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The Effects of Usage of Educational Interface Agent in Virtual Science and Technology Museums on The Interests and Successes of The Students

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Abstract

The aim of this research was to investigate the effects of the usage of educational interface agent in virtual science and technology museum on students successes and interests towards Science. Quasi-experimental research design with pretest-posttest control group was applied.The sample of the research consists of 67 6th grade students from Kırşehir Prof. Dr. Erol Güngör Elementary School in 2010-2011 spring semester. The students were randomly assigned to two different web based MTA Virtual Science and Technology Museum learning environments, one of which provided educational interface agent and the other did not. It took five weeks for the experimental process. According to the covariance analysis (ANCOVA) results, usage of educational interface agent in MTA Virtual Science and Technology Museum made a significant difference between the success scores of students. Students who studied with the virtual museum which provided educational interface agent were successful than the others [$F(1\text{-}64)=4.429$, $p<.05$]. On the other hand students' interests towards science did not significantly change due to the presence or non presence of educational interface agent in the virtual museum environment [$F(1\text{-}64)=0.149$, $p>.05$].

Keywords: Virtual Museum, Virtual Science and Technology Museum, Educational Interface Agent, Web Based Learning, Educational Animation, Science Instruction

Introduction

In its contemporary meaning while museums save and maintain cultural and art works; museums also make the assets they have known from the aspects of their functionality and artistry by means of some exhibitions and different activities. International Council of Museum (ICOM) (2007) defines the museums as a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment. As it is underlined by The International Council of Museum's definition one of the main aims probably the most important aim of the museums are education. Museums have the objective of education since they have been established. However education has become the main function of the museums since mid-twentieth century and it has been considered as the most important task of the museums to make their collections accessible by their audience with the sake of education. In this there had developed a new field in museology called "museum education" (Akahmet & Ödekan, 2006).

Today, there are plenty of aiming the usage of the museums to make the education more effective. In these studies the importance of the life in general and living meaningful life in particular is emphasized and it is underlined that the museums provide this opportunity. Moreover it is also emphasized that the effective usage of the museums in the teaching-learning process can be the most effective constituent in achieving meaningful learnings in all subject areas (Oruç & Altın, 2008). Museum specialists emphasize educational function of the museums and they state the most important function as education (Ginsburg & Marisse, 1997). Likewise it is underlined that the field studies in the natural science education must increase and the formal learnings must be reinforced with some external factors (museum, science centers etc.) (Meriç & Tezcan, 2005; Davies, 1997; Ozfidan, & Mitchell, 2020). Hannu (1993) also underlined that the science and technology museums can support the school education and he stated that these museums increased the interests of the students towards the natural sciences and affected their inner motivations positively and helped them to develop positive attitudes towards natural sciences.

Senemoğlu (2005) stated that various emotions and behavior tendencies such as interest, attitude, self-confidence and loving something are human characteristics belong to affective domain. On the other hand Öner (2008) underlined that in order for a learning to occur the individual must be ready for learning physically, mentally, emotionally and socially and for an

individual to be ready for learning, it is not enough to be mature enough but it includes him/her to be enthusiastic and desirous to learn the topic. Moreover he emphasized that the source of the inner motivation can be the individual's learning need, concern interest feeling about the topic to be learned (Konan, Demir & Karakuş, 2015). Krapp (2007) defines the interest as a motivational variant indigenous to the content that has an important affect on learning and individual development. Moreover it is also stated that establishing and maintaining the educational interest may increase the students' motivation towards the content of the lecture (Krapp, 2005). Interest is defined as a special type of relationship between the individual and the object. Unlike the other motivational concepts, interest is special to the content and object. The studies state that with an increase in the interest for a topic it accompanies with the concentration on the attentiveness on that topic and qualitative effort for learning that topic (Krapp, 2005; Terzi, 2008).

Literature Review

Museums and Internet

The importance of the museums in giving achievements to the students in affective and cognitive fields has been emphasized increasingly. By having such a great place in education and teaching it is unthinkable that museums are affected by todays developments in the communication and information technologies. According to Resnick (2002) technologies will become widespread in the forthcoming years and these technologies will bring a fundamental change about what and how people learn.

The effects of the developments in information and communication technologies on the museums were seen first at The International Conferences On Hypermedia And Interactivity In Museums – ICHIM made in 1991 by beginning the interest about the usage of hypermedia and interactivity applications in museums. Then the first step after that for most of the museums is to be on the internet and to make their collections accessible by the web. By the time of progress more and more museums showed interest to use internet and to share their experiences on the web. This situation was seen at The Annual Conference of Museums and the Web started to be held in 1997 (Schweibenz, 1998). There has been great increase in the usage of digital technologies museums, science centers and exhibitions. It is also stated that more attractive web sites can be constructed by the usage of digital interactive technologies (Hawkey, 2004 Mioduser & Nachmias, 2002).

