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The Effect of Computer-Assisted Applications in the Teaching of "Matter and Heat" Subject*

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Abstract

Problem Statement: The use of computers in chemistry education is increasing rapidly and becoming a supporting device in teaching abstract concepts and complex subjects. Because of the fact that temperature-heat, matter and structural features are the subjects in which the students mostly have difficulties, we try to confirm the effectiveness of using computer-assisted instruction in those subject matters.

Purpose of Study: The aim of this study is to compare the computer-assisted instruction method with the traditional teaching method in terms of their effectiveness in teaching the "Matter and Heat" unit in the 6th grade science curriculum in primary schools. This study aims to confirm if there is a significant difference in the students' academic achievement between the two methods, to investigate the effects of computer-assisted instruction on permanent learning, and to identify the students' points of view about computer-assisted instruction. For this purpose, all the 6th grade students of Asarcık Boarding Primary School of Asarcık in Samsun were enrolled in this study.

Methods: The "Matter and Heat" unit was taught to the control group and experimental group students by the use of computer-assisted instruction and traditional methods. The researcher prepared software by the use of the Macromedia Flash 8.0 programme to serve as a teaching medium for the experimental group. The pre-test, post-test and permanency tests, which were applied to both groups, were analysed by a t-test. In addition,

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the experimental group students were given an inquiry form and interviewed.

Findings and Results: According to the results, it is revealed that computer-assisted instruction improves academic achievement and permanency and that the students prefer computer-assisted instruction to other traditional methods in which subjects were taught without student comprehension.

Keywords: Computer-assisted instruction (CAI), matter and heat, science and technology, animation

We live in an age in which knowledge develops rapidly, new inventions occur in science and technology, and technological devices become an indispensable part of our daily lives. Countries consider not the weapons but the science as the true guide in the race of greatness. The education system is being evaluated in the light of the development of science. The importance attached to education by a country can be regarded as a yardstick against that country's development level. For that reason, countries should follow the educational process in order to improve their development level on the international platform.The effort of following science and technology affects mostly science curriculum in the educational field. Science is the foundation of science and technology. For this reason, all of the developed countries aim to increase the quality of science education, and for this purpose, they study new teaching programmes.

Science education is the teaching of interesting and amazing productiveness in a child's environment. It is the teaching of the meaning that source of the food a child eats, the water s/he drinks, the air s/he breathes, his/her body, the animal s/he feeds, the car s/he rides in, the electricity s/he uses, the light and the sun. In this context, science education is a simple and concrete teaching that must be accomplished by taking the child's interests and needs, developmental level, desires and his/her environmental feasibility into consideration (Gürdal, 1998, p. 45).

It has been inevitable to use technology for education as a result of scientific and technological developments of our age. The use of technology in the educational process presents a rich learning environment for the students. Taking advantage of technology in the process of a student's accessing and configuring knowledge and his/her use of that knowledge in problematic situations improves the quality of education.

When it is considered that primary school students have difficulties in learning abstract concepts, educational technology tools-especially computers-play an important role in concretizing such abstract concepts according to the students' level. These tools bring to life abstract concepts so that they become meaningful learning and result in repeated observation of the objective concept (Akpınar, Aktamış & Ergin, 2005, p. 2). Conceptual errors occurring in the first grade of primary schools in science education carry forward to the following years. For this reason, it is necessary to implement true and permanent learning at the very beginning (Güneş & Demir, 2007). It would be helpful to use supporting teaching tools in order to reduce

conceptual errors. Computer-assisted instruction (CAI) is a teaching method that is formed by combining interactive learning principles and computer technology, in which the computer is used as a supporting device for the teaching in teaching, to strengthen the teaching process and students' motivation and make it possible for a student to learn according to his/her learning speed (Şahin & Yıldırım, 1999; Uşun, 2000).

"The students can configure the concepts that they have difficulty in understanding with the use of CAI applications with computer-assisted software, especially using simulations of abstract concepts and animations, which allow students to participate in the learning process interactively" (Karamustafaoğlu, Aydın & Özmen, 2005, p. 2). According to Forcier and Descy (2002), one of the computer-assisted instruction methods is multimedia programmes.

Multimedia is comprised of a computer program that includes "text along with at least one of the following: audio or sophisticated sound, music, video, photographs, 3-D graphics, animations or high-definition graphics" (Maddux, Johnson & Willis, 2001).

Computer animation is the presentation of a series of images and illustrations in an animated way. Educational computer animations should be built on animated and visual pictures of the given subject matters for students to understand those subjects better. While developing computer animations, attention must be paid to the use of pictures, graphics and voices. Demonstrations are presented in three phases in computer animations: Microscopic, macroscopic, and symbolic. Teachers report that the use of conceptual computer animation affects students' understanding and performance positively. However, the use of computer animations requires much time. Planning should be flexible and teachers should evaluate the material's efficiency and suitability to the subject matter (Burke, Greenbowe & Windschitl, 1998).

"Teaching through concrete teaching with supporting materials at a macroscopic level may help prevent conceptual errors by presenting abstract knowledge as concrete knowledge" (Atılboz, 2004, p. 155). Animation and simulation are the choices that can be used for this purpose (Saka & Akdeniz, 2006). "The use of computer animations helps the presented content to be coded visually in Science Education" (Sezgin & Köymen, 2002, p. 140).

