RESEARCH ARTICLE

COMPARING THE EFFECTS OF COMPUTER ANIMATIONS AND WORKSHEETS ON 6TH GRADE STUDENTS' UNDERSDTANDING OF GRANULAR STRUCTURE OF MATTER

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ARTICLE INFO	ABSTRACT
	The purpose of this study is to determine whether there are differences between the effects of computer based animation techniques and worksheets in the unit of granular structure of matter on 6th grade students' academic success. In this study semi-experimental method was used. The study sample consists of 43 6th grade students. An achievement test consisting 20 multiple choice item was used as a tool for data collection. During the application period, computer based animations were used in one of the sample group while in the other were worksheets. Study data were evaluated using SPSS 15 software package program. To analyze Independent Sample T-Test was used to determine between the effects of the techniques mentioned above. From the findings after finishing the study it was seen that the academic success obtained from the data of group where computer based animations used in, is more effective than the academic success obtained from the data of group where worksheets used in.

INTRODUCTION

All the societies, particularly developed countries are in a struggle for increasing the quality of the science education (Aydo du and Kesercio lu, 2005). Science education formally takes place in primary and secondary schools process for the first time in the schools. The aim of the science education given during the primary and secondary schools is to help students in being sensitive to the changes happened in the environment where they live, using the knowledge they have learnt in their daily lives (Bahar, 2006) and establishing cause-effect relationship through analytical approach towards the events and phenomenon (Temizyürek, 2003).Examining the structure of the science and technology lecture, it is seen that abstract principles and rules are important. The complexity of this lecture emanates not only from its structure but also the fear and prejudice developed towards it. Thus, difficulties are experienced in teaching and learning the science and technology lectures in educational environment (Da demir and Doymu , 2012). On the other hand, teacher's using the traditional methods in teaching these lectures causes increase in fear and prejudices. In this case, it is necessary to ensure active participation of the students in the lectures by making the lectures more pleasurable (Bahadır, 2012).

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The national education curriculums have been designed in line with the constructivist approach since 2005. Many different methods, techniques and materials taking place in the constructivist approach ensure more efficient and permanent lecture along with forming a pleasurable lecture environment (Ayvacı *et al*. 2012). In this context, computer aided animations and worksheets should be benefitted.

Worksheets are the documents that include instructive explanations for the activities asked the students to conduct while teaching a topic. When used in training activities, they arepractical, handy and economic. Worksheets are an effective method in ensuring learning (Kromba and Harms, 2008). It makes the class discipline easier to establish by ensuring individual learning (Kurt and Akdeniz, 2002). Worksheets prepared by taking into consideration the daily life make positive impact on both the students' success and motivation (Nasand Çepni, 2011). Use of worksheets started in 1990's and has become popular over the last two decades. Worksheets are used in the fields of chemistry, biology, physics, science and technology in a widespread manner (Kaymakçı, 2012). Kurt and Akdeniz (2002) have researched the impact of the worksheets on the implementation process. As a result, it has been clearly seen that they increase the interest to physics and ensure students' individual learning. In a study conducted by Ço tu, Karata and Ayas (2003) worksheets were benefitted in concept teaching. It has been concluded that they are effective

in identifying misconceptions and addressing them (Çalık, 2000; Gönen and Akgün, 2005). Özdemir (2006) has researched the impact of the worksheets on students' success and permanence of learning. It has been concluded that comparing to the traditional method, by teaching with worksheets, the positive attitude towards science lecture and permanence of the learning along with students' success have increased. Worksheets were benefitted in the studies with regard to learning biodiversity conducted by (Ev, 2003) and Kromba and Harms (2008), as a result it has been concluded that worksheets have been effective in forming the main knowledge related to subject (Ço tu *et al.*, 2003).

