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THE EFFECTS OF MULTIMEDIA LEARNING MATERIAL ON STUDENTS' ACADEMIC ACHIEVEMENT AND ATTITUDES TOWARDS SCIENCE COURSES

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Abstract. *This study implemented multimedia learning material developed for the 5th grade science course topic "Food and Healthy Nutrition" and examined its effect on students' academic achievement and science attitudes. The study used a control group, a pre-test-post-test quasi experimental research design, and a convenience sample consisting of 62 5th grade students. The research instruments were an achievement test and a science attitude scale. During the implementation process the experiment group learned using multimedia learning material and the control group learned with traditional methods. Data were analyzed using an independent-samples t test, a paired-samples t-test, and ANCOVA statistics. According to the findings there is a statically significant difference between post-test achievement scores of the experimental and control groups, with the experimental group scoring higher. Also there is a statically significant difference between students' post-test scores in terms of gender, favoring females over males. In terms of science attitude there is also a significant difference between post-test scores of the experimental and control groups. In conclusion it may be said that multimedia learning promotes more effective learning in science education.*

Key words: *healthy nutrition, multimedia learning, science achievement, science attitudes.*

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Introduction

One of the teaching technologies included in the learning-teaching process is a series of multimedia applications developed due to advances in information technologies and cognitive theories. Considering the technology available today, it is imperative that the educational system implement information technologies. The rapid growth of the internet highlights the importance of web-based learning environments and paves the way for educators to more greatly benefit from multimedia applications. Yui, Liu & Wai (2005) emphasize some of the most significant features of web-based learning environments, including less need for a multitude of devices; accessibility by anyone, anywhere, and anytime; independence of time and space limitations; and worldwide support for communication and cooperation.

Multimedia teaching theory was developed on the basis of theories such as dual coding, limited capacity, and active processing. According to this theory, learning is enhanced when words and pictures are used together (Mayer, 2005). The results obtained in studies which focus on the use of multimedia materials support this thesis. For instance, Taşçı & Soran (2008) examined the effects of multimedia applications on learning at the level of comprehension and implementation in cell division unit in science classes and discovered that the experimental group taught with multimedia applications achieved more compared to the group taught with traditional methods. In the study, undertaken with university students, Su (2008) investigated the effects of multimedia applications on science performance with the help of educational software. The results revealed that the use of multimedia applications contributed to student learning and positively affected their attitudes towards science. In their study with 8th graders, Ardac & Akaygun (2004) found that students who were taught science with multimedia materials were more successful compared to students who were taught with traditional methods.

Another study which implemented multimedia materials (Chang, Quintana & Krajcik, 2010) investigated the effects of multimedia applications on 7th graders' performance in science class. The study focused on three different groups of students and concluded that learning was more effective in the group taught with multimedia applications. In their study on learning physics, Günel, Hand & Gündüz (2006) stated, that the group presented with multimedia applications was more successful than the groups taught with traditional methods. There are various studies in literature regarding multimedia applications (Neo & Neo, 2001; Norhayati & Siew, 2004; Kim & Gilman, 2008; Neo & Neo, 2009; Tsai, 2009; Chien & Chang, 2012). In addition to studies which stress the positive effects of multimedia applications on learning, there are also studies that state the opposite (Guan, 2009; Montazemi, 2006; Rasch & Schnotz, 2009).

Healthy nutrition is now considered as a unit in science classes due to the rise of obesity in today's youth. Healthy nutrition is one of the conditions for a healthy life since malnutrition and an unbalanced diet are considered among the causes for many diseases, such as heart conditions, cancer, diabetes, and obesity (Hawkes, 2004). Health experts and health institutions regard healthy nutrition's inclusion in basic health education in Turkey as important in raising healthy individuals and a healthy society (Gökkoca, 2001; Turkish Ministry of Health, 2011; WHO, 2012b). In this context there are various implementations possible to raise awareness in society for healthy nutrition. For instance, the World Health Organization has developed assessment tools to identify nutrition and activity in countries, a global strategy for physical activity and health, and implementations for a nutrition-friendly schools initiative (Hawkes, 2004; WHO, 2006; WHO, 2012a; WHO, 2012b). According to official records, the rate of obesity in England is 30% for children between age 2 and 15 and 61.3% for adults (United Kingdom Department of Health, 2013). To promote health in society, the Department of Health in the United Kingdom government is implementing a series of projects that promote healthy nutrition, a healthy diet, and regular physical activity. In addition to England, many countries such as Canada (Public Health Agency of Canada, 2013), Australia (Australia Department of Health, 2010), the United States of America (US National Institutes of Health, 2011) and the European Union Countries (EU Directorate-General for Health & Consumers, 2010) have implemented various programs to raise societal awareness of healthy nutrition (Domnariu, 2010).