Loran (2005) stated that making the collections of the museums more achievable and expanding the information to wider audience are the most important ideas to be used for museums. Donovan (1997) emphasized that internet has a powerful effect to be used by museums and museum specialists for reaching museums to large masses and enabling museums to achieve their educational tasks. Baillargeon (2008) emphasized the change in the way that museums use to reach great masses after he states the unchanging nature of the tasks of the museums. Moreover, it is stated that the increased usage of internet and interactive communication instruments contributed museums to develop means to share the information with the public. Also Chadwick (1998) underlined that peoples spare time activities and ways to reach information have changed with the internet and he indicated that museum specialists have to know why people enter the physical doors of the museums and what kind of learning needs the visitors try to satisfy by entering the physical doors of the museums.

Virtual Museums

Along with the information and communication technologies in other words the internet becoming widespread a new type of museum emerged. This museum is called as virtual museum. In 90's as internet became widespread museums institutional presentation pages and lecture tools and materials started to be used in virtual environment but till 2000's virtual environments haven't been efficient too much (Tepecik, 2007).

McKenzie (1995) defines virtual museums as an electronic collection of all hand made things and information resources. At the same time virtual museums constructed as an electronically accessible collection of the digitally recorded videos, voice files, text documents and other data that can arise historically, scientifically or culturally interest (Britannica, 2010). On the other hand, according to Tepecik (2007)in order for a museum to be contextualized as a virtual museum all of the pieces of it must be presented to internet environment, special links have to be generated for visitors and service pages must be opened for teachers, students and particular field specialists. A more flexible definition for virtual museums is that virtual museum can be composed of digital collection presentations produced by means of web, local web or personal computers (Styliani, Fotis, Kostas & Petros, 2009; Ozfidan, Savas, & Demir, 2019).

Construction of the virtual museums brought important innovations to our life, to museums and to the field of education. Saraç (2007) states this fact as;

> It can be thought that virtual world as a part of the museums can make a contribution to primary tasks of the museums and especially to the education responsibility. The museums to be constructed in this context can have a strong place in the information age society by being in a continuous interaction with other museums and schools that they are going to cooperate with. In a similar way that by the time 80's school-museum cooperation contributed to both parties, it is quite possible that museum – virtual museum – school cooperation may contribute to all the parties in the future.

The opportunity of virtual museums to reach a wider and global audience that has different economic and cultural background without having to adhere to the location and boundaries is one of the most important features of the museums. In this context virtual museums are not only on the service for the people living in that region or for the people have the opportunity to visit that region but they must be considered as social projects those can be reached priceless from everywhere with internet connection and those provide cultural equality of opportunity (Glosset, 2007)

Educational Interface Agents

Along with the increase in the number of computer and web-based learning environments new ideas started to be presented about how these environments must be designed. This is because that when students established a significant dialogue with the software it is stated that their learning will be affected positively from this (Hietela&Niemirepo, 1998). It is emphasized that one of the computer software to be used to establish an interaction with the student and for a web-based learning environment to present the characteristics of a social learning environment can be The Pedagogical Interface Agents (Maes, 1994).

Atkinson, Mayer and Merrill (2005) defined the pedagogical interface agent as a human like computer character that provide teaching by using verbal and nonverbal communication types. Dehn and van Mulken (2000) used the concept of pedagogical agent with animation instead of the pedagogical interface agent. Pedagogical agents with animation are described as the characters those have physical appearance and those seem as if they are alive, those can talk, those have mimics, and their body parts can move. Johnson, Rickel and Lester (2000) described the pedagogical interface agents as the characters those seem like as if they are alive and make the learning easy in computer-based learning environments. Chou, Chan and Lin (2003) defined the concept of agent as the characters those are generated by computers and have emotions and other human-specific characteristic features. They stated that these

characteristics of agents can be presented via text, graphic, animation, multimedia or virtual reality. On the other hand Kızılkaya and Aşkar (2006) defined it as a computer emulated character providing information about topic field, guiding students in the course of learning experience, that can provide feedback when it is needed, having human like characteristics (gesticulate, face mimics, sensation, talent etc.) in order to generate a social learning environment and interacting with the learner by using any communication channel (voice, image, text).

Contributions and advantages of usage of pedagogical interface agents in e-learning environments to these environments has been emphasized by various researchers. Baylor, Ryu and Shen (2003)stated that these agents can make the interaction easier between the computer and the learner. According to the recent researches it is stated that lifelike pedagogical educational interface agents have a positive effect on the attitudes of the students about their learning and the performance they are going to show (Baylor, 2002a, 2002b; Baylor&Ryu, 2003). Moreover it is underlined that by establishing an interaction between the student and the computer resembling the interaction between the humans, pedagogical interface agents are used for students to make them accept the computer as a friend (Atkinson, Mayer and Merrill, 2005). In different studies the positive effects of usage of pedagogical interface agents on the results of learning is seen. In a study by Moreno, Mayer and Lester (2000) it is seen that the usage of pedagogical interface agents in web based learning environments increased deep learning and has positive effect on the motivations of the students about natural sciences. Holmes (2007) underlined the significant positive effects of usage of pedagogical agent on the learning. In a study done by Kim, Baylor and Shen (2007) it is found that agents with positive face expression have a more positive effect on the learning than the agents with negative face expression.

