THE EFFECT OF USING COMPUTER ANIMATIONS AND ACTIVITIES ABOUT TEACHING PATTERNS IN PRIMARY MATHEMATICS

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ABSTRACT

In this study it is investigated that teaching of different pattern types by using computer animations and activities. The sample of this study was 28 eighth grade students in second semester of 2010-2011 educational years. They are at public school in Ankara. The one group pre-test post-test design was used for research methodology. Data were collected by pre-test and post-tests which were developed by researchers and it was revised in terms of reliability and administered to the students. The subject was showed by using computer to the students after pre-test. At the end of the teaching, that achievement test was applied on the group as the post-test. For data analysis, quantitative methods were used. According to the findings; academic performance of the students increased by using computer animations and activities about patterns. Also, it is found that there was a significant difference between academic performances of students about different pattern types.

INTRODUCTION

Mathematics, which is known to improve thinking, is one of the most important devices. As it is known, the basic property which distinguishes humans from other living beings is the ability to think, making inferences and rearranging condition suitable to him (Umay, 2003). Mathematics is a science which has application in science, technology and in all other sciences, and mostly it is called a science of order and pattern. It doesn't mean numbers and operations carried out with them (Yaman, 2010). A sub-branch of mathematics which we confront in nature, art, environment and in many other areas is geometry. Geometrical shapes and objects which have an important place in human life are encountered frequently in daily life. When we look around there are a quite a lot of geometrical shapes, patterns and structures in the good we use (Gürbüz, 2008).

The pattern concept encountered prevalently in daily life has started to be given at primary education level. Pattern concept which takes place in primary education mathematics curriculum, especially at the levels of 6^{th}, a 7th and 8th grade is given with different presentation forms.

Especially given the level of primary education algebra means that abstract and fight for students (Willoughby,1997). The education of algebra that began in the 7th grade with the Mathematical Curriculum, changed in 2004, begins to be given from the first years of primary school with the new programme. Among the subgroups of algebra, patterns and tessellations subject, which is appropriate for the level of students and more concrete, take place in the first step of the primary school in the Mathematics Programme. With the help of this subject, students can make generalizations by seeing concrete models. How the pattern will be presented is as important as the pattern concept itself, taking place in the Mathematics Programme and also significant for mathematical thinking. When the studies are examined, it is seen that the achievements of the students with different presentations about patterns has been examined but the 8th grade students' hasn't been yet. For this reason in this study, the achievements of the 8th grade students with different presentations about patterns are compared. In the comparison it is determined that in which presentation students are more successful.

In mathematics teaching, students have difficulty in especially abstract subjects such as algebra. As well as the subjects, teaching methods and techniques applied on the students for these subjects cause that they are seen as difficult and impossible to understand. In order to make the students like mathematics and increase their academic achievement, it is necessary to notice them the enjoyable and usable sides of mathematics in daily life. This helps students break their prejudice. Among the subgroups of algebra, patterns and tessellations subject, taking place in mathematics curriculum especially from the first years of the primary school, and the way of their presentations can also help the students break this prejudice. The students can see different ways of the subjects with different presentations of the same question and learn the subject suitably for their own level. With this study it is aimed that in which presentation of patterns students get the relation between the numbers better and make generalizations easily. Nonetheless, it is thought that this study will be a leading for the new mathematics curriculum.

Early grades, algebraic notation can play a supportive role in learning mathematics (Carraher, Schliemann, Brizuela & Earnest, 2006). It is clear that algebraic thinking is a particular form of reflecting mathematically (Radford, 2006). The National Council of Teachers of Mathematics (NCTM, 2000) recommends that the

development of algebraic reasoning begin with experiences with patterns and relationships in Grades K-2, incorporate variables and expressions in Grades 3-5, and focus on analysis, representations, and generalisations of functional relationships in Grades 6-8. Number patterns, the relationship between variables and generalisation are considered important components of algebra curricula reform in many countries (Samsan, Linchevski & Olivier, 1999). Children, from a very early age, love colouring patterns and Islamic patterns may be utilized introduce symmetry at the tender age of 3 or 4. At the university level, the patterns may be used to teach transformation geometry (Abas, 2004). A major learning goal for students in the primary grades is to develop an understanding of properties of, and relationships among, numbers (NCTM, 2000). Children's thinking processes in generalisation reports on children's strategies in abstracting number patterns and formulating general relationships between the variables in the situation (Orton and Orton, 1994). The relationship which is called functional relationship begins with the notion of patterns in early grades, develops gradually in algebraic thinking process, and gains the abstract manner with the function notion (Kabael, Tanışlı, 2010).

