilebilir.

Bir öğretmen, matematiği gerçek hayata aktarabilme konusunda zorluk çekmemelidir. Bundan dolayı GME lisans seviyesinde matematik öğretmeni adaylarına ders olarak verilebilir.

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