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THE EFFECT OF USE OF ANIMATIONS ON THE ACADEMIC ACHIEVEMENTS OF THE STUDENTS, RETENTION OF THE KNOWLEDGE LEARNED, AND THE SCIENTIFIC PROCESS SKILLS

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ABSTRACT

This study was conducted to determine the effect of the use of the animation on the academic achievements of the students, retention of this achievement, and the development of scientific process skills in the unit of force and motion of the science and technology course of the 6th grade basic education and to find out the student's views. The sampling of the research was made up of by 40 students studying in a primary school in the city centre in Erzurum who were divided into Experiment Group (EG) (n=20) and Control Group (CG) (n=20). The study was carried out in 2010-2011 education year. While animation assisted student centred teaching approach was used with the students in the experiment group, student centred teaching approach was used with the students in the control group. As a result of the study, it was found that the use of animation in the basic education 6th grade science and technology course in the unit of force and motion had positive effects on the academic achievements of the students, retention of this achievement, and the development of scientific process skills. Moreover, it was determined that the students in the experiment group expressed positive views about the use of animations.

Key Words: Animation use, science and technology course, scientific process skills test, animation view scale

INTRODUCTION

Learning is a process of adding new information to the present knowledge in the individual (Özmen, 2007). Science learning has a very important place for the development of the societies. Science is not only the proven knowledge clusters obtained by the scientists as a result of different researches. Science is also human efforts which require imagination and creativity, influenced by the structure of the society where it lives and to understand the natural world better (Çepni & Çil, 2009). The main purpose of science and technology course is not to make the students memorize the science concepts but to develop their thinking skills by teaching them learning and to raise them as inquisitive and questioning individuals (Lind, 2005). The students in the learning environments and teachers state that they have difficulties in learning and teaching the science and technology course (Taber, 2002). Among its reasons are the mostly abstract science and technology concepts and the use of the expressions and words used in daily life with different meanings in science teaching (Taber, 2002). In addition, a lot of scientific concepts and principles existing in science and technology course and these concepts' being unfamiliar with the students make science and technology course difficult (Daşdemir, 2006). The most important role belongs to the teacher when dealing with this hardship. The teacher can cope with this difficulty with meaningful learning by benefiting from computer technology. In order to provide meaningful learning, the equipment which appeals to the students' sense organs is required to be used in the class environment. The researches related to education reveal that most of the students remember %10 of what they read, %20 of what they hear, %30 of what they see, %50 of what they hear and see, %70 of what they say and %90 of what they do and say (Najjar, 1996).

Moreover, it is rather difficult for the students to contextualize the force and motion, which is the basic subject of Science and Technology course. Thus, the researches conducted revealed that the students had difficulty in understanding these subjects (Beichner, 1996; Düzgün, 2000; Uyanık, 2007).

Scientific process skills frequently take part in Science and Technology course. Scientific

process skill is defined as the skills which ease learning, make students acquire the ability to do research, provide students to be active in learning environment, develop the feeling of taking responsibility for their learning and increase the retention of learning (Akdeniz, 2008). In order to develop the scientific process skills of the students, it is important that laboratory works must be given weight (Aksoy, 2011; Aksoy ve Doymuş, 2012). However, laboratory works are not practised enough due to physical inadequacy and financial problems. Setting up well-equipped labs in schools is both costly and making labs ready for each student's benefit causes problems in terms of time. With this purpose in mind, the necessary experiments and observations required for science and technology course will be downloaded on computers and virtual science and technology laboratories can be set up on the computer. So, the students will have the opportunity to do their experiments and observations on their own in a safe and fun way and they will also have the opportunity to do these experiments again in their homes (Güvercin, 2010). The use of virtual labs and computer animation programs can clear away some of the problems which occur in real laboratory environments and they can also contribute positively to provide the purposes of learning-teaching processes (Kıyıcı & Yumuşak, 2005). Furthermore, the use of computer animations has special importance as they ease the experiments and operations for the students which will be costly and waste time under difficult conditions (Güvercin, 2010).