"Since students can follow the chemical processes, which they cannot understand or visualize, they can easily understand and grasp the subjects that were taught by computer-assisted instruction, especially with animations" (Tezcan & Yılmaz, 2003, p. 5). The students should visualize and assimilate the subject matters in order to understand what and how something happens in a complicated chemical subject matter. After they visualize it in their minds, they can easily understand and remember it later. Merely, computers-especially animations are needed for processes such as visualizing, forming into a meaningful format, and understanding complicated chemical subjects (Sanger & Greenbowe, 1997).

When all these studies are analysed, it is seen that the use of computers in teaching chemistry has become increasingly more important and has developed rapidly. Computers are used as a supporting device, especially in teaching abstract concepts and complex subjects. As temperature-heat, matter and its structural features are considered the subjects in which students experience conceptual errors. This study aims to determine the effectiveness of computer-assisted instruction in teaching these subjects. Considering using science knowledge in daily life-one of the basic aims of science education-is thought to help facilitate the use of knowledge in daily life by meaningful, conceptual learning. It is also seen that when different methods are used, students' interest in the courses will increase. The study in which computer-assisted instruction is used in teaching the "Matter and Heat" unit will contribute to the improvement of effective and permanent science teaching.

The problem of this study is as follows: "How does the use of animation technique-one of the computer-assisted instruction methods-effect academic achievement and permanency? What are the students' reactions towards animations?"

- Does the use of animation instruction-one of the computer-assisted instruction methods-in Science and Technology courses increase academic achievement?
- Does the use of animation-one of the computer-assisted instruction methods-affect permanency?
- Does gender play a role in the results of comparison between computer-assisted instruction and traditional methods for academic achievement and permanency?
- Are students willing to use animations?

The aim of this study is to compare the computer-assisted instruction method with the traditional teaching method in terms of their effectiveness in teaching the "Matter and Heat" unit in the 6th grade science curriculum in primary schools. Furthermore, the study aims to confirm if there is a significant difference between methods in student achievement, to investigate the effects of computer-assisted instruction on permanent learning and to identify the students' points of view about computer-assisted instruction. For this purpose, all the 6th grade students of Asarcık Boarding Primary School of Asarcık in Samsun were enrolled in this study.

Method

Participants

The universe of the study is a state school: Asarcık Boarding Primary School of Asarcık in Samsun. The sample included 50 students: 25 from the 6/B and 25 from the 6/C classes.

Two classes in the 6th grade were assigned to either the experimental group or the control group by lot sampling in Asarcık Boarding Primary School in the academic year of 2006-2007. The experimental group included 25 students from the 6/C class; the control group included 25 students from the 6/B class.

Experimental and control groups included 26 male and 24 female students ranging in age from 12-14. Both the experimental group and control group had 13 male and 12 female students.

Data Collecting Methods

A 30-question Science and Technology success test was prepared by the researcher to identify the pre-class and post-class knowledge and attitudes of the experimental and control group students. Before preparing the test, the acquisitions in "Matter and Heat" found in Science and Technology curriculum, which was prepared by the Ministry of National Education, were determined. At least one question was prepared for each acquisition. While preparing the questions, test preparation techniques found in related sources (Özçelik, 1998; İşman & Eskicumalı, 2003; Yılmaz, 2003; Atılgan, 2007) were considered. To measure the various knowledge, skills and ability and to score the test objectively, the items in the success test included multiple-choice questions (İşman & Eskicumalı, 2003). A 30-question Science and Technology success test was prepared to assess acquisitions. In the process of preparation of the questions, we asked for Science and Technology teachers and specialists' opinions. To evaluate the test, the same test was applied to one hundred two 7th grade students who have already learnt the "Matter and Heat" unit in the same school. As a result of the matter and test analysis, the test was reduced to 25 questions by cancelling 5 questions whose Cronbach's Alpha value was low. The Cronbach's Alpha value of this 25-question test was found to be 0.889. This result shows that the reliability of the test is high.

The Science and Technology Achievement Test was applied as a pre-test to determine the knowledge level of the classes before the application. The "Matter and Heat" unit was taught by the same teacher for four weeks to the experimental group by use of educational software prepared by the researcher. The same unit was taught by the same teacher to the control group by using the traditional method. The success test was designed to confirm if there was a difference between the groups after application was applied as a post-test. After a five-week waiting period, the same test was applied to both groups as a permanency test.

Students were also inquired about their opinion of computer-assisted instruction, computer-assisted science education, and animations on a scale consisting of 5 questions. The written opinions of the students from the experimental group who were taught courses by using the computer-assisted method were collected.

Furthermore, a semi-structured group interview method was used in the study. Interviews lasted 15-20 minutes and were recorded to obtain the thoughts of eight students in the experimental group who were taught courses by using computer-assisted instruction. The students were asked some questions about the effects of animated computer-assisted instruction on learning and permanency.