As a result in every level and field of the learning the museums teaching potential must be used efficiently. Researches showed that museum education affected the success and interest of the students about the lecture positively (Bozdoğan, 2007). However, at the present time the possibilities of the students and education institutions to utilize the teaching potential of the museums are very limited. Some of the reasons preventing the visits to utilize education possibilities of the museums are shown as non-availability of the related museum of the lecture studied in near abroad, parents' can't take students to the museums because of the financial limitations, teachers' obligation to receive permission from some authorities to arrange museum visits and this permission taking process' necessitating long time nature (Baykan, 2007; Ilhan, Ozfidan, & Yilmaz, 2019). Nowadays along with the development in the information and

communication technologies and internet infrastructure's becoming widespread museums started to present their presentations to the virtual environments. Today there can be seen various samples of such virtual museums. There were studies done about the educational effectiveness of the museums in different fields and the positive effects of these museums on the successes and interests of the students about the lecture in various fields. Nowadays there is a pursuit for e-learning environments to achieve more effective learning outputs. For this reason it is stated that in e-learning environments the usage of pedagogical interface agents can be a right choice (King, 2002). In this context it is important for science and technology education to research the effects of the usage of pedagogical interface agents in virtual science and technology museums on the students.

Aim of The Research

The general aim of this research is to find the effects of virtual science and technology museum's learning environment with and without pedagogical interface agent aid to the successes and interests of the students about natural science by using Mineral Research and Exploration Institute's Energy Park Virtual Science and Technology Museum and Battery Friend Pedagogical Interface Agent.

Within the framework of this general aim the answer to the following research question will be searched:

1. Is there a significant difference between the corrected last test success grades of
2. Is there a significant difference between the corrected last test interest points of

The students utilized The Mineral Research and Exploration Institute's Energy Park Virtual Science and Technology Museum constructed with and without the support of pedagogical interface agent?

Method

In this part there are some information are provided about the method of the research, study group, The MRE virtual science and technology museum's learning environment with and without the support of the pedagogical interface agent that is used in the research, data collection tools and data analysis. This research is a qualitative study aimed to define the opinions and considerations of the study group of this research 6'th year students of the primary school- about the virtual museum and pedagogical interface agent.

Study Group

The research was done with 25 each students from the classes 6A and B, 24 students from the class 6C and 23 students from the class 6E of Prof.Dr.Erol Güngör Primary School's city center, Kırşehir, Turkey, 2010-2011 school years' spring semester. Experiment and control groups are constituted by unbiased assigning. The students of the students of the classes 6A and 6E constituted the experiment group and the students of the classes 6B and 6C constituted the control group with unbiased assigning.3 of the 48 students of the experiment group were excluded from the study because they didn't attend the experiment and 4 of the students were excluded from the study because they didn't attend the last test and the experiment group is taken as a group of 41 students. In the same way the control group was consist of 49 students and 9 of them were excluded from the study because they didn't attend the study and 14 other students of control group were excluded from the study because they didn't attend the last test. As a result when we exclude the students those didn't attend the study and didn't attend the last test the experiment group is composed of 41 and the control group is composed of 26 students. The range of the students according to the gender and experiment – control groups are shown at the Table 1.

Table 1. *The Range of The Students In The Experiment and Control Groups According to The Gender.*

Group		Gender		Total	
		f	%	f	%
Experiment Group	Male	25	60,98	41	61.19
	Female	16	39,02		
Control Group	Male	16	61,54	26	38.81
	Female	10	38,46		
Total	Male	41	61,19	67	100.0
	Female.	26	38,81		

Learning Material

The content was constituted first while The MRE Energy Park Virtual Museum learning material was being developed. The virtual museum environment was designed after the content was constituted and required corrections were made. MRE Energy Park Museum's physical structure was held up as an example in the design. There is one main gallery and there are six sub-galleries in the virtual museum. Students can move on the x-axis direction at main gallery of the virtual museum. However when we come to the sub galleries on which the content is going to be presented the transition is provided via the links at the main gallery. The direction on which the agent moves and the places of the sub-galleries are shown at Figure 1.