In order to have the students visualise the events happening in science and technology course, teaching with the support of concrete teaching aids can help the abstract knowledge to be shaped as concrete concepts (Atılboz, 2004). Animation is among the technologic options which can be used like that (Saka & Akdeniz, 2006**)**. This technologic instrument has to be adapted to the knowledge of the student and the development of student's knowledge during the learning process (Schnotz, 2001). Because animations have the quality to portray abstract events and dynamic look, they have a positive effect on learning (Lewarter, 2003; Lowe, 2003).

Animation, a Latin originated word, means to animate. According to Burke *et al*.(1998) , animation is a moving animated picture which tells the movement of the object drawn or

illustrated. The researchers conducted assert that the use of animation in teaching has a significant increase for the students' attitude towards the course and academic achievement **(**Çepni et al., 2006; Katırcıoğlu & Kazancı, 2003; Powel-Aeby & Carpenter-Aeby, 2003; Rowe & Gregor, 1999**)**. Again, a lot of researches conducted found that animation assisted teaching was especially a more effective method in biology, chemistry, physics, foreign language, and electrical- electronics education than the other methods, increased student motivation, contributed positively to their learning, and helped the development of scientific process skills (Bosco 1986; Fletcher 1989, 1990; Khalili & Shashaanib 1994; Kulik et al., 1980; Kulik et al., 1983; Kulik et al. 1985; Kulik et al. 1986).

It was introduced that the animations used in teaching not only had a significant increase in the students' attitude towards the course and academic achievements but also they had a lot of contributions such as safety, speeding up time, analysis of events rarely seen, simplifying complex systems, being practical and cheap, and motivation. (Güvercin, 2010; Tekdal, 2002). Because of this, the use of animations is very common in a lot of schools in different countries in the world. But, inadequate use of animation in primary school science and technology course in our country attracts attention (Güvercin, 2010). Due to lack of animation assisted teaching software, the animations' not being in Turkish, and not conducting enough studies about their use in science and technology course, there is an important gap in this field. This study conducted is aimed at filling the present gap.

The purpose of this study is to determine the effect of the use of the animation on the academic achievements of the students, retention of this achievement, and the development of scientific process skills in the unit of force and motion of the science and technology course of the 6^{th} grade of primary education and to find out the student's views. In this process, the answers to the following questions below were sought.

1. In the unit of force and motion, does the use of animation have an effect on the retention of the knowledge learned and the students' academic achievements?
2. Does the use of animation have an effect on the scientific process skills of the

students?

3. What are the views of the students about the use of animations?

METHOD

While the effect of materials and teaching methods are analysed in different schools and classes, it is convenient to use semi-experimental design. In this design, the classes are included within the content of the study for the educational purpose. This method is useful and helpful in case the sampling is not chosen equally (Karasar, 2005; McMillan & Schumacher, 2006). Because of this, the research was conducted in semi-experimental structure with randomly chosen groups according to pre-test and post-test design.

Sampling

The sampling of the study was made up of 40 students in the 6^{th} grade studying in one of the schools connected to the Ministry of Education. One of these classes is the experiment group (EG) (n=20) which uses animation assisted student centred teaching and the other one is the control group (CG) (n=20) which uses student centred teaching method.

Data Collection Tools

As the data collection tool, basic education Science and Technology Achievement Test (STAT), Scientific Process Skills Test (SPST) and Animation View Scale (AVS) for animation groups were used. Before starting the study, Science and Technology Achievement Test (STAT) and Scientific Process Skills Test (SPST) were carried out as pre-test. In the research groups, after the related units were studied, science and technology achievement test (STAT) and scientific process skills test (SPST) which were used in pre-test was used as post-test in order to asses the students' academic achievements and scientific process skills and also Science and Technology Achievement Test (STAT) was applied as retention test after a four week period. Moreover, Animation View Scale (AVS) was performed with the students in animation group in order to determine their views about animations.