Data Analysis

We gathered these findings through the analysis of the data obtained from the pre-test, post-test and permanence test. The SPSS statistic package programme was used in the analysis of data. The results of the tests were coded as "one point" for

correct answers and as "zero" for wrong answers. After coding, dependent and independent t-tests were used to investigate the experimental and control group students' academic achievement, the effects of permanence, and gender. Also, a frequency analysis was made to identify the distribution of genders in the groups. The results were given in tables in the findings chapter. The significance level of p value was determined as 0.05 to interpret the results of the t-test.

Preparation and Improvement of Educational Software

Animated educational software was prepared by the researcher through Macromedia Flash 8.0 for the subject matter to be taught by the use of computer-assisted instruction. At least one animation was created for each of the subject titles in the "Matter and Heat" unit. Adobe Photoshop CS3, Image Ready and Corel Draw were used for the drawings of the animations.

In the software, all the titles were given as a list on the main page and were linked. When you click on any title, you reach the animations related to the title. The exit button at the end of the page shuts off the software.

Figure 1. Main menu page for "Matter and Heat" unit animations

When you click on the link, you go to the main page of explanation for the subject; after commentary and sampling, you can pass to the animation page. After you watch the animation, you click the main menu button at the end of the page to return to the menu page. Additionally, there exist explanations at the end of each page during the animation projection. Animation is supported by written expression.

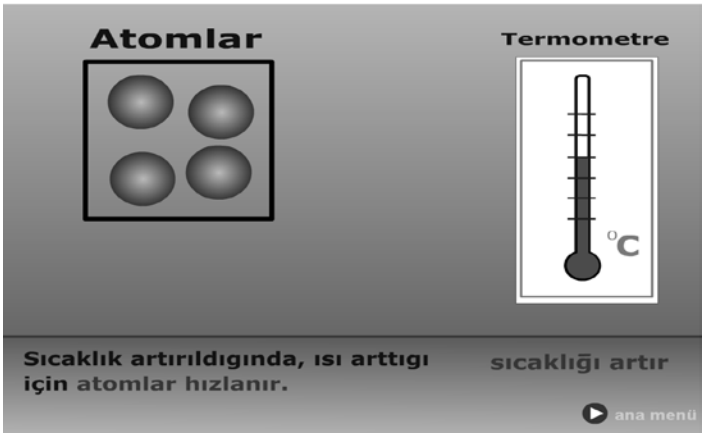


Figure 2. "Warming is movement" animation (Step2)

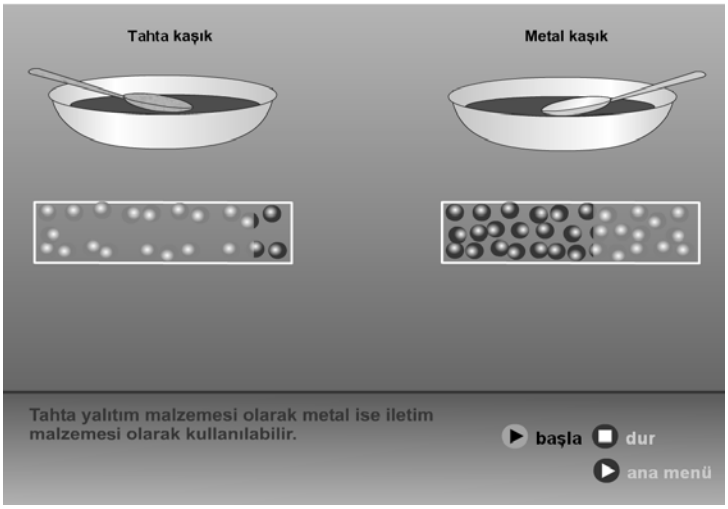


Figure 3. "Metal's warming" animation

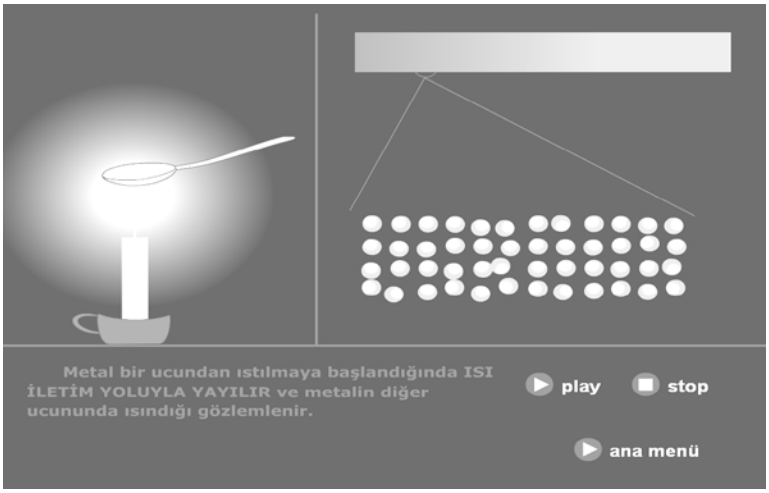


Figure 4. "Metal's warming" animation

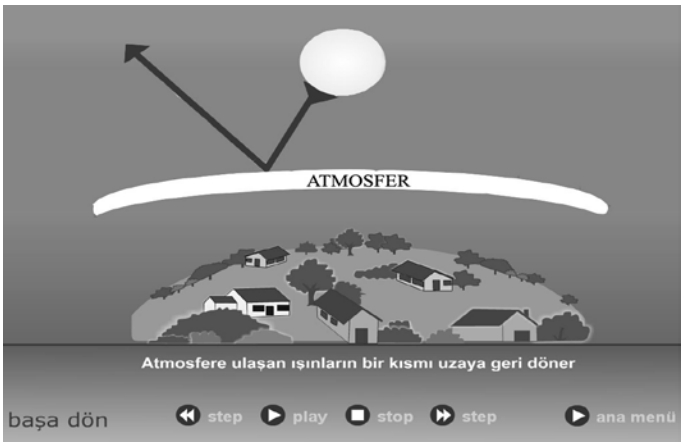


Figure 5. "Earth's warming" animation (Step 1)