One of the best methods that would be able to support the science and technology lectures visually,is computer animation technique. Computer animations can be described as moving the already drawn pictures. It is an effective method which can be used for materializing the lectures that include abstract concepts and then envisioning them. It would allow for clearer and better understanding of the knowledge that seems complex and also permanence of learning thanks to colours used (Arıcıand Dalkılıç, 2006). This also provides the students with opportunities of more creative thinking (Falvo, 2008). Along with these, it also increases the power of critical thinking in students thereby providing them with opportunities for gaining high-level communication skills (Pekda , 2010). It wouldn't possible to conduct experimental examinations of some dangerous and expensive experiments and studies in laboratory environment. Experiments in this genre can easily be presented to the student with the simulation methods that would be designed together with animations (Arıcı and Dalkılıç, 2006). Studies have been conducted in the fields such as physics, chemistry, biology, language education and science and technology with regard to the use of animation technique on academic success, scientific process skill, student motivation, permanence of learning and how it can be used as a teaching/lecture tool. In a study conducted by Barak and Dori (2011), it has been examined whether the animation technique is effective on changing the way of thinking of the students. As a result, it has been concluded that the animation technique supports various learning methods and teaching strategies as well as forming different way of thinking of the students, being an auxiliary element. Da demir and Doymu (2012), in their study, have examined the effects of animation technique on academic success, permanence of this success and development of scientific process skill. They have concluded that animation technique has increased student success (Akçay *et al.*, 2003; Ayvacı *et al.*, 2012; Karaçöp *et al.*, 2009; Tekdal,2002), developed scientific process skill (skender, 2007) and provided for more permanent learning (Çelik, 2007). Similarly, in a master thesis conducted by Kaba (1992) it has been researched the use of animations in education and pointed out the necessity of use of animations in crowd classes by concretizing abstract concepts and in a study conducted by Nguyen (2006), it has beenexamined the effect of animation technique on students' attitudes towards mathematic learning. Examining the literature, it has been seen that use of computer aided animations and worksheets has always positive effects in teaching process. The two educational tools generally are compared with the traditional method and the effects have been assessed in the studies conducted.

The aim of this study is to identify whether there is a difference between the effects created by animation technique and worksheets on the academic success for the chapter on granular structure of matter. Answers to the followings questions have been sought in lien with this aim;

Is there a difference between the effects created by animation technique and worksheets on the academic success for the chapter on granular structure of matter?

1. Is there a meaningful difference between the grades in pre-test in chapter on granular structure of matter received by the group of students to whom the animation technique is applied and the group to whom the worksheets method is applied?

2. Is there a meaningful difference between the grades in post-test in chapter on granular structure of matter received by the group of students to whom the animation technique is applied and the group to whom the worksheets method is applied?

This study is regarded as important in terms of;

- Providing a new perspective to the science and technology lecture,
- Identification of effect which is one of the two known as effective on science and technology lecture

On the other hand, the study is of importance in terms of being a source for the studies to be conducted on teaching science and technology lecture with animations technique and worksheets in the future.

METHODS

In this study, pretest-post test comparative group model of quasi-experimental method has been used by taking into consideration classification of Mc Millian and Schumacher (2010). In quasi-experimental method, groups to which the methods are applied are randomly selected and selected groups are considered equal to each other (McMillian and Schumacher, 2010).

Table 2.1.Experimental pattern of the research

groups	Neutral identification	pre-test	method	post-test
G1	R	O1.1		O1.2
G2	R	O2.1	X_2	O2.2
	time			

R:Neutrality in forming the groups.

G1: Working group 1(the group to whom worksheets method is applied)

G2: Working group 2(the group to whom animation technique is applied).

O1.1 and O2.1: Test prior to the experiment (pre-test).

X_1: independent variable (use of worksheets)

X_2: Independent variable (use of animation technique).

O1.2 and O2.2: Test after experiment (post-test)

According to the pretest-posttest comparative group model, two working groups have been established with a neutral selection. In the first one of the working group, worksheets have been used, while animation technique has been applied to the second one. Achievement tests have been applied to both groups before and after the experimental works in order to

measure their successes regarding the granular structure of matter (Karasar, 2009).