Science and Technology Achievement Test (STAT)

Science and Technology Achievement Test (STAT) was made up of 25 multiple choice questions which included the subjects in the unit of force and motion. Multiple choice test questions were chosen among the questions asked between 1991 and 2010 in the state free boarding and scholarship exam (SFB), secondary education inter-organizational exam (SIE) and the 6th grade level determination exam (LDE). The questions were chosen according to the curriculum and the goals and objectives (the student acquisition which is aimed). The views of three science and technology course teachers and an academician from the Department of Physics were taken about STAT test. The academician and the teachers stated that the questions were suitable to the levels of the students and they included the goals and the objectives. In order to evaluate the reliability of STAT test, the test was performed with 52 7th grade students who were taught about the subject before. The reliability coefficient of the test was determined as Cronbach Alpha (α) = 0,73

Scientific Process Skills Test (SPST)

Scientific Process Skills Test (SPST) was obtained from the combination of test questions which were developed by Smith & Welliver (1994) and translated into Turkish by Güneş & Başdağ and the test questions developed by Smith & Welliver (1994) and translated into Turkish by Kanlı & Şenyüz . The test was made up of total 50 questions and these questions include thirteen scientific process skills which are observation, classification, making deduction, predicting, assessment, recording the data, building up number-space relations, functional description, building up hypothesis, doing experiments, determination of variables, interpretation of the data, and composing a model. The reliability of "Scientific Process Skills Test" translated by Güneş & Başdağ (2006) was found with the calculation of Kuder Richardson-20(KR-20) coefficient. Excel programme was used and the reliability of the test was found as 0,81 in this calculation (Başdağ, 2006). The reliability of "Scientific Process Skills Test" translated by Kanlı & Şenyüz (2008)was evaluated with the calculation of Kuder Richardson-20(KR-20). The reliability of the test was determined as 0,86 in this calculation (Şenyuz, 2008). The reliability of "Scientific Process Skills Test" was determined as

Cronbach Alpha (α) = 85 by the researcher.

Animation View Scale (AVS)

Animation View Scale (AVS) is a scale in 5 Likert type prepared to get the views of the students about animations after the subject was taught. Animation view scale was prepared by benefiting from the scale prepared by Doymuş et.al (2004). After the opinions of the experts were taken about the scale prepared and the necessary changes were made, it became ready to be used. The reliability of AVS was calculated by the researcher and it was found as Cronbach Alpha (α) = 0,82. The expressions of "I totally agree"(5), "I agree"(4), "I partially agree" (3), "I don't agree" (2), and "I strongly disagree" (1) were used in AVS. The given grading with the negative expressions was done reversely.

Practise

Before starting the practise with the students in experiment group, the animations about the in the unit of force and motion was obtained from different websites (science school, fenci.gen.tr. etc). The subject content suitability of the animations obtained were analysed by two university lecturers who work in chemistry education, three science and technology teachers, and a researcher. The use of animations and its technical qualities were analysed by an expert who works in the department of Computer and Education Technologies. Two-hour lesson for animation assisted student centred teaching was planned like that. The researcher asked the students to analyse the pictures related to the subject in the course book in order to trigger the students' prior knowledge and make them concentrate on the subject. Afterwards, the researcher formed the discussion environment by asking the question in the teacher's book. The researcher helped the students to reach the correct result with the answers they gave. The researcher provided the students to build up relations with the subject's place in daily life as suggested by the teacher's book and he used the animations to do the activities found during the course. The researcher made the necessary explanations during the display of animations and asked questions about the activities. The researcher helped the students to reach the correct result by evaluating the answers given by the students. The animations were displayed

again when the students answered the questions wrong so they were made to reach the correct answer. The researcher made the students do the activities in the student's book with the help of the teacher's book. While the activities were being done, the researcher explained how the sample activity was done in the study book and helped the students do the other activities one-to-one. While the students were doing the activity, the researcher controlled the student by walking around the classroom. During the control, the teacher determined the deficiencies and provided them to be repaired. The teacher had the students get prepared for the next subject by assigning them homework or researches to study out of class. The animations used during the study of the subject were shown via projector.