Findings

The Science and Technology success test applied to the experimental and control group students was analysed with a t-test using the SPSS statistic package programme. Findings were interpreted with a significance level of p 0.05.

The mean of experimental group students was found as 26.24, and the mean of control group students was found as 24.48 according to the independent t-test analysis results of the experiment group and control group students' pre-test scores. As a result of the t-test, the t value was calculated as 0.628 and the p value was calculated as 0.533. As the significance level was 0.05, it was revealed that there was

not a significant difference between the pre-test results of the experimental- and control-group students. It was concluded that there was not a difference between two groups before application and that the level of the groups were comparable.

Table 1

Independent t-Test Analysis Results of the Experimental and Control Group Students' Pre-test Scores

Groups	N	$\bar{X}$	SD	df	t	p	
Experimental Group	25	26.24	9.457				p > 0.05
				48	0.628	0.533	necessary
Control Group	25	24.48	10.349				

When Table 2 was investigated, the mean of the experiment group was found to be 66.88 and the mean of the control group was found to be 44.96 according to the independent t-test analysis results of the experimental- and control-group students' post-test scores. The t value was calculated as 7.769 and the p value was calculated as .000. As the p value was < 0.05, there was a significant difference between the experimental and the control group students' post-test results. According to the results, The t value was found statistically significant in favour of the experimental group. In other words, the success level of the experimental group was relatively higher than that of the control group.

Table 2

Independent t-Test Analysis Results of the Experimental and Control Group Post-test Scores

Groups	N	$\bar{X}$	SD	df	t	p	
Experimental Group	25	66.88	11.805				p < 0.05
				48	7.769	.000	unnecessary
Control Group	25	44.96	8.023				

While looking for a solution to the question of permanency in the study, independent t-test analysis results of the experimental- and control-group post-test scores were analysed. When the results in Table 3 were analysed, the mean for the experimental group permanency test was found to be 54.08, where the mean of the control group permanency test was 34.08. The t value was calculated at 5.931, and the p value was calculated at .000. When the results of the permanency test in the experimental group were compared with those in the control group, it was revealed that there was a significant difference in favour of the experimental group ($p < 0.05$). In other words, computer-assisted instruction (CAI) was more effective than the other traditional instruction (TI) methods. In light of this data, it was revealed that

computer-assisted instruction (CAI) was more effective than other traditional methods in improving academic achievement and permanency in science lessons.

Table 3

Independent t-Test Analysis Results of Experimental and Control Group Permanency Test Scores

Groups	N	$\bar{X}$	SD	df	t	p	
Experimental Group	25	54.08	12.655	48	5.931	.000	p < 0.05 unnecessary
Control Group	25	34.08	11.143				

Pre-test, post-test and permanency test results of the control-group and experimental-group students were analysed to investigate the influence of gender on academic achievement and permanency. As it was shown in Table 4, according to the pre-test results of the control group students, the p value was calculated as 0.605 for female students and 0.600 for male students. Since the p value was > 0.05 (above the significance level), the result was not significant. According to the post-test results of the control group students, the p value was calculated as 0.681 for female students and 0.676 for male students. Since the p value was > 0.05 (above the significance level), gender was not significant in the post-tests. When the permanency tests were analysed, it was concluded that gender differences were not significant in the permanency tests (p > 0.05)

Table 4

Findings of Control Group Test Scores Concerning Gender Variables

	Gender	N	$\bar{X}$	SD	t	p	
Pre-test	Female	12	23.33	8.500	- 0.524	0.605	p > 0.05
	Male	13	25.54	12.060	- 0.532	0.600	not significant
Post-test	Female	12	45.67	5.774	0.416	0.681	p > 0.05
	Male	13	44.31	9.861	0.424	0.676	not significant
Permanency test	Female	12	35.00	9.816	0.390	0.700	p > 0.05
	Male	13	33.23	12.584	0.394	0.698	not significant

Analyses that were performed to determine the influence of gender on pre-test, post-test and permanency-test scores of control-group students were shown in Table 5. According to the pre-test results, the p value was above the significance level in both genders. In other words, gender was not significant in pre-test scores. The post-test p value was calculated at 0.116 for female students and 0.115 for male students. Since the p value was above the significance level, it is concluded that gender was

not significant in post-test scores. When permanency tests were analysed, it was revealed that gender was not significant in post-test scores either $p > 0.05$).