Nutrition, a factor that affects development in the early childhood period, is emphasized as crucial for a healthy future life (Domnariu, 2010). Diseases - including obesity - resulting from malnutrition or unbalanced nutrition can be observed worldwide in the period of childhood (WHO, 2006).

Considering the importance of healthy nutrition on overall health, it is crucial to educate children early in their development. The World Health Organization's initiatives to promote nutrition-friendly schools include providing nutrition education in schools (WHO, 2006). The World Health Organization also suggests school-based implementation for educating adolescents (WHO, 2009). A series of projects implemented by the Turkish Ministry of Health (2011) at schools to introduce students to the habits of healthy nutrition and regular physical activities are examples of school-based implementations. In addition to these types of applications, 5th grade Science and Technology classes in Turkey include units on healthy nutrition (Turkish Board of Education, 2012). England includes healthy nutrition as a teaching unit beginning in 2nd grade. Students in England are taught about eating the right amounts of different foods, the different food types, and the importance of exercise (UK Department for Education, 2013). In Finland, healthy nutrition is taught in 5th grade science education and there is an independent course called health education beginning in the 7th grade (Finnish National Board of Education, 2013).

Information gleaned from literature shows that multimedia applications provide opportunities to facilitate learning. Therefore, multimedia applications can be utilized to make learning more effective in important topics such as healthy nutrition and to support implementation of this knowledge in real life. The lack of studies regarding multimedia applications in nutritional education in the existing literature strengthens the importance of the current study. As stated by Ausubel (1968), learning is meaningful when prior knowledge is associated with new knowledge, and multimedia applications create opportunities to internalize these associations.

Many studies report that achievement, motivation and learning attitudes of students with different learning styles are changed positively when teaching designs are supported with technology, including web-based designs (Lu, Yu, & Liu, 2003; Kettanurak, Ramamurthy & Haseman, 2001). In this context, the current study aims to identify changes in 5th grade student achievement and attitudes towards science class due to the implementation of multimedia materials developed to teach healthy nutrition.

Aim of the Study

Nowadays, because of the rapid spread of the internet usage, using internet effectively in learning environments has become a necessity. Considering children's interest on computer and internet and the time they spend on using them, it is clear that in science classes teachers should benefit more from these environments. Therefore, the study mainly focuses on searching the effect of using multimedia assisted educational technology on students' science learning. The study aims to investigate students' academic achievement and their attitudes towards science in learning environment by using web based software in the subject of foods and healthy nutrition. The current study investigated academic achievement and attitudes towards science classes of students, who were taught using web-based software with multimedia assisted educational animation in the "Foods and Healthy Nutrition"

1. Does the instructional material make significant differences in students' academic achievement in "Food and Healthy Nutrition" subject?
2. Does the instructional material make significant differences in students' attitudes towards science?

Methodology of Research

Research Design

In the study, a non-equivalent control group design - a type of quasi-experimental design - was used, since the educational system did not allow for randomly placing students in groups and because the groups were pre-designed (Gall, Gall & Borg, 1996). One experimental and one control group were selected in a school in the Kahramanmaraş Province during the 2011-2012 academic years. Groups containing 31 5th grade students each were randomly selected. Experimental and control groups were taught by the same teacher who can use multimedia material. Prior to the application, lecture plans for both groups were prepared and processing the same content for both groups was taken into consideration.

The control group was taught following the activities included in the Science and Technology textbook (Turkish Ministry of National Education, 2011) and the experimental group was taught with the software developed by the researcher based on a multimedia-assisted educational animation web-based learning method. The experimental group was taught in the computer laboratory under the guidance of the teacher and included individual student work. Lesson plans were prepared and methods determined by the researcher were utilized during teaching and no changes were undertaken during classes. The implementation lasted for eight weeks (32 class hours), including the pre-test, post test, pilot implementation, and the actual implementation.