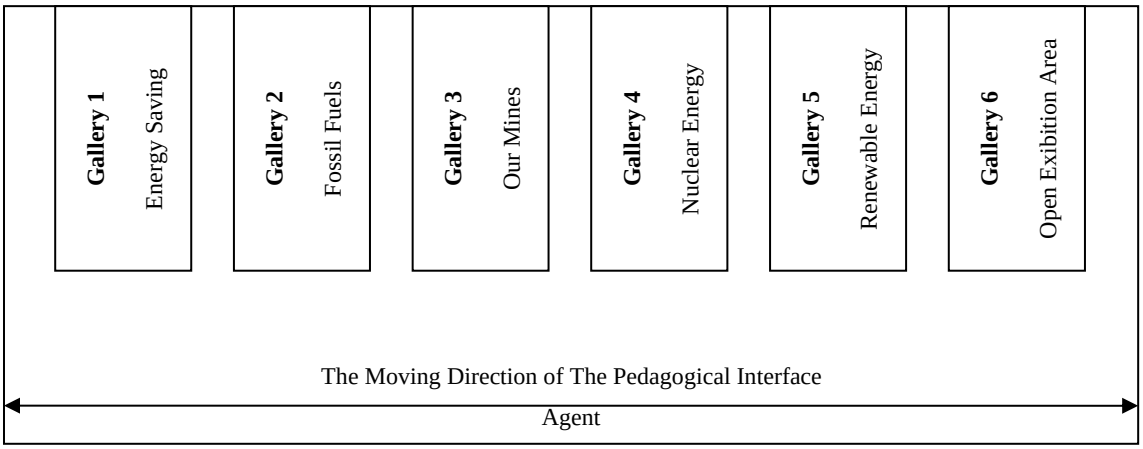

Figure 1. *The General Structure of the MRE Energy Park Virtual Science and Technology Museum*

In the main gallery design it is decided to make the movements of pedagogical interface agent on the x-axis by the direction keys of the keypad. Moreover as it is seen on the Figure 2 the main gallery is designed to give the sense of 3d to the students as far as it is possible and the care is taken to the graphics that are used to be interesting. The sub-gallery entrances are indicated by the texts and the interesting graphics representing the content of the gallery.

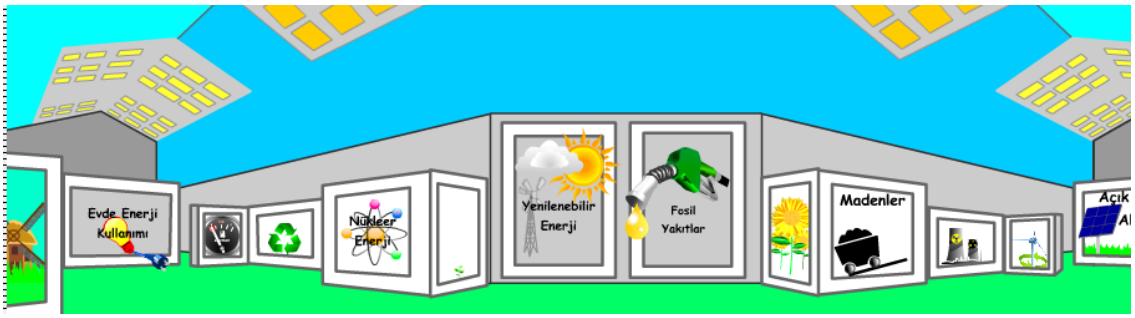

Figure 2. *The Main Gallery of the MRE Energy Park Virtual Museum*

In the main and sub-galleries of the virtual museum environment with the support of pedagogical interface agent (Figure 3) the students are given informing, guidance and feedback by means of pedagogical interface agent.

Figure 3. *Main Gallery of the Pedagogical Interface Agent Supported Museum*

Informing, guidance and feedbacks are turned over via information boxes within the environment in the virtual museum environment without the pedagogical interface agent support (Figure 4).

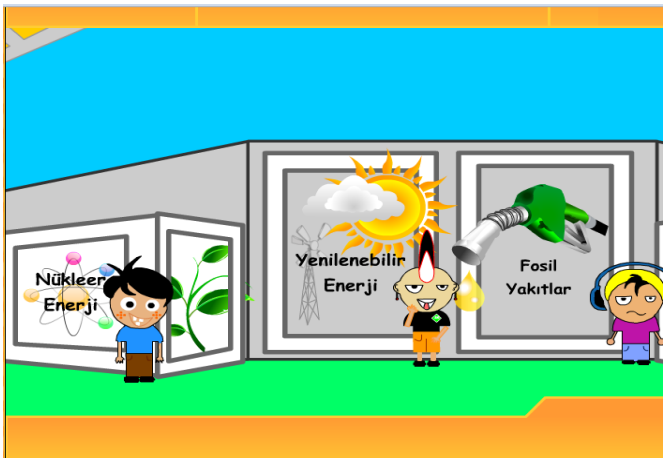

Figure 4. *The Main Gallery of the Museum Without Support of the Pedagogical Interface Agent*

Data Collection Tool

In this research in order to evaluate experiment group students' successes and interests about the science lectures those used the pedagogical interface agent in the virtual science and technolgy museum The Success Test and Interest Scale developed by Bozdoğan (2007) is used.

Success Test: The Success Test consists of 20 articles covering the galleries of The MRE Energy Park Science and Technology Museum. According to the results of the validity and reliability analyses, pre-test and post-test articles' average discrimination power (Dort) are 0.524 and 0.551 respectively and difficulty levels are (Port) 0.492 and 0.523 respectively. KR-20 reliability co-efficients are 0.778 and 0.797 respectively.