Table 5

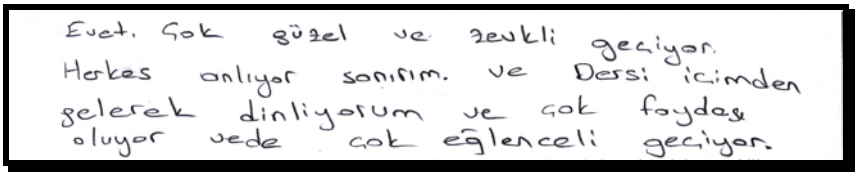
Findings of Experimental Group Test Scores Concerning Gender Variables

	Gender	N	$\bar{X}$	SD	t	p	
Pre-test	Female	12	26.00	8.268	- 0.119	0.906	p > 0.05
	Male	13	26.46	10.775	- 0.121	0.905	not significant
Post-test	Female	12	63.00	11.070	- 1.633	0.116	p > 0.05
	Male	13	70.46	11.723	- 1.637	0.115	not significant
Permanency test	Female	12	51.67	12.816	- 0.913	0.371	p > 0.05
	Male	13	56.31	12.592	- 0.912	0.371	not significant

In the study, 25 students in the experimental group were also inquired about their opinion of computer-assisted instruction on a scale consisting of five open-ended questions. Most of the students reported that computer-assisted instruction (CAI) improved their positive attitude towards science courses, they really liked it, and they did not get bored. Students also reported that permanent learning was obtained by the use of computer-assisted instruction (CAI), and thus the success level increased. Furthermore, students indicated that they prefered interactive animations to audio-animations.

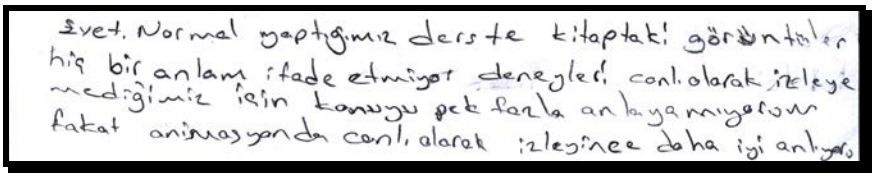
The experimental group students' responses to the five open-ended questions were as follows:

Question 1: Are the courses taught by the use of computer-assisted instruction exciting or boring?



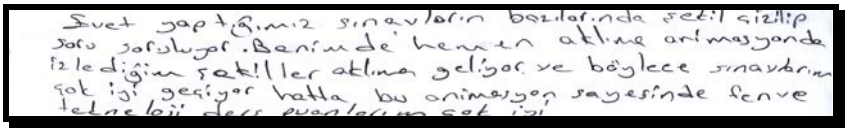
Courses are exciting. I think everybody has a good grasp of the subject. I really want to listen to the teacher.

Question 2: Is it easy to grasp the subject taught by the use of computer-assisted instruction? Is it efficient? Could you tell us?


Evet. Normal yaptığımız derste kitaptaki görüntüler hiç bir anlam ifade etmiyor deneyleri canlı olarak izleyemediğimiz için konuyu pek fazla anlayamıyorum fakat animasyonda canlı olarak izleyince daha iyi anlıyo

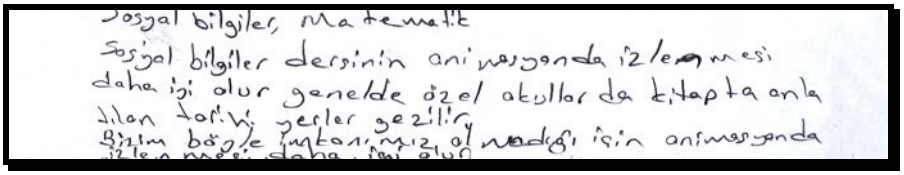
Yes it is. Animations in the course book do not mean anything to me. Experiments were not animated in the course book, so it is difficult to learn meaningfully.

Question 3: Are the subjects easily remembered when taught by the use of computer-assisted instruction? Could you tell us?


Evet yaptığımız sınavların bazılarında şekil çizilip soru soruluyor. Benimde hemen aklıma animasyonda izlediğim şekiller aklıma geliyor ve böylece sınavlarım çok iyi geçiyor hatta bu animasyon sayesinde fen ve teknoloji ders evrelerim çok iyi

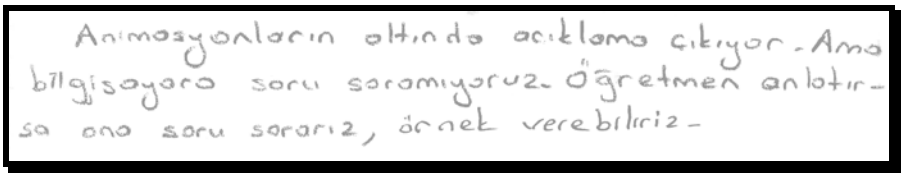
Yes, there are some figures in the exams. Animations help to remind me of the topic. I improved my science mark with the help of these animations.

Question 4: Which lessons would you like to be taught by the use of computer-assisted instruction? To you, which courses should be taught by this method?


