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THE EFFICIENCY OF COMPUTER- AIDED INSTRUCTION AND CREATIVE DRAMA ON ACADEMIC ACHIEVEMENT IN TEACHING OF INTEGERS TO SEVENTH GRADE STUDENTS

Abdullah Kaplan¹, Mesut Öztürk^{2*}, Eren Ertör³

¹Atatürk University, Department of Elementary School Mathematics Education, Erzurum,

²Gümüşhane Centre of Science and Art, Gümüşhane,

³Ağrı İbrahim Çeçen University, Department of Child Development, Agri (TURKEY)

*Corresponding author: mesutozturk@live.com

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ABSTRACT

This study aims to compare computer-aided instruction, creative drama and traditional teaching methods in teaching of Integers to the seventh grade students. The study was conducted in a primary school with eighty seven students (N=87) in a county of Ağrı, in spring term of academic year 2011-2012. A non equivalent control group quasi experimental research design was used for the evaluation. Data of study were obtained through educational achievement test. SPSS 16.0 software program was used for two-way ANOVA analysis. At the end of the study, most successful group was computer-aided instruction group, while there was no significant difference between creative drama and conventional education group.

Key words: Interactive Learning Environments, Secondary Education, Teaching/Learning Strategies

1. INTRODUCTION

Schools exist to ensure that students are prepared to be productive individuals, however traditional education methods are not adequate. New learning environments and instructional designs are needed to overcome the problems. New schools have rules created with the contributions of all the students and shared responsibility. Instructional design flaws can be resolved by active learning strategies (Açıkgöz, 2003; Dewey, 1936/ 2011). In active learning approach, active participation improves the students' skills. Through contemporary methods of this approach which focuses on student centered learning and group work, the children learn creativity, improve their problem solving skills and learn to express themselves. This approach is based on speaking, listening, reading, writing and reflecting (Karamustafaoğlu,2009).

Mathematics is a subject that contributes to student development in many ways. With the help of active learning strategies, several subject of mathematics can be taught without causing any boredom, by drawing interest of students and it could turn into an enjoyable subject. However, there are some abstract concepts in mathematics that are difficult to learn. To teach these concepts, using concretizing models or including some activities that concretize mathematics would be needed.(Bottino and Kynigos,2009;Ersoy and Baki,2004). Computer is one of the concretizing materials in instruction methods for computer-aided instruction.

Computer-aided instruction could be defined as usage of the computer in instructional environment (Haliloglu, Tatli, 2009).As for the computer-aided mathematics instruction it could be defined as processing, production and application of mathematical knowledge based on computer.

Although computer is thought to be very useful in instructional environment, its use is delayed due to many reasons, such as; efforts to implement technology to traditional methods, lack of qualified teachers and the belief that computers would replace the teachers (Baki, 2001).In spite of current limitations, the use of computers in education is growing at a rapid rate. Computer-aided instruction has become important in parallel with this development and with various application methods, it is becoming widely used. There are two types of softwares used in computer-aided instruction; conventional software use in a more conventional computer-aided instructional environment and innovative software that supports constructivist learning environments. Each of this software would be equally effective in instructional environment. (Baki, 2002; Öztürk, 2011).

In learning environment, conventional computer-aided instruction software classified by purpose and usage into two categories as "Drill and practice" and "Tutorials", while innovative computer-aided instruction software classified into six categories as, "Dialog based application", "Spreadsheets", "Animation", "Microworlds", "Hypermedia" and "Internet".(Baki,2002).In this study, MS Excel Spreadsheet,one of the computer-aided instruction software, was used. Commonly used spreadsheet is a table which displays numbers in rows and columns, graphs and statistics, it helps to create database and also helps students to visualize mathematical formula tables as a whole (Baki, 2002; Peker and Bağcı, 2008).The other method used in the study is "Creative Drama".

Lessons taught through creative drama, which was introduced in mathematics instruction in twentieth century, spark curiosity in students. It prepares them for learning and problem solving, and socialization becomes more meaningful and enjoyable. Also, some mathematical concepts are learnt faster and easier through drama. Mathematics instructors can make the lessons more concrete and attractive. With the help of drama in mathematics classes, students can become creative individuals (Erdoğan and Baran, 2009; Özsoy, Güneş and Yüksel, 2002).

Karadağ and Çalışkan (2008) define drama in education as learning lifetime situations. Creativity is the ability to make unprecedented connections. Consequently, it is a new way of life, experience, formation of new opinions and products, redefining our environment, introducing innovations that are convenient and realistic for individuals and cultures in a new thinking system (San, 1985). Based on these two definitions, creative drama can be described as, recreating real life situation drama in group interaction process by experts. (San, 1990).