From the national survey, reasoning on geometric number patterns is a proper initial activity for learning algebraic thinking in Grade 7 (Lin, Yang, 2006). The study of patterns' generalization in school mathematics has been the focus of research conducted over the last years. Many researchers have made some attempts to investigate stages or levels in the development of patterning ability mainly focused on students' ability to generalize (Cruz, Martinon, 1998). Some definitions are in order here by Bishop (2000),

> *"A number pattern is a sequence of numbers in which there is a well-defined rule for calculating each number from the previous numbers or from its position in the sequence. In a geometric number pattern, the numbers relate to a sequence of geometrical figures in which each figure is derived from the previous figure by some well-defined procedure. A number or geometric number pattern is linear if each number is obtained by adding a constant increment to the previous number or, equivalently, if each number is a linear function of its position in the sequence."*

Past research has indicated that children tend to have a propensity to look for the additive strategy (look down the table) when searching for patterns in tables of values (Warren, 1996). Children try to construct simple multiplication (proportional) structures, but when it does not fit the database, they quickly give up and then invent all kinds of error-prone recursion strategies. In all activities where students identified a function rule, most of them described their rule in words rather than using symbols (Samsan, Linchevski and Olivier, 1999). Experiences with a variety of patterns help students recognize order and make predictions. Creating patterns gives students opportunities to describe what is being repeated or how the pattern grows and to explain what should come next (NCTM, 2000).From 2000 to 2005, close to 70,000 students in the US Bay area participated in open-ended assessment that involved generalizing linear patterns. Five years of data collection and analysis of 8th grade students' work have shown that while 72% of those tested could successfully deal with particular cases of linear patterns in visual and tabular form, less than 18% of them could use algebra to express correct relationships or to generalize to an explicit, closed formula (Rivera & Becker, 2006).

As students work with multiple representations of number and with counting, their knowledge of number concepts grows more sophisticated. As students have repeated experiences with patterns, they will be able to make and investigate conjectures about counting sequences (NCTM, 2000).

The Study

In this research;

.● Is reminding has an effect, according to presentation styles of 8th grade students, in their performances with mathematical patterns by using computers?

● Is there a significant relationship between performances regarding mathematical patterns according to presentation styles of patterns at the reminding in 8th grade students by using computer?

questions will be answered.

The experimental study was carried out at a primary school in 8th grade class belonging to National Education Ministry in Ankara. We worked with 28 eighth-grade students (11 boys, 17 girls, mean age of 13) in an urban school in Ankara. Prior to application a pretest comprising 6 questions prepared by scientists was applied to the students. The questions were prepared by using three different presentation styles from linear increasing patterns (shape, number sequence, and table). While the validity of the questions were provided by taking expert opinions, the reliability coefficient was found as α =.8905. Reliability coefficient of achievement tests being more than 0.70 is a significant reliability level (DeVelles, 1991). The result of the analysis show the level of validity and reliability was high for pattern subject of mathematics lesson. The application was carried out for four hours with 28 students in the 8th grade in a primary school chosen for the application. In the first lesson pre-test was applied. Students knew pattern presentation styles which could be shown in three different ways

comprising shape, number sequence and table.

During the application students were educated for two hours by using computer in a way to remind presentation shapes (figure–1). The presentations which were used during the application were prepared by the scientists in accordance with the curriculum by scanning necessary literature. Different examples belonging to three different presentation styles were solved with the students and the application was completed and following this a post test was applied.