Sosyal bilgiler, Matematik
Sosyal bilgiler dersinin animasyonda izlenmesi daha iyi olur genelde özel okullar da kitapta anla yılan tarihi yerler gezilir. Bizim böyle imkanımız ol madığı için animasyonda

Social science, maths. Private school students can visit historical places, but in our school we can't, so it is better to use animations in social science courses.

Question 5: Which one do you prefer, instructions given by the teacher or instructions given by audio-animations?


Animasyonların altında açıklama çıkıyor. Ama bilgisayara soru soramıyoruz. Öğretmen anlatırsa ona soru sorarız, örnek verebiliriz.

Animations have explanations, but we cannot ask questions to the computer. If instructions are given by the teacher, we can ask questions or give examples.

In the present study, semi-structured interviews were performed with the experimental-group students to obtain their opinions. Following is an example:

Interview with a student named Emre

Researcher: Which subjects were you taught by the use of computer-assisted instruction?

Emre: Particle structure of a substance, heat diffusion and isolation.

Researcher: Could you give an example?

Emre: Yes, for example, heat diffusion has three types: radiation, transmission and convection. The convection term refers to the movements of molecules.

Researcher: Was the lesson delivered in a fun or a boring way?

Emre: It was exciting. I really liked the course taught by the use of computer-assisted instruction.

Researcher: Was it efficient?

Emre: Yes it was. Computer-assisted instruction helped us to learn thoroughly. It also has positive effects on students.

Researcher: What are they? Could you tell us please?

Emre: We can learn the subjects better. Subjects were easily-remembered. In exams, I can easily remember the topics that were taught by animated figures. I improved my scores.

Researcher: Were there any differences in the number of the participants in courses taught by the use of computer-assisted instruction?

Emre: Yes there were. None of our friends—not even the naughtiest one--made noise in the course. They listened carefully.

Researcher: To you, what was the reason?

Emre: We all like computers, and all the animation that we watched was interesting and exciting. We all focused on the computer, and we did not show interest in anything else.

Researcher: Which one do you prefer, instructions given by the teacher or instructions given by audio-animations?

Emre: I think it is better to listen to instruction by teachers.

Researcher: Why?

Emre: Because it takes time to follow explanations on computers, and earphones and speakers may not be available every time you need them. Additionally, our teacher can help us whenever we need help.

These interviews have revealed that the animated computer-assisted teaching method was liked by the students and was found useful. The advantages of the computer-assisted instruction were listed by the students as follows: learning meaningfully, prevention of classroom behaviour problems, permanency, and ease in understanding complex topics. In courses in which computer-assisted instruction

was used, students also reported no longer experiencing negative behaviours such as talking out of turn, making noise, hindering other students or leaving the seat without permission.

Results and Suggestions

According to the results of the post-test performed to identify the effects of computer-assisted instruction (CAI) on academic achievement, it is revealed that the success level of the experimental-group students to whom courses were taught by the use of computer-assisted instruction was higher than the students in the control group (Table 1). Hence, it was concluded that computer-assisted instruction (CAI) was more effective than the other traditional instruction (TI) methods in improving students' academic achievement. In a study performed by Tezcan and Yılmaz (2003), it is revealed that courses that were taught by the use of computer-assisted instruction were more effective than the courses taught by the traditional instruction method. These findings were consistent with those in our study. Additionally, our study runs parallel with previous findings (Klein & Koroghlainan, 2004; Guliska & Barterzewich, 2006; Yılmaz & Doğan, 2005).

The effects of computer-assisted instruction on permanency were shown in Table 3. The permanency test has revealed a higher level of success in experimental-group students than in control-group students. These results were consistent with those in the studies performed by Arıkan, Aydoğdu, Doğru and Uşak (2006), Çelikler, Güneş and Güneş (2007). In the study performed by Arıkan, Aydoğdu, Doğru and Uşak (2006), the effects of computer animation tools on permanency in biology courses were investigated. The study has revealed that the permanency level of knowledge was higher in courses taught by the use of computer-assisted instruction than those taught by the use of traditional instruction methods. In a study performed by Çelikler, Güneş and Güneş (2007), the effects of computer-assisted instruction (CAI) on permanency were investigated among 1st grade students at the Department of Science Education. According to the data obtained from the students, it was revealed that the permanency level of the experimental-group students was higher than those in the control group to which traditional instruction methods were used. It was expressed that computer-assisted instruction has positive effects on academic achievement and permanent learning.

Students were able to express their thoughts and suggestions on computer-assisted instruction through a questionnaire and interviews. Firstly, computer-assisted instruction helps to make the courses more exciting and break up the monotony of the class. Interesting animations make it easy for students to grasp complex concepts. They easily remember the subjects that were learnt by audio-visual aids, and thus, they can solve the problems easily. Furthermore, some negative behaviour can be eliminated in the courses in which computer-assisted instruction is used. When computers are used as a tool to focus students' attention, negative behaviour such as making noise, talking out of turn and hindering other students can be minimized. Financial problems in applying teaching techniques such as school excursions, observations or laboratory studies can be eliminated by the use of computer-assisted instruction.

In light of the findings, we concluded that the following suggestions would be helpful in science teaching:

- As computer-assisted instruction improves academic achievement, animations may help teachers to teach more complex topics.