With the help of drama, children become more active and curious. Creative drama in instructional environment, along with interaction and socialization, improves students' self-confidence and respect, as well as communication and problem solving skills with the sense of belonging in a society. (Duatpe-Paksu and Ubuz 2009; Karadağ and Çalışkan, 2008; Yeğen, 2003). In drama studies, real life situations are formed to maintain efficiency of instruction. Senses, along with imaginative realism, increases intellectual capacity of children (Erdoğan and Baran, 2009).

In numerous studies, carried out by applying creative drama to mathematics instruction, creative drama or drama is compared to the traditional instruction methods, and drama is found to be more effective (Duatpe-Paksu and Ubuz 2009; Fleming, Merrell and Tymms, 2004; Karapınarlı, 2007; Kayhan, 2004; Kayhan and Argün, 2008; Kayhan, 2009; Örnek 2007; Saab, 1987; Sözer, 2006). Studies also demonstrate that, in comparison of computer-aided instruction versus traditional instruction on the academic performance, students were academically more successful (Baki and Özpınar, 2008; Çakir and Simsek, 2007; Ganguli, 1990; Kaplan and Ozturk, 2011; Liao, 2007; Tuluk and Kaçar, 2007; Yılmaz, Ertem and Güven, 2010).

Birgin, Kutluca and Gürbüz (2008), compared their experimental study of computer-aided instruction, by using "MS Excel and "Coypu" software versus traditional instruction. Results indicated that computer-aided instruction was much more effective than the traditional instruction on increasing academic achievement.

1.1. The Aim of the Study

This study was conducted to compare computer-aided instruction, creative drama and traditional instruction method on academic achievement level in the instruction of Integers, limited to seventh grade mathematics program. Therefore, the following sub-problems has been tried to resolve:

1. Is there any statistically significant difference between pretest results and academic achievement in instruction of Integers to seventh grade students?
2. Is the effect of interaction between different instructional methods applied groups and pretest on academic achievement significant?
3. Is there a significant difference between computer-aided instruction, creative drama and traditional instruction method on academic achievement level in the instruction of Integers to seventh grade students?

2. METHOD

2.1. Population and Sampling

Population of the study consists of the seventh grade students in 2011/2012 school year in city of Ağrı and districts. A total of 87 seventh grade students participated in the study, and the school was chosen by convenience sampling method which is one of the random sampling methods. Pilot study was conducted with 29 students.

2.2. Data Collection Instruments

In the study, the questions were selected by literature searching, then changed and rearranged, and also some more questions were prepared by researchers in order to develop a questions pool. A total of 20 questions were chosen by researchers and these questions were reviewed by four mathematics teachers to ensure they were appropriate and suitable for instructional purposes. Subsequently, the questions were reviewed by two faculty members and validated. These tests covered 20 questions about seventh grade level Integers subject and they were applied to the 29 students for the pilot study. The reliability of the scale was found as 0.714 with Cronbach Alpha. This value is considered to be quite reliable by Kayış (2009).

2.3. Data Analysis

SPSS 16.0 statistical package was used for data analysis. The two-way ANOVA was used to examine the influence of two independent variables (pretest, groups) on a dependent variable (academic achievement). Subsequently, the data were assessed based on the assumption of the level of significance equal to $p=0,05$.

2.4. Research Method

We used non equivalent control group design as one of the quasi-experimental study designs (Yount, 2006). There is no random assignment in this design and one of the present groups is selected as control group. Pretests are implemented to the groups and after the application of program, posttest are implemented (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz and Demirel, 2010). In quasi-experimental designs, pretests and posttests would provide a more reliable estimation (Grimshaw, Campbell, Eccles and Steen 2000). In this trial, three different groups participated. Control group was selected randomly and they received traditional instruction

(education with chalk-board, paper-pen); first experimental group received computer-aided instruction and second experimental group received instruction through creative drama.

2.5. Experimental Process

Pretests were applied to the groups at the beginning of the study. Following the test results, first group received traditional instruction, second group received MS Excel program used computer-aided instruction, and creative drama was applied to the third group.

2.5.1. Application of Computer-Aided Instruction

In the trial, one of the new computer-aided instruction instruments, Microsoft Excel compatible "spreadsheets" were used. Excel has features that make it quite convenient to apply for mathematical instruction. (Baki, 2002; Bell and Baki, 1997). Below, screen displays of two Excel program windows is presented.