Interest Scale: The interest scale consists of 22 articles covering the galleries in the Energy Park and testing apparatus. The scale is decided to use in this research because it includes expressions to define the students' interest levels about the science lectures. It is decided to take the scale under two dimensions resulting from the factor analyses implemented under the validity and reliability analyses results to use the interest scale in the study. These dimensions are "The Energy Types and Energy Production Processes" and "Energy Sources and The Effects of The Energy Sources to The Environment". The Cronbach alpha validity co-efficients of "The Energy Types and Energy Production Processes" consisting 12 articles and "Energy Sources and The Effects of The Energy Sources to The Environment" consisting of 10 articles are respectively 0.868 and 0.882. According to the results the interest scale is decided to be used in this study.

Data Analyses

Single factor co-variance analyses method is used to define the pedagogical interface agent supported virtual science and technology museums and the virtual science and technology museums those don't include pedagogical interface agent to the successes of the students and their interest points about the science lectures.

Results

The Results about the Successes of Experiment and Control Group Students

Single factor co-variance analyses (ANCOVA) is used in order to analyze the change before and after the experimental activity in the success points of the experiment group students those used the "MRE Energy Park Virtual Science and Technology Museum" with pedagogical interface agent support and of the control group students those used the "MRE Energy Park Virtual Science and Technology Museum" without pedagogical interface agent support.

In Table 2 final test grades those are corrected according to the pre-test grades of the experiment and control group students are shown.

Table 2. *Corrected Final Test Success Grade Averages of the Experiment and Control Groups*

Learning Environment	N	$\bar{x}$	$\bar{x}$ (Corrected)
The Virtual Museum Environmet used with the Support of Pedagogical Interface Agent	41	13.17	12.99
The Virtual Museum Environmet used without the Support of Pedagogical Interface Agent	26	11.00	11.29

According to Table1 when we analyze the average final test grades after the experimental activity it is found that the average grades ($\bar{x}$=13.17) of the students those utilized the pedagogical interface agent supported virtual museum environment are higher than the average grades ($\bar{x}$=11.00) of the students those utilized the virtual museum without pedagogical interface agent support. When we analyze the final test average corrected success grades the final test success grade average of the experiment group is 12.99 on the other hand the control group's final test average success grade is 11.29. According to the corrected final test average grades there is seen a difference in favor of the experiment group.

In Table 3 the ANCOVA test results regarding whether the difference observed between the final test average success grades of the experiment and control groups is significant or not is shown.

Table 3. *The ANCOVA results of the Experiment and Control Groups' Corrected Final Test Average Grades according to the Pre-Test Grades*

Variance Resource	KT	Sd	KO	F	p
Pre-Test	35.704	1	35.704	3.783	.056
Group	41.807	1	41.807	4.429	.039
Deviation	604.101	64	9.439		
Total	714.776	66			

When the Ancova results in Table 2 are analyzed there is found a significant difference in favor of experiment group students between the final test corrected average grades of the experiment and control group students [$F_{(1-64)}$=4.429, p<.05].

According to this significant difference it can be said that the students of experiment group whose final test averages are 12.99 are more successful than the students of control group whose average final test grades are 11.29. Thus it can be said that the pedagogical interface agent utilization in virtual museum environment contributes the successes of the students significantly. This result is consistent with field literature.

In the Sel's study (2009) with primary school second level students the effects of the utilization of pedagogical interface agent on the successes of students in competitive and cooperative environments. In this study there are four different groups generated in which the pedagogical interface agent play the role of the competitor and there is one group formed in that pedagogical interface agent played the role of the partner. The group that used the partner software is more significantly successful in the student success than the other three competitive

software (the groups in which those competed with successful/unsuccessful competitor and the audience supported the opponent).

In the study made by Kızılkaya (2005) the effects of pedagogical interface agents and these agents' containing and not containing motivation support effects on the success according to the gender. As a result of the study it is found that the environment containing pedagogical interface agent has a positive effect on students' successes.

In a study of Esgin (2010) it is researched that whether the usage of picture and communication properties of pedagogical interface agents have any significant effect on the academic success of the students, on the emotional attitude toward the virtual pedagogical agent and on the technical usefulness of the virtual pedagogical agent. The function of the PIA in the software prepared by the researcher is defined as to guide users, to provide feedback and give motivation messages. As a result of the study it is found that PIA's interactions in pedagogical multimedia software as being a cartoon or pictures of human no-human does not make difference on the academic success of the students however, in general the usage of pedagogical interface agent is found to increase the success of the students.

In the study by Moreno, Mayer and Lester (2000) it was aimed to define the effects of usage of pedagogical interface agents in pedagogical software on the learning results. In the study performed in Natural Science lecture the success grades of the experiment group students those studied in the environment with pedagogical interface agent are found to be higher than the students of the control group those studied in the environment that does not contain pedagogical interface agent.