- The subjects learnt by visual aids are more permanent than the subjects learnt by audio aids. In light of this data, audio-visual animations can be used for permanent learning.
- Teaching techniques that are used in computer-assisted instruction can be improved and used efficiently to teach conceptual and complex subjects in other courses.
- Because the employment of alternative methods and techniques aiming at motivating the students are useful, it is possible to draw their attention to the subject taught by making use of their interest in computers.
- Using educational software as a means of computer-assisted instruction and giving an individual-learning opportunity to the students will enable them to repeat the points they failed to understand, thus contributing to their grasping of the subject thoroughly. Furthermore, using the computer themselves or having the ability to control software will help students to improve their self confidence. Additionally, differences in level that may occur due to the individual learning capacity will be prevented.
- Some useful teaching techniques that cannot be applied due to financial problems will be applicable by the use of computer-assisted instruction.
- Computer-assisted instruction can be used to eliminate negative behaviours such as making noise in the classroom.

By way of conclusion, academic achievement and permanency in science education can be improved by the use of computer-assisted instruction and the software that was designed for teaching conceptual and complex subjects, taking into account students' levels and interests.

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Madde ve Isı Konusunun Öğretiminde Bilgisayar Destekli Uygulamaların Etkisi (Özet)

Problem Durumu: Çağımız bilginin hızla geliştiği, bilim ve teknoloji alanında her geçen gün yeni buluşların yapıldığı, teknolojik araç ve gereçlerin günlük yasamın vazgeçilmez parçası haline geldiği bir dönemdir. Çağımızda yaşanan bilimsel ve teknolojik gelişmeler ve bu gelişmelerin eğitim sistemine yansımaları sonucu, teknolojinin eğitim için kullanılması kaçınılmaz hale gelmiştir. Eğitim süreci içinde teknolojinin kullanılması, öğrencilere daha zengin bir öğrenme olanağı hazırlamaktadır. Öğrencinin

bilgiye erişme, yapılandırma ve problem durumlarında elde edilen bilgiyi kullanma sürecinde teknolojiden faydalanmak, eğitimi nitelikli hale getirmektedir.

Özellikle ilköğretim çağındaki öğrencilerin soyut kavramları öğrenmede zorlandıkları düşünüldüğünde, bu kavramların öğrenci seviyesine uygun bir şekilde somutlaştırılmasında ve adeta canlı bir şekilde sunulmasında, anlamlı öğrenmede ve olayların yeniden tekrarlı bir şekilde gözlenmesinde eğitim teknolojisi araçları ve bu araçlardan özellikle bilgisayarlar önemli rol oynamaktadır (Akpınar, Aktamış ve Ergin, 2005). İlköğretimin birinci kademesinde Fen bilgisi meydana gelen kavram yanılgıları daha sonraki yıllarda aynı şekilde devam etmektedir. Bu nedenle başlangıçta doğru ve kalıcı öğrenmenin gerçekleştirilmesi gerekir (Güneş ve Demir, 2007).

Fen bilgisi öğretiminin temel amaçlarından biri olan, bilginin günlük yaşamda kullanılması ilkesinden yola çıkarsak, yapılan bu çalışma ile anlamlı bir şekilde kavramların öğrenilmesi bilginin günlük yaşama uygulanması açısından da kolaylık sağlamak hedeflenmektedir. Farklı yöntemler kullanıldığı zaman öğrenci ilgisinin arttığı, görsel ve teknolojik materyallerin öğrencide kavramsal yapılanmanın oluşmasında son derece etkili olduğu görülmektedir. "Madde ve Isı" ünitesi seçilerek, bilgisayar destekli öğretim yöntemi uygulanan bu araştırma, elde edilen bulgular dikkate alındığında etkili ve kalıcı fen öğretiminin geliştirilmesine katkı sağlayacağı için önemlidir.

Araştırmanın Amacı: Bu çalışmada amaç, ilköğretim 6. Sınıf Fen ve Teknoloji dersi müfredatında yer alan "Madde ve Isı" ünitesinin öğretiminde bilgisayar destekli öğretim yöntemi ile geleneksel öğretim yönteminin etkililiğini karşılaştırmak, öğrencilerin akademik başarıları arasında anlamlı bir fark olup olmadığını saptamak, bilgisayar destekli öğretimin kalıcı öğrenme üzerine etkisini araştırmak ve bilgisayar destekli öğretim yöntemi hakkında öğrenci görüşlerini belirlemektir. Araştırmada Macromedia Flash 8.0 programıyla hazırlanmış eğitim yazılımının kullanımı ile öğrencilerin akademik başarı durumları araştırılmıştır.

Araştırmanın Yöntemi: Araştırma öntest- sontest kontrol gruplu yarı deneysel yöntem kullanılmıştır. Çalışmaya Samsun ili Asarcık İlçesi Asarcık Yatılı İlköğretim Bölge Okulu'nda öğrenim görmekte olan 50 6. sınıf öğrencisi katılmıştır. Öğrencilerden rastgele oluşturulan iki gruptan biri deney, diğeri ise kontrol grubu olarak belirlenmiştir. Milli Eğitim Bakanlığı 6. sınıf Fen ve Teknoloji Dersi müfredatında yer alan "Madde ve Isı" ünitesi 6. sınıf öğrencilerine farklı iki yöntem kullanılarak anlatılmıştır. Deney grubuna araştırmacı tarafından Macromedia Flash 8.0 programı kullanılarak hazırlanan animasyonlardan oluşmuş eğitim yazılımı kullanılarak bilgisayar destekli öğretim yoluyla, kontrol grubuna ise normal öğretim yöntemi kullanılarak konu anlatımı yapılmıştır. Uygulamanın yapıldığı ünite, her iki gruptada 5 haftalık bir sürede tamamlanmıştır.