The subjects in the classes which were determined as control group were studied according to student centred teaching method. In the student centred teaching method, two hour lesson was carried out in that way. The researcher presented the basic knowledge related to the topic according to the teacher's book. The researcher helped the students to focus on their prior knowledge and the topic by asking them to analyse the pictures related to the topic in the course book and asking them questions about what they understood from the pictures,. Afterwards, the researcher formed the discussion environment by asking the questions in the teacher's book. The researcher provided the students to reach the correct result with the help of the answers they gave. The researcher helped the students form a connection with the subject's place in daily life as suggested by the teacher's book. Moreover, the researcher helped the students do the activities about the subject with the help of the teacher's book. While the activities were being done, the researcher explained how the sample activities were done and had the students do the activities one to one. While the students were doing the activities, the teacher checked the students by walking around the classroom. During the control, the teacher determined the missing points and ensured to compensate them. In addition, the researchers explained some important knowledge to the students and did some note-taking activities. The researcher made sure that the students get prepared for the next lesson by assigning them some homework or researches.

Unit of force and motion was completed in 20 hours according to the curriculum both in control group and experiment group. The animation example used with the students in experiment group were given in Figures 1

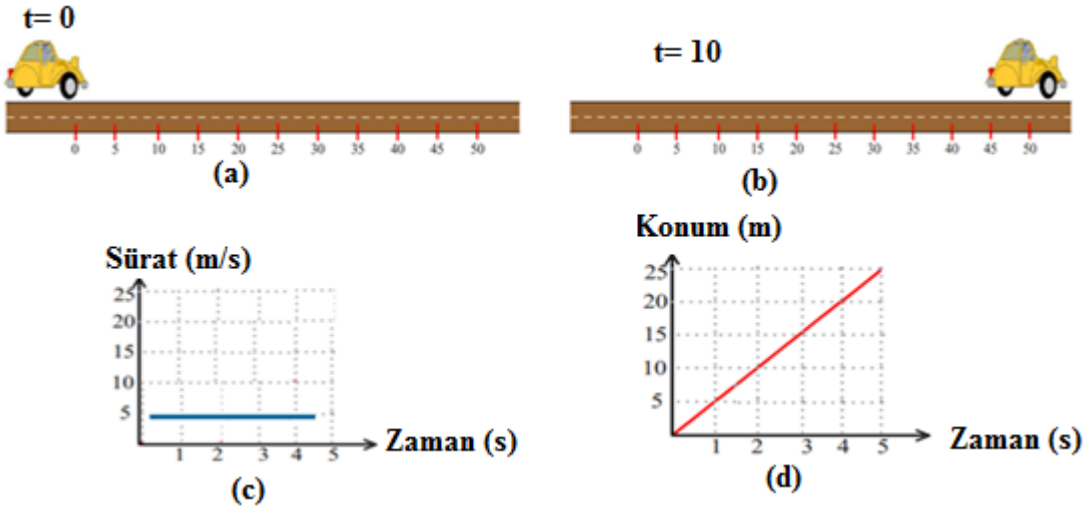

Figure 1. Fixed fast-moving vehicle

The purpose of these animations are to get the understanding the moving rapidly fixed speed-time and lead-time graph of the car. The animations in Figure 1 show (a) moment of a moving vehicle (b) Ending moment of the vehicle movement (c) speed- time graph of the vehicle (d) road- time graph of the vehicle

Data Analysis

In the analysis of the data obtained from the research, descriptive statistics and independent t-tests were used. Moreover, the data obtained from the animation view scale was presented with frequency and percentages distribution. The data was evaluated with SPSS 16.00.

FINDINGS AND INTERPRETATION

The independent t-test analysis results of the data obtained from the statistical analysis of STAT questions which were performed in both the experiment and control group of the basic education 6th grades as pre-test, post test and retention test was given in Table 1. When the

data in Table 1 was looked at, the arithmetic average of experiment group in STAT pre-tests was higher that the control group ($X_{(Experiment)}$ = 30,68, $X_{(Control)}$ = 27, 62) , but it was observed that there wasn't a meaningful difference between the arithmetic averages statistically ($t_{(38)}$= 1,057; p=0,297; p>0,05). These results indicate that there was no superiority in terms of academic achievements of the students with the application of the same program in the same school.