The Results about the Interests of the Experiment and Control Group Students about the Natural Science Lectures

The results about whether there is a significant difference between the interests of the experiment group students those utilized the virtual museum with pedagogical interface agent support and of the control group students those utilized the virtual science and technology museum without pedagogical interface agent towards the natural science lectures are given below according to the scale's sub-factors.

The Results about the Energy Sources and the Effects of These Energy Sources to the Environment

The covariance analyses (ANCOVA) is used to analyze whether there is a significant difference between the final test grades when the pretest points of interest scales of the students from experiment and control groups about "Energy Sources and Effects of these Energy Sources to the Environment" sub-factor.

The average corrected final test points of students from experiment and control groups about the first sub-factor are given in Table 4.

Table 4. *The Average Corrected Final Interest Points of Students of Experiment and Control Groups about the Sub-Factor of Energy Resources and These Resources' Effects to the Environment*

Groups	N	$\bar{x}$	$\bar{x}$ (corrected)
The virtual museum environment with pedagogical interface agent	41	37.88	38.23
The virtual museum environment without pedagogical interface agent.	26	34.27	33.72

According to Table 3 if we analyze the final test grade averages of the participants' those utilize the each museum environment it is found that the final test grade averages ($\bar{x}$=37.88), of the students those utilized the virtual museum environment with learning friend pedagogical interface agent are higher than the final test average grades ($\bar{x}$=34.27) of the students those utilized the virtual museum environment without learning friend pedagogical interface agent.

However, when the pretest interest points of the experiment and control group students are analyzed it is seen that there are some changes in the final test interest grades. When we analyze the final test corrected average grades, the final test average grades of the experiment group students increased to 38,23 on the other hand the corrected final test average grades of the control group students decreased to 33,72. By considering these grades it can be said that there is a difference in favor of the experiment group.

The ANCOVA results about the significance of observed difference between the experiment and control group students' final tests are shown in Table 5.

Table 5. *The First Interest Scale Sub-factor's Final Test Average ANCOVA Results Corrected According to the Pre-test Results of Experiment and Control Groups*

Source of Variance	**KT**	**Sd**	**KO**	**F**	**p**
Pre-test	540.488	1	540.488	9.246	0.003

Group	315.031	1	315.031	5.389	0.023
Deviation	3741.017	64	58.453		
Total	4488.716	66			

When the results of ANCOVA shown on Table 4 analyzed, considering the results of corrected final test first sub-factor average grades of students of experiment and control groups a significant difference in favor of experiment group is found [F(1-64)=5.39,p<.05]. According to this result it can be said that the pedagogical interface agent supported virtual science and technology museums are more affective on the interest grades of the students.

In the study of Stinson (2001) the effects of real visit to Bayou Bend Collection and virtual museum visit to Bayou Bend Collection on successes of the fifth year students in social sciences lectures are analyzed. The researched carried out with 211 students from two different schools in the years 2000 and 2001. The results of the research showed that virtual museum visits can be used as an alternative to the real museum visits.

In the study of Sanghoon (2005) usage of seductive details/seductive augmentations those used for increasing the interests of the students to learning material and learning content with pedagogical interface agents effects' on the interests of the students about the learning contents are analyzed. According to the results of the study carried out with 127 students of computer literacy lecture in the state university it is seen that the environment supported with seductive details and pedagogical interface agent increased the interests of the students to the lecture.

In the study of Kim and Baylor (2007) software of problem solving and exercise called MathGirl developed by Kim for the math lectures was used. Many girls have prejudices that they won't be successful in the fields of natural sciences, technology, engineering and mathematics that can be arose from their families, friends, perimeters or even their teachers. As a result of these prejudices they less interested to the lectures of natural sciences, technology, engineering and mathematics. In the study the increase in the motivations and interests of the students those studied in the MathGirl environment about mathematics and engineering is observed.

In the study of Baylor (2002) with 135 students in Southeastern University within The Introduction to Education Technologies Lecture the students are asked to prepare an instructional plan. In the study an education software called MIMIC (Multiple Intelligent Mentors Instructing Collaboratively) and two other pedagogical interface agent developed according to different learning approaches. While the first agent "Peddy" was prepared with a

conventional educational approach namely an instructive and prescriptive approach, the second agent "Merlin" was prepared with a structuring approach. Four different learning environments were prepared. The first environment contained only "Peddy", the second environment contained "Merlin", the third environment contained both "Peddy" and "Merlin" and finally the fourth environment did not involve any agent. In this study the performances of the students and the difference in the perspectives of the students about the education design were tried to be analyzed. In the study results it is observed that "Merlin" guiding with a structuring approach significantly changed the perspectives of the students about education design.

In a study done by Rosenberg, Baylor, Plant and Doerr (2008) the effects of the pedagogical interface agents those have a humanlike appearance on the negative opinions and low self-sufficiencies of the young girls about the engineering fields are analyzed. The results of the study showed that the agent's being on the screen visually constituted a significant difference on the young girls' opinions, self-sufficiencies and interests about engineering fields.