Software

Multi-media can be identified as an environment in which text, pictures, sound, animation, video or a combination of these media are used for students to access information. Using multimedia material as an option with texts, pictures, animations and videos can make learning easier (Mayer, 2003). It is also situated in Paivio's dual coding theory (Paivio, 1991). Paivio explains that both hemispheres of the brain are used actively in learning environments in which both visual and textual information items are used.

The multimedia software is developed according to the principles of cognitive theory of multimedia learning (CTML) (Yue et al., 2013). Cognitive theory of multimedia learning and cognitive load theory give information about learning from words and visuals. According to these theories suggested, there are two distinct channels in the human information processing system, one of them processes information presented in a visual format and the other processes information presented in an auditory or verbal format (Issa et al., 2011). The capacity of these channels is limited. While learning, different parts of human memory system work. Issa et al. (2011) explain the cognitive learning process in their study as given below: Sensory memory can get unlimited information through verbal and pictorial stimuli, but only limited amount of these stimuli can be processed at any given time. The selected information is transferred to the working memory. There, the information is organised and this takes a significant amount of time. The schema, prepared by Issa et al. (2011) that displays dual channel theory for multimedia learning, is given below.

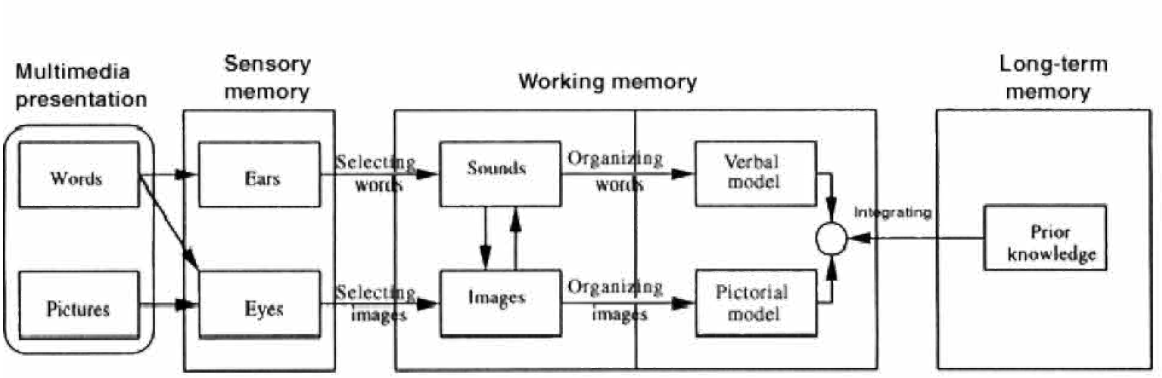

Figure 1: Dual Channel Theory for Multimedia Learning (Issa et al., 2011).

The software contains "Foods and balanced diet, the necessity of nutrients, the content of them, their functions, healthy nutrition" subject that is in science curriculum. The educational gains of the curriculum are given below (Turkish Ministry of National Education, 2006);

Related to the necessity of foods and healthy nutrition students:

- realize that living organisms need nutrition to sustain vital activities;
- identify the primary duties of nutrition contents in our bodies;
- test the amount of carbohydrates, protein and fat content in foods;
- search for the vitamins and which of the foods have rich vitamin contents and present their research;
- indicate that all the nutrients and minerals are found in water and they serve as regulator in our bodies;
- prepare an example of a balanced diet;
- search for the freshness of the food, the cleanliness and the health effects of additives contained and present their research;
- know the importance of the expiration date on packaged foods;
- explain that food varieties increased in parallel with the scientific-technological development.