Table 1: The results of the independent t-test analysis of the points obtained from the pre-test, post test and retention test of STAT questions

Tests	Groups	N	X	Ss	t	p
Pre- test	Experiment	20	30,68	10,384	1,057	0,297
	Control	20	27,62	7,845		
Post Test	Experiment	20	62,78	14,165	2,826	0,008
	Control	20	48,75	16,212		
Retention test	Experiment	20	61,14	16,031	3,235	0,002
	Control	20	45,71	15,189		

When the post-test analysis results of STAT questions were looked at in Table 1, the arithmetic average of experiment group was higher than the control group ($X_{(Experimet)}$ = 62,78, $X_{(Control)}$ = 48,75), and it was observed that there was a statistically meaningful difference between the arithmetic averages in favour of experiment group ($t_{(38)}$= 2,826; p=0,008; p<0,05).According to this result, it can be stated that the use of animation in the unit of force and motion in the basic education 6^{th} grade science and technology course had a positive effect on the academic achievements of the students. In the findings related to the retention test in Table 1, the arithmetic average of experiment group was higher than the control group ($X_{(Experiment)}$ = 61,14, $X_{(Control)}$ = 45,71) and it was observed that there was a statistically meaningful difference between the arithmetic averages in favour of experiment group ($t_{(38)=}$

3,235 ; p= 0,002; p<0,05). According to this result, it can be stated that the use of animation in the unit of force and motion in the basic education 6th grade science and technology course helped the students' knowledge being permanent.

The independent t-test analysis results of the data obtained from the SPST which was performed in both experiment and control groups of the primary 6th grades as pre-test and post test was given in Table 2. When the data in table 2 was analysed, the arithmetic average of experiment group in the pre-tests of SPST was higher than control group ($X_{(Experiment)}$ = 45, 46, $X_{(Control)}$ = 44, 86), but there was not a statistically meaningful difference between the arithmetic averages ($t_{(38)}$= 0,130; p=0,897; p>0,05). According to this result, it can be stated that the students who are at the same age and had the same education had the same skills of observation, classification, deduction, guessing, assessment, recording the data, building number-space relationship, functional definition, building hypothesis, determining the variables and creating models.

Table 2: The results of independent t-test points obtained from the pre-test and post test of SPST questions.

Tests	Groups	N	X	Ss	t	p
Pre test	Experiment	20	45,47	16,517	0,130	0,897
	Control	20	44,86	13,499		
Post test	Experiment	20	56,95	13,406	2,101	0,043
	Control	20	46,84	16,115		

Maximum score: 100

When the post-test analysis results of multiple choice questions of SPST were analysed in Table 2, the arithmetic point average of experiment group was 68,24 and the arithmetic point average of control group was 52,80. The difference between the animation and control group was statistically meaningful according to independent t-test analysis ($t_{(38)}$= 2,101; p=0,043, p<0,05). According to this result, it can be stated that the use of animation in primary 6th grade

science and technology course helped the development of the scientific process skills of the students. The point average of AVS which was practised with the animation group of the primary 6th grade was given in Table 3.

Table 3 :The average likert points obtained from Animation View Scale (AVS

Expressions	X^a
1.The subjects studied with the animations attracted my attention more.	4,72
2. Animations helped me to solve the questions related to the subject.	4,72
3. The use of animations provided me to think more elaborately about the subject.	4,50
4. The use of animations encouraged me to do research.	4,22
5. Animations helped me to enjoy science and technology course.	4,72
6. Animations must always be used in science and technology course.	4,22
7. Animations must be used in the other lessons, too.	4,17
8. The use of animations provided me to focus on the subject.	4,28
9. I liked the subjects taught by animations.	4,50
10. It is nice to teach the course with the animations.	4,50
11. The use of animations helped me to thinks creatively.	3,78
12. Because animations were too complex, I didn't learn the subjects..	4,11
13. The use of animations in the courses is effective.	4,17
14. Animations helped me to understand the course better.	4,11
15. It is boring to learn with animations.	3,83
16. The use of animations led to lack of organization in the class.	4,22
17. The use of animations complicated the understanding of the subjects studied.	4,06
18. Animations must not be used in science and technology course.	4,06

a: Maximum average point:= 5 (Average)	(4,27)

When these data was analysed, it was determined that the average points obtained from the views of the students about the use of animations were 3,78 the highest and 4,72 the lowest. According to this data, it can be said that the students of basic education in the 6^{th} grade had positive views about the animations.