The Results about the Sub-Factor Energy Types and Energy Production Processes

After the checks of pre-test grades of the interest scales of the students of experiment and control groups regarding "The Energy Types and The Effects of the Energy Types to the Nature Sub-Factor", in order to analyze whether there is a significant difference between the results of the final test covariance (ANCOVA) analyses is utilized.

The corrected final test average grades of experiment and control group students about the second sub-factor are given at the Table 6.

Table 6. *The Corrected Final Test Average Interest Grades of Experiment and Control Group Students about the sub-factor of Energy Types and Energy Production Processes*

Groups	N	Average ($\bar{x}$)	$\bar{x}$ (Corrected)
The virtual museum environment with Pedagogical interface agent	41	45.46	45.34
The virtual museum environment without pedagogical interface agent.	26	49.04	49.23

According to Table 6 when we analyze the final test average grades of the participants those used one of both museum environments it is found that final test average grades of the students those utilized virtual museum environment with pedagogical interface agent ($\bar{x}$=45.46)are higher than the participants' those utilized the virtual museum environment without learning friend pedagogical interface agent ($\bar{x}$=49.04). According to the results of final test corrected average grade analyses while the average of the experiment group is 45.34, the

average of the control group is 49.23. According to the corrected final test average grades it can be said that there is a significant difference in favor of the students of control group.

ANCOVA results about whether the difference seen between the corrected average final test grades of the students of experiment and control groups are significant or not are shown at Table 7.

Table 7. *The Ancova results about Final Test Average Grades Corrected According to Pre-test Grades of Second Sub-factor of Interest Scale of Experiment and Control Groups.*

Variance Resource	KT	Sd	KO	F	p
Pre-Test	2403.802	1	2403.802	35.783	.000
Group	240.343	1	240.343	3.578	.063
Deviance	4299.354	64	67.177		
Total	6906.507	66			

According to the ANCOVA results given in Table 6 there isn't a significant difference [$F_{(1-64)}$=3.578, p>.05] between the final test grades corrected according to the pre-test grades of the students of experiment and control groups. Considering this result it can be said that utilization of pedagogical interface agent in virtual museum doesn't make a significant difference on the interests of the students about the topic of "Energy Resources and The Effects of the Energy Resources on the Nature".

In a study by Yılmaz (2010) three different learning environments containing pedagogical interface agents are developed. These environments are one with a pedagogical interface agent resembling real human in looks, one with a drawing pedagogical interface agent and one with a pedagogical interface agent isn't seen on screen but can only be heard. Within these environments it is seen that the environment with real human like looking and the environment with only the voice have positive effects on behavior and the environment containing drawing pedagogical interface agent hasn't any positive effect on the behavior.

In an experimental study implemented with 135 students with an education system called as MIMIC by Baylor (2002) two different agents are used. One is an agent that is instructive and ditactic called as Peddy and the other agent called as Merlin guided students with a configurative approach. The results of the study showed that the agent Peddy with instructive and ditactic character effected the behaviors of the students about the education design negatively.

The Results about Total Interest Points

The covariance analyses (ANCOVA) is used in order to analyze whether there is a significant difference between the final test grades when the pre-test grades of the students of experiment and control groups about the interest scale is analyzed.

Corrected average final test grades of the experiment and control group students are given in Table 8.

Table 8. *Final Test Corrected Interest Scale Average Points of the Experiment and Control Groups*

Groups	N	Average ($\bar{x}$)	$\bar{x}$ (Corrected)
The virtual museum environment with pedagogical interface agent	41	83.34	83.75
The virtual museum environment without pedagogical interface agent	26	83.31	82.67

According to the Table 7 when we analyze the final test average grades of the each museum environments it is observed that the final test average grades of the students ($\bar{x}$=83.34)utilized the virtual museum environment with pedagogical interface agent is higher than the ones those utilized the virtual museum environment without pedagogical interface agent ($\bar{x}$=83.31). When the final test corrected average grades are analyzed it is seen that the average of the experiment group is 83,75 and the control group's is 82,67. According to the corrected final test average grades it can be said that there is a significant difference in favor of the experiment group students.

The ANCOVA results about the significance of the difference between the corrected final test average grades of the experiment and control groups are given at Table 9.

Table 9. *The ANCOVA Results About the Final Test Average Grades Corrected According to the Experiment and Control Groups' Interest Scale Pre-test Grades*

Variance Resource	**KT**	**Sd**	**KO**	**F**	**p**
Pre-Test	3379.479	1	3379.479	27.188	.000
Group	18.576	1	18.576	.149	.700
Deviance	7955.279	64	124.301		
Total	11334.776	66			

According to the ANCOVA results given at Table 8 there isn't any significant difference between the final test average grades corrected according to the pre-test grades of the students of experiment and control groups [$F_{(1-64)}$=0.149, p>.05]. According to this finding it can be said that the utilization of pedagogical interface agent in virtual museum does not generate a significant difference on the interest points of the students about the Natural Science lecture.