This program is implemented in an educational environment, according to the computer-aided instruction program approach. Consequently, presentations were given, in accordance with achievement gains of seventh grade instruction lessons and several sample problems were solved throughout the class. After the presentation, beginning with the examination of solved problems in Excel, students were able to create various generalizations, such as "multiplying two negative numbers gives a positive one". Students answered many questions (measuring from knowledge level to analyzing ability level) on the worksheets, prepared with the help of this program. Here is the recorded macro of ready-to-use screen display (Figure 1 and Figure 2), worked by a student:

```
Range("A3").Select
ActiveCell.FormulaR1C1 = "-3"
Range("C3").Select
ActiveCell.FormulaR1C1 = "-5"
Range("A4").Select
ActiveCell.FormulaR1C1 = "5"
Range("C4").Select
ActiveCell.FormulaR1C1 = "-3"
```

One more macro recorded by another student as the study progressed:

```
Range("T3").Select
ActiveCell.FormulaR1C1 = "=QUOTIENT(RC[-4],RC[-2])"
Range("P4").Select
ActiveCell.FormulaR1C1 = "6"
Range("R4").Select
ActiveCell.FormulaR1C1 = "-2"
Range("T3").Select
Selection.AutoFill Destination:=Range("T3:T6"), Type:=xlFillDefault
```

2.5.2. Implementing Creative Drama

At the beginning of this project, the students were requested to design money imitations appropriate for daily life usage. Students were prepared for the lessons and they chose to act like butcher, fruit seller, barber... or a customer. During class a drama was played according to an event in real life. This drama included daily shopping activities. While some of the students played the drama, one of the students chosen by them wrote the shopping on the blackboard with mathematical operations. During these operations, the operations were declared out loud by the students playing the drama. The mistakes made in the operations were corrected by the rest of the students.

3. FINDINGS

To make the Variance and Kovariance analyze of the parametric test, the data must match normal distribution. The variation of the coefficient of skewness between "-1" and "+1" means there is no significant deviation from the normal distribution (Büyüköztürk 2005). In this study, it was determined that the variation of the coefficient of skewness was between "-1" and "+1" and matched the normal distribution. Descriptive statistics of the test is given in Table 2.

Descriptive statistics of pretest and posttest results related with academic achievements of groups are given in Table 3.

As shown In Table.3, experiment-1 group had the highest score among the groups' academic success in pretest mean values, and the control group has the lowest. As for the posttest results, the same group was again holding the highest score, whereas the experiment-2 group had the lowest one.

To determine if there is a significant difference among the groups' pretest success scores, analysis of variance (one way ANOVA) was carried out. Two basic assumptions of one way ANOVA are examined. If the variances from these assumptions are homogeneous, it is assumed that all assumptions are matched (Antalyalı, 2009, s.133). When the homogeneity of variance test is applied, variances were found to be homogeneous ($p=0,184>0,05$). Analysis of variance results are given below in table.4.

According to the analysis of variance, there was no significant difference among the groups' academic achievement pretest scores [$F(13,73)=1,530$; $p=0,127$]. In another words, the groups' pretest achievement scores could be considered equal to each other.

In the implementation of two way ANOVA, test of homogeneity of variances was done, and the variances were found not to be homogeneous ($p=0,000$; $p<0,05$). Since the variances were not equal, the results of "Equal Variances Not Assumed" in two-way ANOVA were checked. In table.5, two-way ANOVA results are given.

When the p values in table.4 is evaluated, it shows that the groups have a significant effect on the dependent variable ($p=0,004$; $p<0,05$), while pretest and groups-pretest interaction has no significant effect on academic achievement.

Because the group factor is comprised of three categories, multi comparisons have been made to find the source of the significant difference. Since the variances among the groups were not equal, "Games- Howell", one of the multi comparison tests, was reviewed. Multi comparison test results have been given in Table.6.

Experiment-1 group subjects were more successful than the ones getting education in experiment-2 group and control group. On the other hand, no significant difference was found between experiment-2 group and the control group.

4. RESULTS AND RECOMMENDATION

Students in computer aided education are more successful than the ones in creative drama and traditional education. No significant difference has been found between creative drama and traditional education groups. This result shows similarities to some other trials (Kariuki and Humphrey, 2006). The computer aided education groups were more successful than the traditional education group. This result showed similarities to many other studies on comparing computer aided mathematics education to traditional mathematics education (Aktümen ve Kaçar 2008; Buran, 2005; İpek ve İspir, 2011; Liao,2007; Özkök, 2010; Pilli, 2008; Tatar, 2012; Tuluk ve Kaçar, 2007; Wang, 2011; Yılmaz, Ertem ve Güven, 2010). Another result is computer aided education group is more successful than the creative drama group.

Although active learning is adopted as a principle in our education system, there are still problems in our schools providing this kind of education. However, our teachers do not have enough practice and they have known these methods on information level only, so they fail to transfer the information to the classes. As a reflection of this problem, students who have never seen education with the drama method and haven't faced the problems of daily life have been interested in classes; however, they had a hard time putting daily life and mathematics together. Therefore, finding no significant difference between drama and the traditional group at the end of the research could be connected to this result.