In the Software, above-mentioned achievements of the curriculum are processed separately. In the introduction part of the Software, students ask for "why do we eat? What is ringing in your stomach and will you feel when it is happening?" and photos of some animals while they are eating something are presented. By the way, students discuss the idea that nutrients are needed for all life events. After this discussion, students investigate the priority of nutrition contents for our body. Students are requested to guess which of the foods have rich content of carbohydrates, protein, fat and take their duty in the body. After that they are requested to conduct the activity. In the activity, students are requested to classify some foods such as bread, potato, egg, sugar and walnut according to their characteristics. Then, by the help of educational agent they drop iodine solution on them and observe the color changes. The blue-purple, brown color displays the carbohydrate content. By the help of educational agent they drop nitric acid on them and the yellow color displays the protein content. For the third group, nutrition's rubbed on paper and the transparence on paper shows the presence of oil.

The prepared multimedia material contains animations that resemble the cartoons broadcasted in Turkish television channels for the target group of 10-11 year old children. Dubbing was done by adults with voices resembling those of children. Short animations depicting what will be watched precede the animation that will be used in each class (Figure 1).

Figure 2: General outlook of the software.

The user guide includes nutrition, foods/nutrients, nutritional elements, "let's learn about foods", healthy nutrition, and evaluation sections. An educational agent welcomes students at the beginning of each section, asks students motivational focus questions, and directs the students by using visual and auditoria alerter (Figure 3).

Figure 3: Content.

The "Back" button directs students to the main page and allows them to move on to the other topics. After lesson presentations are completed, the students are asked to complete the activities to present what they have learned.

In the software, it is examined that when healthy nutrition is not implemented, people face with health problems such as obesity, which is examined in the software. It is highlighted that, today, one of the most important health problems the world faces is obesity. Examples of food menus for a healthy diet are prepared with the students.

As described in the examples above, lectures were conducted in an interactive learning environment which is appropriate for multimedia learning. So learning environment was designed for students in which they can learn by individual and whole-class discussions, along with the help of computers.

The Nutritional Education program was prepared by Microsoft Visual Studio C# 2008 software coding. The design of the forms, buttons and other visual elements used in the program was performed with Adobe Photoshop CS4 software. Adobe Flash CS4 Professional software was used in the animations presented inside the program. A setup file was prepared so that attachments in the program could work accurately and completely.

Working Group

66 5th graders attending a primary school in the province of Kahramanmaraş participated in the study. Four students in the control group were excluded from the study since they did not attend some of the lectures during the implementation and also did not answer some of the questions in the scales. A pilot implementation on the topic of "Necessity for Nutrients" was provided for two weeks to familiarize the experimental group students (N = 31) with the method. Pre-tests were given to both groups before the pilot implementation. Working group was formed according to the simple probability sampling method. Simple probabilistic method is a selection process in which selecting n items from N items and the item has equal chance of being selected from the N (Wales, Wales & Borg, 1996).

Data Collection Tools

As a data collection tool, the study implemented an academic achievement test prepared in line with the goals from the 5th grade Science and Technology class topic "Nutrients and Healthy Nutrition" in the unit "Let's Solve the Puzzle of Our Bodies". To prepare the achievement test, 4-item multiple choice questions were generated on the topics of healthy nutrition, varieties of nutrients, balanced nutrition, and the importance of exercise. An achievement test of 35 questions was prepared in this phase. Five of these questions were eliminated and the possible answers of five questions were changed after assessing the views of science and biology teachers. The test was then finalized for the pilot implementation. The developed achievement test was implemented on 164 students who had previously taken the lesson and were now attending a state and private school in the provincial center of Kahramanmaraş for reliability analysis.

After the trial, implementation item and test analyses were undertaken in order to identify the items for the academic achievement test that would be used in the experimental implementation. Item difficulty indexes and item discrimination indexes were calculated for each item in the item analysis. Items with item discrimination indexes lower than 0.30 were eliminated from the test. The test was also examined via dependent group t-tests to identify whether significant differences occurred between the lower and higher 30% segments. A $p > 0.05$ value was obtained. Item difficulty indexes, item standard deviations, and t-test values for the items valid for the achievement test were obtained at the end of the analyses of the 30 items. The number of questions was reduced to 28 after performing the analyses. The highest score that can be obtained from the test is 28 and the lowest is zero. The Kuder Richardson reliability coefficient of the test (KR-20) was 0.85. According to this value, the test can be accepted as reliable. Examples of Academic Achievement Test are given App.-1.