Sample

The sample of the study is composed of 6th grade students from central primary schools in Yakutiye county of Erzurum province. The sample of the study is composed of 43 students studying in two 6th grade classes of which one has 20 students and the other has 20 of a primary school in Erzurum province. The sample of the study is selected with random selection method. In this sampling method, all the units in the sample has equal and independence chance to be chosen to the sample group (Büyüköztürk et al., 2010). The selection of the sample has been carries taken place in two stages. In the first stage, the lists of central primary schools have been obtained from Yakutiye District National Education. The schools to be studied have been randomly selected from the list where a number of schools of which their student levels, amenities and socio-economic level are close to each other. In the second stage, 6-c and 6-d classes have been randomly chosen to be studies among the 6th grades of the schools selected at the first stage.

Data Collection Tools

Achievement test which is one of the quantitative data collection tools have been used with the aim of testing the problem and sub-problems of the study. Primarily, while preparing the test, the schoolbooks have been examined on the basis of relevant subjects to identify which subject headers of the chapter on granular structure of matter will be used. Test items identified on the basis of target behaviours with respect to the subjects were equally distributed to the target behaviours. Achievement test is composed of 20 multiple-choices (four options) questions. The multiple-choices questions forming the achievement tests have been prepared by benefitting the Level Specification Examination (LSE), Secondary Education, Student Selection and Placement exam (SESPE) and State Free Boarding Schools Exam(SFBSE) exams which are conducted by The Ministry of National Education(TMNE) of Turkish Republic. After taking the opinions of 2 lecturers and 1 science teacher working in department of science teaching for the scientific verification of the test, necessary corrections were made to the test. The corrected test was applied to the 50 students who are not joined to the study but took the subject previously. As a result of the implementation of the study, reliability coefficient (Cronbach's Alpha) was found as 0,761. Büyüköztürk et al. (2009) shows that reliability coefficient between 0,60   safety coefficient 0,80 for educational studies is reliable.

Validity measures taken during the preparation of the achievement test

- Test items in the achievement test have been prepared following track of all the (LSE), Secondary Education, (SESPE) and (SFBSE) exams which are conducted by The Ministry of National Education(TMNE) of Turkish Republic.

- The number of question is equally distributed to the acquisitions (gains) and it is paid attention that the test includes equal number of questions with respect to all the acquisitions.
- Instructions on the number of question in the achievement test, the way to be followed for answering the test and the duration of the exam have been added to the beginning to the test
- After preparing the test, linguistic scientist was consulted to purify any grammatical and typo mistakes.

Safety measures during the preparation of the achievement

- Test items in the achievement test have been prepared following a track of all the (LSE), (SESPE) and State (SFBSE) exams which are conducted by (TMNE) of Turkish Republic.
- Instructions on the number of question in the achievement test, the way to be followed for answering the test and the duration of the exam have been added to the beginning to the test
- A pilot practice was conducted before the application of the achievement test and inappropriate questions were removed from the test.

Application

Before starting chapter on granular structure of matter achievement tests of granular structure of matter were applied to both groups as pre-test. The practise was planned to last four weeks (16 lecture hour/period). The chapter on granular structure of matter is composed of four sections. The chapter is applied to the animation technique group as following;

Each section was taught through animations where the topics are elaborated with animations from web-sites approved also by TMNE, necessary experiments were also shown with animations and simulations. Activities for over learning were performed via colourful computer applications. The teacher followed the curriculum in the schoolbook to teach the section. Activities in the textbook were realised together with the students at the end of the section. As for the group to which the worksheet method is applied, groups each has four students were set-up. At the beginning of each section, attentions of the students were drawn to the topic with appropriate questions and worksheets were distributed to the students. Before starting the lecture, while some parts of necessary materials for performing the activities in the worksheets were prepared by the teachers, the remaining parts were provided by the students prior to the lecture. The students carried out activities in the worksheets within the context of given knowledge as a group and they answered the questions with regard to what the group has gained as a group. The curriculum was complied with as in the other group. Activities in the textbook were realised together with the students at the end of the section. After finishing the chapter, achievement test of granular structure of matter was applied to both groups as post-test.

Validity measures taken during the implementation stage

- Sampling group to apply the study was chosen in a way so that it ideally represents the population.
- Working groups were randomly selected among equal groups.
- The lectures in the working groups were given by the same teachers during the four-week implementation period.
- The lecture was given through animation technique in one group, while it was given through worksheets in another group during the four-week implementation period.
- Equal time was given to both groups for their answering the questions in pre-test and pots-test.