Çalışmanın verileri üç farklı veri toplama aracı ile elde edilmiştir. Bunlarda biri, öğrencilerin ders sonundaki başarı ve hatırlama düzeylerini ölçmek üzere araştırmacı tarafından geliştirilen Fen ve Teknoloji Başarı testidir. Test, geçerliğini ölçmek üzere, daha önce bu konuda eğitim almış olan 102 tane 7.

sınıf öğrencisine uygulanmıştır. Yapılan değerlendirme sonucu 30 soru olarak hazırlanan test, 25 soruya indirilmiş ve bu soruların cronbach alpha değeri .889 olarak hesaplanmıştır. Diğer bir veri toplama aracı olarak 5 açık uçlu sorudan oluşan görüş formu hazırlanmıştır. Deney grubu öğrencilreinin tümüne uygulanan bu formlarla öğrencilerin bilgisayar destekli öğretim yöntemi hakkındaki görüşlerini belirlemek amaçlanmıştır. Ayrıca yine öğrencilerin bilgisayar destekli öğretim yöntemi hakkındaki görüş ve önerilerini belirlemek üzere, bilgisayar destekli öğretim yöntemi ile konu anlatımı yapılan deney grubu öğrencilerinin sekiz tanesi ile yarı yapılandırılmış mülakat görüşmeleri yapılmıştır.

Araştırmanın Bulguları: Elde edilen veriler, SPSS istatistik paket programı kullanılarak t-testi ile analiz edilmiştir. Başarı testlerinden elde edilen verilere göre, başlangıçta aynı seviyede olmalarına rağmen, uygulama sonunda bilgisayar destekli öğretim gören öğrencilerin, diğer öğrencilere oranla akademik başarı testinden daha yüksek puan aldıkları ve dersin bu grupta daha kalıcı olduğu belirlenmiştir. Araştırmanın verileri, cinsiyet değişkenine göre değerlendirildiğinde ise anlamlı bir fark olmadığı, başarı ve kalıcılığın cinsiyetten bağımsız olduğu saptanmıştır. Ayrıca öğrencilerin bilgisayar destekli öğretim yöntemini daha faydalı buldukları, bu sayede dersi daha iyi anladıklarını, daha çabuk kavrayıp hatırlayabildikleri ve dersin bu sayede daha eğlenceli geçtiği belirlenmiştir. Mülakat sonuçları ise görüş formlarıyla paralellik göstermekte, öğrencilerin bilgisayar destekli öğretim yönteminin derslerde kullanılmasını istedikleri görülmektedir.

Araştırmanın Sonuçları ve Önerileri: Çalışmamızda, yapılan analizler sonucu bilgisayar destekli yöntemin hem akademik başarıyı, hem de kalıcılığı artırdığını göstermektedir. Etkili bir fen eğitimi için, bilgisayar destekli eğitimin derslerde tercih edilen bir yöntem haline gelmesi yaralı olacaktır. Öğrencilerin zihinlerinde canlandırmakta zorlandıkları, üç boyutlu düşünme becerileri gerektiren konuların anlatımında animasyon kullanılması hem kavram yanılgılarını önlemede, hem de konuyu daha hızlı ve kalıcı olarak kavramada öğrenciye yardımcı olacaktır.

Ayrıca bilgisayar destekli öğretim yöntemi ve özellikle animasyonlar öğrencinin ilgisini çekeceği için derse olan katılımı artıracak ve sınıf içinde oluşan monoton havayı kıracaktır. Bunun dışında bilgisayar destekli eğitim yazılımı, öğrencilere kendi kendilerine kullanma imkanı verildiğinde öğrencilerin bireysel öğrenme hızlarına göre bir öğretim yapılmış olacaktır. Bununla beraber okullarda yapılması sorun yaratan, tehlikeli, uzun süreç gerektiren ya da yüksek maliyetli deneylerin bilgisayar destekli öğretim yöntemi ile animasyonlar kullanılarak anlatılması, öğretim açısından bir takım zorlukları aşmayı sağlayacaktır.

Sonuç olarak, fen ve teknoloji dersinin öğretiminde, öğrencilerin anlamakta güçlük çektikleri soyut kavramların somutlaştırılması ve bu konuların anlaşımlasını kolaylaştırmak amacıyla, öğrencilerin seviyeleri, istekleri ve problemleri göz önünde bulundurularak hazırlanan eğitim yazılımları ile bilgisayar destekli uygulamaların kullanılması akademik başarı ve kalıcılığı artırdığı görülmüştür.

Anahtar sözcükler: Bilgisayar destekli öğretim, madde ve ısı, fen ve teknoloji, animasyon