Student attitudes towards science and technology were obtained by the "Science and Technology Attitude Scale" developed by Nuhoğlu (2008). The scale is a three-point Likert type and contains a total of 20 statements; ten positive and ten negative. Reverse coding was implemented on the negative statements during the analysis. The Cronbach Alpha reliability coefficient of the original scale was calculated as 0.87 and that of the current study was calculated to be 0.82.

Parametric analyses were used since the data showed normal distribution, were homogeneous, because

the sample size was sufficient (Frankel & Wallen, 2006). Before analysis process, one Sample Kolmogorov Smirnov analysis is conducted to clarify if the data has normal distribution [for academic achievement test: $p_{pretest}$ = 0,864, 0,392 (experimental group, control group); $p_{postest}$ = 0,229, 0,377 (experimental group, control group); for attitude test: $p_{pretest}$ = 0,498, 0,06 (experimental group, control group); $p_{postest}$ = 0,380, 0,152 (experimental group, control group)] and for all analysis p > 0,05. In one sample K-S analysis when p > 0,05 is, we can say that the data has normal distribution (Field, 2009) The analyses included arithmetic means, total scores, standard deviations, frequency and percentages. *t*-test and ANCOVA analyses were utilized in comparisons.

Results of Research

Achievement scores of the experimental and control groups were taken into consideration to evaluate the effect of web-based software with multimedia assisted educational animation on learning. As an indicator of effectiveness, the study compared the achievement scores of the experimental and control groups to each other and within themselves to determine the effect of the software. The differences between pre-tests, post-test, and attitude scores of both groups were compared.

An independent samples *t*-test was undertaken to observe whether there were significant differences in attitude scores between the experimental and control groups prior to the study. The results are presented in Table 1.

Table 1. Relationship between groups' pre-test attitude scores.

	M	SD
Experimental	1.57	0.17
Control	1.56	0.16

The results show that there existed no significant differences in "attitudes towards science and technology" scores between the experimental and control groups prior to the study ($t(60) = 0.307$; $p > 0.05$). According to their pre-test attitude scores, the experimental and control groups were at the same level prior to the study.

An independent samples *t*-test was undertaken to observe whether there existed significant differences in academic achievement scores between the experimental and control groups prior to study. The results are presented in Table 2.

Table 2. Relationship between groups' pre-test academic achievement scores.

	M	SD
Experimental	15.29	3.10
Control	15.81	4.91

The results reveal that there existed no significant differences in academic achievement scores between the experimental and control groups prior to the study ($t(60) = 0.495$; $p > 0.05$). According to their pre-test academic achievement scores, the experimental and control groups were at the same level prior to study.

Having controlled both groups' pre-test academic achievement and attitude scores, a covariance analysis (ANCOVA) was implemented on the data to observe whether there were statistically significant differences in academic achievement scores between experimental and control groups after the study. Results are presented in Table 3.

Table 3. Results of ANCOVA analysis after controlling pre-test academic achievement and attitude scores*.

Group	M	SD	df	F
Experimental	28.333	0.609	1-58	29.581
Control	19.070	0.609		

* $R^2 = 0.528$

According to Table 3, the model used in ANCOVA analysis is meaningful (p = 0,000 for the model) and the implemented model can explain 53% of the variance in cognitive achievement in the topic of healthy nutrition (R^2 = 0.528). Examining Table 3 to observe whether post-test academic achievement scores of the groups statistically differed shows a significant difference between groups (mean difference = 4.763; $p < 0.05$). Variances of the post test scores of the groups were compared with the Levene test to decide which test to use in identifying the location of the difference and it was found that group variations were equal. (Levene statistics = 0.589 and $p = 0.446 > 0.05$). Since the variations of the groups' academic achievement post-test scores were equal in the study, independent samples *t*-test, a parametric analysis method, was used and the results are summarized in Table 4.

Table 4. Relationships between groups' post-test academic achievement scores.

	M	SD
Experimental	23.55	3.28
Control	19.35	5.05

Table 4 presents a significant difference in favor of experimental group between post-test academic achievement scores of experimental and control groups after the study (t(60) = 3.876; $p < 0.05$). The effect size of students' post-test academic achievement scores is calculated as Cohen's d. The effect size value $d = t\sqrt{\frac{N_1 + N_2}{N_1 N_2}}$ is calculated by given formula and the value is 0.98. The value displays that the effect size is large.