Theater actors can be brought to schools; and children could be taught how to act according to the role, also students could be taught how to make improvisations, so that they can become accustomed to real life situations through drama. Teacher could be trained in in-service training activities through seminars about computer aided instruction tools such as preparing animation stories, so teachers can prepare computer aided activities suitable to their schedule.

Appendix A

TOPLAMA İŞLEMİ				ÇIKARMA İŞLEMİ			
1. SAYI	2. SAYI		SONUÇ	1. SAYI	2. SAYI		SONUÇ
-3	+	-5	= -8	-7	-	3	= -10
5	+	-3	= 2	-7	-	-3	= -4
2	+	-5	= -3	7	-	-3	= 10
8	+	-3	= 5	7	-	3	= 4
8	+	-5	= 3		-		= 0
-7	+	3	= -4		-		= 0
-5	+	-1	= -6		-		= 0

Fig. 1. Screen display of addition and subtraction operations

ÇARPMA İŞLEMİ			BÖLME İŞLEMİ		
1. SAYI	2. SAYI	SONUÇ	1. SAYI	2. SAYI	SONUÇ
X	=	0	:		= 0
X	=	0	:		= 0
X	=	0	:		= 0
X	=	0	:		= 0
X	=	0	:		= 0
X	=	0	:		= 0
X	=	0	:		= 0

Fig. 2. Screen display of multiplication and division operations

Table 1. Applications Based On Methods of Instruction Weeks

Week	Period	Gain	Trial-1 Group	Trial- 2 Group	Control Group
			1	2	-
2	4	Student can add and subtract Integers.	Integers addition and subtraction presentation were given and sample problems were solved. Operations were verified by a program .Students learnt about addition and subtraction generalization.	Students lent, borrowed and also shopped with money, cheque and bonds they prepared. They demonstrated these procedures on class board.	The rules of adding and subtracting Integers were taught to the students. Relevant problems were solved.
			Integers multiplication and division presentation were given, and sample problems were solved. Operations were verified by a program .Students learnt about multiplication and division generalization.	Students used the money, cheque and bonds they prepared for the market shopping and demonstrated these procedures on class board.	The rules of multiplication and division of Integers were taught to the students. Relevant problems were solved.
3	4	Students can multiply and divide Integers.			
			Students can solve and set up Integers problems.	“Problems” menu was set up in the program and 8 problems and solutions were given. After solving the problems, they accessed the solution by clicking on the screen.	Students answered more complicated problems with shopping theme. Various problems were solved and suitable problem was set up for the given solution.
4			Academic achievement posttests were applied.	Academic achievement posttests were applied.	Academic achievement posttests were applied.
1					

Table 2. Descriptive Statistics of The Test

	Pretest	Posttest
Mean Values	33,00	39,71
Medium	34,00	35,00
Standard deviation	12,50	14,13
Variance	156,12	199,63
Skewness	0,51	0,13
Kurtosis	0,14	0,69

Table 3. Descriptive Statistics of Pretest And Posttest Results Related With Academic Achievements of Groups

Groups	N	Pretest		Posttest	
		Mean Value	Standard Deviation	Mean Value	Standard Deviation
Experiment-1	29	38,28	13,65	48,68	2,75
Experiment-2	31	31,87	10,04	31,20	3,04
Control	27	28,63	12,13	36,30	3,08
Total	87	33,00	12,50	36,23	2,96

Table 4. The Pretest One-Way ANOVA Results of The Group's Academic Achievement

Variance source	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance level (p)
Intergroup	11,982	13	0,922	1,530	0,127
Within-group	43,972	73	0,602		
Total	55,954	86			

Table 5. Groups academic achievement pretest-posttest. The pretest-posttest two-way ANOVA results of the group's academic achievement

	Sum of Squares	Sd	Mean Square	F	p	Eta Square
Groups	2157,99	2	1078,60	6,89	0,004	0,343
Pretest	2033,06	13	156,39	1,00	0,479	0,333
Groups*Pretest	2317,48	15	154,50	0,95	0,518	0,203

Table 6. Games- Howell Multi Comparison Test Results of The Groups' Academic Achievement

Groups (I)	Groups (J)	Mean Difference (I-J)	Standard Error	Significance level (p)
Experiment- 1	Experiment - 2	15,07	3,23	0,000
	Control	11,40	3,90	0,014
Experiment- 2	Experiment - 1	-15,07	3,23	0,000
	Control	-3,67	2,99	0,442
Control	Experiment - 1	-11,40	3,90	0,014
	Experiment - 2	3,67	2,99	0,442

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