RESULTS AND SUGGESTIONS

Depending on these results, when it was thought that the knowledge in science and technology course was not concrete, in contrast, the knowledge had direct relationship with the students' lives (Ayas & Çepni, 1997), it can be stated that animations helped to form a statistically meaningful difference because they increased the attitude and interest of the students towards the course positively, helped the learning of the students by visualising the (Russell et.al., 1997), provided opportunities for the students to watch some concepts visually such as the events which can't be observed with naked eye , especially with the fields whose microscopic dimension is in the foreground (Ebenezer, 2001). After a four week period, STAT was performed as retention test with the experiment and control groups. The statistical analysis of the arithmetic point average of the results of retention test revealed that there was a meaningful difference between the retention of knowledge of the experiment and control groups (Table 1). It was found that this difference was in favour of animation group (Table 1). Depending on this result, as animations showed the events which were not comprehended directly on the molecule level, and helped the students to visualise and comprehend the complex scientific models in the mind (Yeung, 2004),it can be stated that they helped the knowledge to be permanent. Again, animations helped the students to watch the course subjects concretely and think creatively (Arıcı & Dalkılıç, 2006; Najjar, 1996), it can be concluded that they might be helpful for the knowledge in science and technology course to be permanent. The results obtained from this study are compatible with the studies of (Ardac & Akaygun 2004;Ben-Zvi et al. 1987; Bunce & Gabel, 2002; Daşdemir, 2006 ; Doymus et.al.

2009a; Ebenezer, 2001;; Gabel et al., 1987; Hoffman & Laszlo 1991; Merritt et al., 2007; Nakhleh & Samarapungavan, 1999; Jacobson & Kozma, 2000; Wu et al., 2001; Ayas & Özmen, 2002; Özmen, Ayas & Cofltu, 2002, Harrison & Treagust 2002; Justi & Gilbert 2002; Othman et al., 2008,Yezierski & Birk, 2006 ; Venkataraman, 2009).

It was determined that there was not a statistically meaningful difference between the pre-tests of SPST practised with the experiment and control groups of the students in basic education 6th grade (Table 2). After the practise was completed, the statistical analysis of the post test points of SPST which was performed with each class showed that there was a meaningful difference between the groups (Table 2). It was found that the difference in question was on behalf of animation group. Depending on these results, it can be concluded that the use of animations in basic education science and technology course might help the students to interpret scientific knowledge and their cognitive abilities (Mayer & Anderson 1991; Pekdağ, 2005; Yang et al., 2003). Again depending on this knowledge, it can be concluded that the animations contributed to the students' post tests to be high in animation group, they increased the thinking abilities of the students, made their learning easy, developed the feeling of responsibility while learning on their own (Doymus et al., 2009), developed their logical thinking besides learning science (Afacan, 2008), helped the students to seek an answer by asking reasonable questions and solve the problems they encounter in daily life and develop high level cognitive abilities (Tasker & Dalton, 2006) . The result obtained from the scientific process skills test was also supported with the studies of (Karaca, 2010; Reid & Serumola, 2007).

At the end of the practise, the average point of AVS of the experiment group students was 4.27 (Table 3). Depending on this result, it can be stated that animations developed the thinking abilities of the 6th grade basic education students, helped the subjects to be understood, and increase the interest of the students in science and technology course. The result obtained from this study was also supported with the study of Karaçöp, 2010.

The data obtained at the end of the study reveal that animation-assisted teaching in the unit of the force and motion in the 6th grade basic education promoted the academic achievements of the students, retention of knowledge learned, and the scientific process skills. When the views of the students against animations were thought, it can be stated that the subjects taught with animations motivated and enlivened the students more, and made the lessons taught more enjoyable and fun. When analysed in terms of science and technology course in basic education, abstract concepts were encountered more than concrete concepts. While teaching these abstract concepts, animation assisted student centred teaching exhibits more successful results than student-centred teaching. At the end of the study, it was suggested that animation assisted student centred teaching method is used in the other units and classes of science and technology course.

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