This result shows that implemented software had positive effects on student achievement. Independent samples t-test was implemented to observe whether there were significant differences between experimental and control groups according to arithmetic means of the attitude scores and the results are provided in Table 5.

Table 5. Relationships between groups' post-test attitude scores.

	M	SD
Experimental	1.65	0.16
Control	1.57	0.15

Table 5 presents a significant difference between post-test attitude scores of the experimental and control groups after the study, favoring the experimental group ($t(60) = 2.065$; $p < 0.05$). The effect size of students' post-test attitude scores Cohen's d is calculated as 0.52. According to this, it can be said, that the effect size of multimedia material on experimental group students' post-test scores is medium level. This result reveals that web-based software with multimedia assisted educational animation positively increased students' attitudes towards science and technology. A dependent samples *t*-test was implemented to observe whether there were significant differences in the experimental group's academic achievement scores prior to and after the study. The results are provided in Table 6.

Table 6. Comparison of the pre-test and post-test achievement scores of the experimental group.

	M	SD
Pre-test	15.29	3.10
Post-test	23.55	3.28

Table 6 reveals a significant difference between the experimental group's pre-test and post-test academic achievement scores, in favor of their post-test scores (t(30) = 12.853; $p < 0.05$). According to this, Cohen's d is calculated as 3.26. It can be said, that the effect size of pre-test scores of experimental group on post-test scores is large. This result suggests that the implemented software increased students' academic achievement. An independent samples *t*-test was implemented to observe whether there were significant differences among genders in the experimental and control groups' post-test academic achievement scores. The results are provided in Table 7.

Table 7. Relationships between Achievement and Gender.

	M	SD
Female	22.56	3.67
Male	19.57	5.72

Table 7 shows a significant difference between female students' academic achievement scores and male students' academic achievement scores, in favor of female students ($t(60) = 2.518$; $p < 0.05$). Cohen's d value is calculated as 0, 64. According to this, the effect size of gender on achievement is medium level. This finding may suggest that the software developed and implemented in the framework of the study did not have the same effect across genders.

The study also examined possible statistically significant differences between genders in the academic achievement scores of the experimental and control groups when pre-test achievement scores and attitude scores are controlled. A covariance analysis (ANCOVA) was implemented on the data for this purpose and the findings are presented in Table 8.

Table 8. Results of ANCOVA analysis when pre-test scores are controlled*.

Data Resource	MS	df	F	p
Model	751,193	5	13,789	0.000
Pre-Academic Achievement**	0,120	1	0,012	0.914
Attitude**	15,706	1	1,442	0.235
Gender	7,865	1	0,722	0.399
Group	309,381	1	28,395	0.000
Group*Gender	22,975	1	2,109	0.152
Error	610,162	56		
Total	29892	62		

** R2= 0,552 ** Controlled Variables*

According to Table 8, the model used in the ANCOVA analysis is meaningful (p = 0.000 for the model) and the implemented model can explain 55% of the variance in cognitive achievement in the topic of healthy nutrition ($R^2 = 0.552$). η^2 value is calculated as 0.74. According to this, when the pre-test scores are taken under control, the effect size of the gender and group on the academic achievement is large. Further, no significant differences exist between the combined effects of groups, gender, and implemented method, and post-test academic achievement scores (for combined effect of group and gender, $F = 2.109$; $p > 0.05$).

Discussion

The current study investigated the academic achievement and attitudes towards science classes of students, who were taught with web-based software featuring multimedia assisted educational animation in the "Foods and Healthy Nutrition" topic in Science and Technology class. Post-test academic achievement scores of students, who were taught with web-based software with multimedia assisted educational animation, were found to be higher than those of control group students and the difference was observed to be statistically significant [($t(60) = 3.876$; $p = 0.000$)]. This finding is supported by various studies in the literature. For instance, Sun, Lin & Yu (2008) identified in their research that web-based virtual laboratory applications increased student academic achievement more than traditional methods. Similarly, a study conducted by Hwang, Wu & Ke (2011) found that web-based teaching methods enriched by concept maps positively affected student achievement and attitudes towards science. There are additional studies which reveal similar conclusions (Traynor, 2003; Ardaç & Akaygün, 2004; Çepni, Taş & Köse, 2006; Liao, 2007; Hwang & Chang, 2011). The results of the current study illustrate that multimedia applications used in the topic of healthy nutrition help raise students' awareness of obesity, a common problem today.