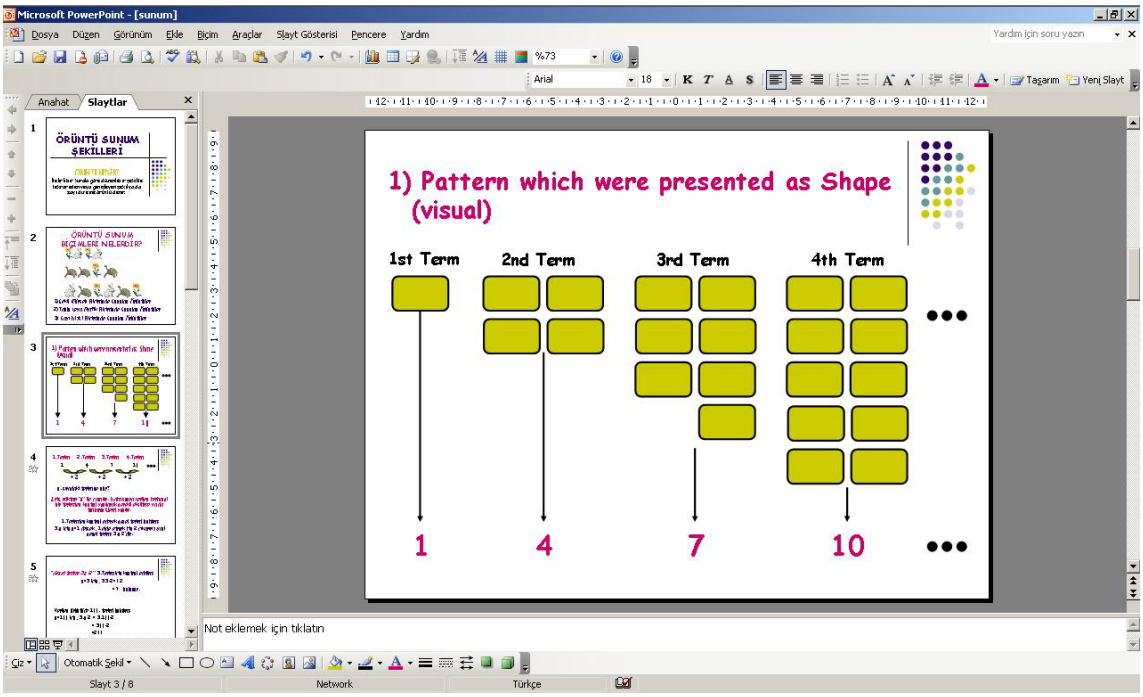

Figure – 1: The example belonging to the presentation used in the application

FINDINGS

In this section, in order to answer the research questions, statistical analysis administered and the findings about research, the comments based on these findings, are mentioned. In order to find an answer for the first question in the research, it is analyzed if there is a significant difference between pre-test and post-test marks of the groups on whom they made application. The students' pre-test and post-test average marks they take from the achievement test about patterns in Math lesson, standard deviation values, and results of paired sample t-test are such as in table-1.

Table-1: The Paired Sample T-Test Results about Pre-Test and Post-Test Average Marks

Measurement	N	$\bar{x}$	S	df	t	p
Pre-test	**28**	**2.21**	**2.347**	**27**	**-4.500**	**.000**
Post-test	***28***	***4.79***	***1.371***			

After the reminders with using computer, students' academic achievement has a significant increase in pattern lesson [t_{27}=-4.500, p<.01]. As the average of the true answers, that the students give before the applications, is $\bar{x}$ = 2.347, this average increases to $\bar{x}$ = 4.79 after two-hour application with computer. This finding shows that the reminder, made by computer, has a significant effect on increasing the academic achievement of the 8th grade students in linear increased pattern.

In order to find an answer for the second question in the research, by looking the post-test marks of the group, it is analyzed if there is a significant difference between their academic achievements according to the pattern presentations. The questions in the achievement test are grouped as set of number presentation style, figure presentation style and form presentation style, and the difference between these groups are compared. The

average post-test marks of 28 students, in the application, according to different presentation styles of patterns' achievement test in Math lesson, their standard deviation values and *simple factored ANOVA* results of the paired sample are such as in table-2.

Table-2: Post -Test Marks' ANOVA Results According To Pattern Presentation Styles

Variance Source	Total Squares	df	Average Squares	F	p	Significant Difference
Intersubjects	16.905	27	0.626			
Measurement	3.167	2	1.583	10.469	.000	1-2,1-3
Mistake	8.167	54	0.151			
Total	28.239	83				

1-Form presentation style, 2-Figure presentation style, 3-Number sequence presentation style

It is found a significant difference between set of form, number and figure from the students' pattern presentation styles [$F_{2\text{-}54}$=10.469, p<.01]. Figure presentation style mark ($\bar{x}$ = 1.7143) and set of number presentation style mark ($\bar{x}$ = 1.7500) are higher than form presentation style mark ($\bar{x}$ = 1.3214). On the other hand the difference between figure presentation style and number sequence presentation style is not seen as significant.

The finding shows that the students are more successful with the figure presentation and number sequence presentation style than that of form presentation style.

CONCLUSIONS

In this section, it is mentioned about the results, reached by the findings and comments of the research said before, the arguments about these results and suggestions developed by the results. In this study, the achievements of the 8th grade students with different presentations about patterns are compared after the reminders made by using the computer aided teaching. In the comparison it is determined that in which style of presentation students are more successful. When the data, obtained by this aim, is examined, those results are reached: According to the pre-test results, made before the application, a significant difference isn't seen between the academic achievements of the students with different presentations about patterns.

At the end of this research, it is appeared that the reminders, made by using the computer aided teaching, are effective in increasing the achievements of the students about the patterns and tessellations in mathematics. This result shows that computer aided teaching has positive effects on the achievements of the students and also supports different studies determining that computer aided teaching increases the students' achievement in different teaching levels and subjects. In the research, Akçay supports the studies those of Tüysüz and Feyzioğlu's Science lesson in the 8th grade (2003), of Ebenezer's Chemistry lesson (2001), of Yenice's Primary School Science lesson (2003), and of Sulak's Primary School Mathematics lesson in the 6th grade. The research above, displays that computer aided learning method has a positive effect on the students' achievements and the findings of the research are parallel with them.

In conclusion, people encounter with computer almost everywhere in Turkey. It is unavoidable for computer to be used while it is commonly preferred by everyone. Enabling active participation and addressing more than one feeling at the same time, computer makes the learning states more dynamic and colourful. Because of all these reasons, it is thought that computer aided teaching can be used effectively with many lessons including even mathematics.

This research is one of the few research made about computer aided teaching in Primary School Mathematics in Turkey. According to the research results, the suggestions for the Mathematics teachers, classroom teachers, and the corporations growing up teachers, program developers and researchers studying on this section are: in primary school level, computer aided learning method can be used more in mathematics lessons according to learning areas.

Computer aided learning method, used in the research, can be tried on different class levels and different subjects in mathematics lesson and then the results can be evaluated. The problems that the mathematics teachers, using computer aided learning method, encountered at the time of the applications, can be studied.

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