Safety measures taken during the implementation stage

- The final shape of the test itemsin the achievement test has been given following a track of all the (LSE), (SESPE) and State (SFBSE) exams which are conducted by (TMNE) of Turkish Republic and pilot implementation.
- The lectures in the working groups were given by the same teachers during the four-week implementation period.
- The lecture was given through animation technique in one group, while it was given through worksheets in another group during the four-week implementation period.
- Equal time was given to both groups for their answering the questions in pre-test and pots-test.

Analysis

Packaged software SPSS 15 was used to analyse the data obtained from the main problem and sub-problems. Independent Samples t-test in paired comparisons was used between the groups differing from each other in terms of types of data.

FINDINGS

The data obtained from the study was analysed with statistical methods and the results were supported with tables in this part. Conclusions were reached in the light of the data obtained and recommendations were made based on these conclusions.

Findings obtained from pre-test

The test results show that there is no a meaningful difference among the students regarding their knowledge in statistical terms ($t_{41}= 1.77$; p> .05).The level of readiness on granular structure of matter of the groups are the same and the groups are equal to each other. this can be justified with the fact that the groups haven't taken any previous lecture on the subject.

Table 3.1. Comparison of pre-tests grades of the working groups

groups	number of subject	arithmetic mean	standard deviation	df	T	p
Animations	20	39.25	8.926			
					1.77	
Worksheets	23	33.48	11.912	41		.083

Findings obtained from the pos-test

Table 3.2. Comparison of working groups' grades from the post-test

Groups	number of subject	Arithmetic mean	standard deviation	DfT	p
Animation	20	75.75	11.616	413.91	.000
Worksheets	23	54.57	21.633		

The test results show that there is a meaningful difference among the students regarding their knowledge in statistical terms ($t_{41}= 3.91$; p< .05) between their post-tests. This difference is in favour of animation group. The group studied with animation technique is more successful than the group studied with worksheets. The fact that the animation technique is more effective can be justified by the fact that animations are more pleasurable to the students and they can ensure permanent learning by drawing students' attentions.

RESULTS AND DISCUSSION

This study is of importance because of the fact that it makes comparison between the effects of worksheets and effects animation technique to the academic success in science and technology teaching. It is accepted as unique in literature because although there are studies on the comparison of the animation technique and study paper with the traditional method; however, no study has been conducted on the effects of these two methods on each other. Examining the results of the study, it is seen that whereas no meaningful difference has been found among the pre-test grades, there is a meaningful difference among the post-test grades in favour of animation technique. In literature the fact that animation technique increases academic success is supported by many studies (Barak and Dori, 2011; Bayrak, 2008; Da demir and Doymu , 2012; Pol, Harskamp and Suhre, 2005). In this study the fact that the animation technique is effective can be explained by the facts that the animation technique increases the interest for the lecture by stimulating the sense of wonder through colourful demonstrations and making the abstract subject of granular structure of matter more concrete by increasing its visibility along with its effect for increasing the success.In literature, whereas the animation technique has been compared with traditional methods, Doymu , Karaçöp, im ek and Do an (2010) in their studies have compared the effects of animation technique and Jigsaw technique on electrochemistry. The study shows parallelism with their studies in terms of the facts that they compared the two modern techniques and the animation technique is more effective show parallelism with the study. Worksheets have also ensured success to a certain extent. While arithmetic average of pre-test is 33,48, average of post-test is 54,57 and increase of 62,9% has been ensured. Worksheets can be used as an alternative method in educational process. However, the aim of the study is to put forward the comparative effects of using of worksheets and computer aided animations and success rate of animation technique is 92,9. Although the both method is effective,

animation technique is more effective compared to the worksheets as a course material.

Recommendation

This study is only limited with the 6th grade granular structure of matter of science and technology lecture. Similar studies to be conducted in the future can be applied to different lectures at various stages of teaching. Thus, it may be concluded that since the results can be applied to more fields, they can be more generalised. In order to create more effective learning environment and increase student success both the worksheets and the animation technique can be benefitted. The animation technique can be used especially for the subjects and concepts which are hard to understand.

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