This situation was identified during the development of the academic achievement test with the help of

inquiry questions to detect whether students had acquired awareness of healthy nutrition. For instance, the test included the following question: "When Faruk fell, his wounds healed late. A lack of which nutrients in his body may have caused this situation?". This question was answered correctly by 28 students in the experimental group whereas only 21 students in the control group answered the question correctly. Similarly, the question "What should we not do in order to have balanced and healthy nutrition?" was answered correctly by 26 students in the experimental group, whereas only 15 students in the control group answered the question correctly. Therefore, it can be argued that use of multimedia applications had a positive effect in raising student awareness of healthy and balanced nutrition. Indeed, Wang's (2004) study emphasized that multimedia software are effective in raising students' content awareness of the related subject.

The effect of multimedia applications on student achievement is due to the applications' innately interactive learning environments. With both visual and auditory presentation, multimedia applications can simultaneously address students with different learning styles. In today's information age, students can connect with the internet beginning at an early age. Presenting science lessons in web environments in attractive formats suitable to their cognitive developments will bring growth in academic achievement and positive attitudes towards the subject matter. In their study, Dunsworth & Atkinson (2007) determined that multimedia learning environments used in science education positively contributed to learning via their visual content and animated educational agents.

Another reason that multimedia applications positively affect student achievement may be because they create correct mental models or images in learning complex and abstract science concepts. Although individuals express concepts in statements in the form of hypotheses, they actually think with mental models. Therefore, whether we understand a concept or not is simply related to the formation of the correct mental model. Multimedia applications contribute to the generation of correct mental models by students.

The study investigated the relationship between students' post-test academic achievement scores and genders and a significant difference was detected in favor of the female students ($t(60) = 2.518$; $p = 0.014$). This finding suggested that gender and group common effect should also be examined when pre-test achievement and attitude scores were controlled. The resulting ANCOVA analysis showed no significant differences in this regard ($F = 2.109$; $p = 0.152$). Therefore, it was concluded that the implemented software had the same effect rate on male and female students.

The study shows that there existed significant differences between experimental and control group students in attitudes towards science and technology ($t(58) = 2.065$; $p = 0.043$). Accordingly, web-based software with multimedia assisted educational animation implemented on the experimental group was found to positively affect not only student achievement, but also their attitudes towards science. Similar studies in literature show that multimedia software affects the development of student attitudes towards science (Su, 2008; Hwang, Wu & Ke, 2011). It is believed, that the effect of multimedia applications, used in the current study on attitudes towards science, resulted from the use of animations that were attractive and age appropriate. The educational agents, visuals and dubbing used in the software were designed in a way to attract student interest and students were highly interested in the software. Student views related to the educational agents, visuals, and dubbing used in the software were not obtained, however it was identified via informal observations that students liked the content.

In line with the findings from this research, it is important to be careful while designing learning activities to develop students' attitudes as well as students' learning scientific concepts. Especially considering the age group of students, this type of learning environment will be a guide for new multimedia creations and other experimental methods. This finding is thought to make an important contribution to the literature.

The results of the study have displayed, that following to the application, there is a significant increase of students in experimental group achievement and attitude scores in favor of the post test. Since attitudes are related to our feelings, when a joyful learning environment is presented to students, it can be said that students' positive attitudes are developed and their achievement is increased. It is known, that many factors are affecting the success (Germann , 1988; Simpson & Oliver , 1990; Singh , Granville, & Dika , 2002) . One of these is attitudes (Germann, 1988). In line with the findings from this research, while designing science classes, the teachers should be careful in designing activities for developing positive attitudes as well as developing effective concept teaching activities.

Especially, considering the age group of students, this type of learning environment will be made thereafter multimedia creation and other experimental methods should be considered in the design. This finding is thought to make an important contribution to the literature.