In a study of Dunsworth and Atkinson (2007) the content is given to the students as only text on the screen, as only expression with voice and last as expression with voice with the support of pedagogical interface agent. According to the results of the study it is seen that differentiation of the presentation types didn't generate any significant difference on the attitudes of the students about the learning content learning environment.

In an experimental study by Dungan and Adcock three different environments are developed. There are text based dialogues in the first environment, there is a case study between two agents one is helper and the other one is getting help in the second environment and lastly in the third environment the agent has the role of help getter and the students plays the role of help provider and there is an interactive dialogue between the agent and the student. In the study the agent's role on the sense of students is analyzed. Following the study it is found that there isn't a significant difference between the perception points of the students those studied in the environment with and without different utilizations of the pedagogical interface agents. The sub-dimensions of the perception variable are the developed interactiveness's motivation to the student about improving his/her knowledge about the topic studied in the learning environment, improving the interest of the student about the topic, interactions' increasing the motivation of the student, helping student to learn new things about the human relations and believing the accuracy of the things said. It is seen that studying in different environments doesn't generate a significant difference about the the content which is taken as sub-dimensions of the perception variable.

Discussion

The Energy Park Virtual Museum developed within the extent of this study and can be reachable by internet is generated Flash based by using real museum pictures of the content of the Energy Park Museum in order to have virtual attractiveness. "The Battery Friend" pedagogical interface agent that is the content of the studying environment of the experiment group students is a cartoon character that doesn't have any gender identity and in the learning environment provides information to the students about how they can utilize the learning environment, can vocalize the content by their wishes, can give reinforce and escorting them along with their tour in the learning environment.

According to the results of this study it is found that the students studied in the learning environment with pedagogical interface agent are more successful than the students studied in the learning environment without pedagogical interface agent but although there is a difference

in interest points about science lectures favoring the students studying in the environment with pedagogical interface agent this difference is not found as significant. The results obtained according to the research questions are given below:

After the end of the five week experimental process period it is seen that the success grades of the experiment group students those studied in the virtual museum environment with the pedagogical interface agent are significantly higher than the success grades of the control group students those studied in the virtual museum environment without pedagogical interface agent.

Although interest points of the experiment group students about the science lectures those studied in The Energy Park Virtual Museum are higher than the interest points of the students in the control group, there isn't any significant difference found between two groups. In other words the utilization of pedagogical interface agent in Energy Park Virtual Museum did not generate a significant difference in the interest points of the students about the science lectures.

It is seen that the success grades of the both experiment and control group students are affected positively by the teaching activities used in the Energy Park Virtual Museum. While the average success grade of the experiment group students before studying in the virtual museum is 6.76 it changed to 12.99 after experimental process. The success points of the control group students are increased from 5.31 to 11.29.

It is seen that Energy Park Virtual Museum increased the interest points of the both experiment and control group students about the science lectures. While interest points of the experiment group students before the virtual museum teaching is 64.85 it is become 83.75 after the experimental process. The interest points of the control group students is changed 67 to 82.67

Suggestions About the Implementation

In the developed Energy Park Virtual Science and Technology Museum the pictures, information and vocal presentation of the objects exhibited in the Energy Park took place. Giving place to the videos about the museum is thought to effect the interest and satisfaction of the students positively.

The content of the virtual museum is limited because of being limited with the content of the real museum in constructing the content of the virtual museum. It is thought that in addition to the objects in the real museum presentation of the various samples related with the content will be helpful to enrich the content and increase the student satisfaction.

It is thought that accompanying the voice characteristics of the pedagogical interface agent used in virtual environment with the mimics and more effective hand and arm movements can increase the effectiveness of the pedagogical interface agent.

Giving students chance to select the pedagogical interface agent that will escort them in their tour in the virtual museum will be helpful to develop the social interaction that they will establish between the agent and so with the environment.

Utilization of the pedagogical interface agents in e-learning environments can be helpful to increase the successes of the students in learning environment and to increase their satisfaction about the learning environment. Thus utilization of the pedagogical interface agents in the learning environments to be designed.

Suggestions About Topics Required to be Studied

Researching the effects of the virtual museum samples will be designed about the various topic fields to the successes, interests and motivations of the students will be helpful to define the utilization of the virtual museums for teaching of the different fields.

Definition of the pedagogical effectiveness of the samples of three dimensional virtual museum and pedagogical interface agents to be designed will be helpful to develop different museum designs.

Researching the utilization of the different pedagogical interface agents such as with the role of mentor, motivation supporter or field specialist in virtual museums will be helpful to effective utilization of the agents in e-learning environments.

Researching the effectiveness of different agent types by differentiating the reality, physical appearance, emotional appearance, costume characteristics, gender and voice characteristics of the agents will be helpful about the effective usage of the agents in virtual museums and e-learning environments and about the effective agent choice.

Researching the usage of the pedagogical interface agents to be designed by 3d modeling software in e-learning environments can be helpful to research the contribution of dimension variable to the development of the pedagogical interface agent.

Designing the game-based virtual museum environments may be helpful to the utilization of the entertainment component in museum education.

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