In the light of the findings, obtained from the current study, it was examined to see whether the use of web-based software with multimedia assisted educational animation or the use of activities based on text books, was

more effective in developing mental models. The result shows that web-based software with multimedia assisted educational animation was more effective in the development of mental models. The effect of web-based software with multimedia assisted educational animation on student achievement can be observed via the students' more active participation in the web-based learning process. Students in the experimental group learned in the computer laboratory and each one of them directly participated in the learning process. Direct and active participation may have resulted from the fact, that web-based software with multimedia assisted educational animation, was appropriate to students' mental development levels, suitable to their interests and social experiences, and was inherently motivational. As an implication of 5th graders' ages, they were more attuned to animation-based computer games and the TV programs they watched, which helped them to better understand the web-based software with multimedia assisted educational animation. The fact that the implemented program included animations may have contributed to the increase in positive attitudes towards science. Visual content and educational agent animations in the software increased learning.

The results of the study imply that web-based software with multimedia assisted educational animation, is more suitable to the mental processes of 5th grade students and is therefore more suitable to learning strategies, and makes lessons more interesting, fun and pleasant. Especially in recent years, web-based teaching materials have become important components of learning. The use of distance education applications in learning environments has increased the importance of web-based educational software to a greater extent (Tekerek, Ercan & Tekerek, 2011; Tekerek & Ercan, 2012). Therefore, the study encourages the development of multimedia based educational materials for different science units in 5th grade and other grade levels to contribute to the learning and teaching processes. These materials can also be developed and implemented for different lessons at different grade levels. It is crucial to replicate the current study with different samples to evaluate the generalized effects of these materials.

Conclusions

In recent age, students are fond of using technology. They use them so willingly and have more positive attitudes towards technology compared to the previous generation before them. Therefore, web based materials can be used in learning environments for an effective learning. Students' positive attitudes towards learning material effect their attitudes towards science and the learning subject positively. For this reason, using instructional materials preferred by students is inevitable.

In the traditional approach, students sit passively and wait for the information. And this situation generally decreases students' motivation. They get bored easily. Therefore, teachers should find alternative teaching methods for learning. At this point, technology based instructional materials are very effective. Web based instructional materials address students' different senses. When teachers provide students' learning environments enriched by different senses, students learn more easily and effectively. Instructional materials can address students with different characteristics and give them opportunity to learn in their own learning way and speed. The subject of healthy nutrition is very important for children. When they learn this subject in early ages, they will be healthy adults in future.

In the content of the study, a multimedia software related to the subject of "Food and healthy nutrition" has been developed and applied to the students. Due to the rapid advancement of computer technology and students' positive attitudes towards computer technologies, many instructional multimedia tools, related to the subjects which are difficult to be understood by students and their applications can be found in litrature. In this study, the subject may seem to be easy to learn by students, but according to the WHO data, obesity is one of the most serious health problems we struggle with. Therefore, the importance of struggling with obesity and healthy nutrition subjects have been selected. The most important aspects of this study, apart from other studies, is teaching a subject from the core of the life to the students by using a technology which students are fond of, instead of teaching a difficult subject more easily. In this sense, the increase of students' academic achievement in experimental group and statistically significant increase in attitude scores display, that the student reaches its' goal and develops awareness related to the subject. With this aspect of the research, the research is thought to be original and contributes to the literature in this regard.

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APPENDIX

Examples of the test questions are given below.

Zeynep's mum says that she should always eat natural foods. According to this, which of the foods given below should not eat Zeynep?

A) Chocolate
B) Orange
C) Egg
D) Milk

" meat –milk –egg –fish – sunflower"
When we group the foods given above according to their origins, which of them does stay out of the group?

A) Meat
B) Egg
C) Milk
D) Sunflower

What should we think about "balanced diet"?

A) Eating mostly vegetables and fruits
B) Eating each group of nutrition in sufficient amounts
C) Eating food with rich vitamin
D) Eating meat, milk and egg so often

What should we do for dental health?

A) Do not eat large amounts of sugary foods
B) Do not eat sugary foods before meals.
C) Should eat milk-yoghurt-cheese in sufficient amounts
D) Should brush our teeth per a week

Which of the foods given below do cause obesity when it eaten in large amounts?

A) Carbohydrate
B) Protein
C) Vitamin
D) Mineral

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