ISSN:1306-3111
e-Journal of New World Sciences Academy
2009, Volume: 4, Number: 1, Article Number: 1C0016

EDUCATION SCIENCES
Received: September 2008
Accepted: January 2009
Series : 1C
ISSN : 1308-7274

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A WEB BASED LEARNING IN SCIENCE EDUCATION: STUDENT ATTITUDES AND PERCEPTIONS

ABSTRACT

The Internet has been identified as important factors that affect learners' motivation, interests and performance in web-based learning environments. The purpose of this study was to determine students' perceptions of a specific online information system into the science curriculum using authentic tasks in a class setting. The subjects of this study were 17 students in the 8th grade. The students were interviewed in groups of three after the site had been used for six months. There was a significant difference between the pre-attitude and the post-attitude scores in the attitude scale of the 8th grade students. The findings of this study showed that the amount of information supplied in the course web site, doing assignments and taking online exams played important roles in students' science learning. But, the participants did not prefer to use chat rooms and other communication tools.

Keywords: Web-Based Learning, Attitude Toward Science, Perception Towards The Web-Based Learning

WEB TABANLI YAKLAŞIMLA FEN BİLGİSİ ÖĞRETİMİNİN ÖĞRENCİ TUTUMUNA ETKİSİ VE ÖĞRENCİLERİN ALGILARI

ÖZET

İnternet ağ-tabanlı öğrenme ortamlarında öğrencilerin isteklendirme, ilgi ve başarıları etkileyen önemli bir etken olarak tanımlanır. Araştırma Fen Bilgisi dersinde ağ-tabanlı öğrenimin, öğrencilerin fen bilgisi öğrenimindeki tutumları üzerindeki etkilerini ve algılarını ortaya çıkarmayı amaçlamaktadır. Bu çalışmanın örneklemi on yedi sekizinci sınıf öğrencisidir. Web sayfası altı ay kullanıldıktan sonra öğrenciler üçer kişilik gruplar halinde mülakata alınmıştır. Çalışmanın nitel sonuçları, Tutum Ölçeği (TÖ)'nin ön-test, son-test uygulamaları arasında anlamlı farklılıklara işaret etmektedir. Web sitesinde verilen bilgi türlerinin sayısı, ödevlerin yapılması ve çevrimiçi değerlendirmenin öğrencilerin fen bilgisini öğrenmelerine etkisinin olduğu tespit edilmiştir. Fakat, katılımcılar konuşma odaları ve diğer iletişim araçlarını kullanmayı tercih etmemişlerdir.

Anahtar Kelimeler: Web (AĞ) Tabanlı Öğrenme, Öğrenim Teknolojisi, Fen Bilgisi Öğrenimine Yönelik Tutum, Web Tabanlı Öğrenme Algıları

1. INTRODUCTION (GİRİŞ)

The use of computers and the Internet is revolutionizing teaching and radically changing some faculty's and students' approaches to teaching and learning. Although technological advancements have developed rapidly, research assessing the effects of this technology on students is just now starting to inform best-practice guidelines for educators. Over the years, research has highlighted many benefits of using instructional technology with students. Competent use of computers prevents learners from 'academic and social marginalization' (Murray and Kouritzin, as cited in *International Society for Technology in Education*, 2000, Collins, 2000). It allows them to have the most control over the direction of their learning by controlling their time, speed of learning, autonomy, choice of topics or even their own identity (Hoven, 1992). In other words, technology greatly helps students build on their confidence.

The general acceptance of the use of information technology in industrialized societies places greater responsibility on schools and families to help children become more efficient at accessing, transmitting, and using this information. The National Association for the Education of Young Children has developed a position statement that professionals have a responsibility to use technology, particularly computers and software to benefit children (Parette, Hourcade, and Heiple, 2000).

Personal computers are being used increasingly in distance education, and they have the potential to change the nature of that education radically. For the student learning at a distance or using self-instructional material, computers can be powerful study tools, whether providing general 'clerical' support, e.g. word processing facilities, spreadsheets, databases, or contributing to the subject area, e.g. via simulations in Physics, calculation and statistical packages in Mathematics, programming environments in Computer Science (Federico, 2000).

Keegan (as cited in Federico, 2000) indicates that; distance learning typically implies instruction via nontraditional means, i.e. courses via correspondence, radio, television, satellite, and, more recently, Internet with its associated software, hardware, multimedia, digital links, and supplementary audio and videotapes or CD-ROMs. Also, it implies on-campus classes, seminars, and workshops where the instructor is not physically present, and communicates with students at several sites simultaneously via electronic media (Laws, 1999).

Internet-based information and communication technologies are changing how instruction and assessment are being conducted in innovative schools, colleges, and universities throughout the world. Training and testing are experiencing a noticeable transition from the traditional centralized, local, classroom-teacher focused approach, to a de-centralized, global, network based, and student focused one. With the widespread use of personal computers in the classroom, on the job, and at the home, and the connectivity to the internet increasing exponentially, many individuals have immediate access on their desktop to remote educational resources, and even instruction itself.

The Web is a collection of cross-linked, usually graphical, `pages', stored on computers around the globe, for providing friendly direct-manipulation interfaces for, or `point-and-click' access to, worldwide sites discovered via browsing programmes, e.g. Netscape's Navigator, and search engines, e.g. Yahoo. With its implicit hypermedia design (Federico, 1999; Jonassen, 1999, 2000), the Web represents an innovative means of structuring and presenting on-line instruction, because it can simultaneously serve as delivery medium, content provider, and subject matter (Nix and Spiro, 1990).

Research and development in the field of hypermedia have made rapid progress in the past decade, moving from system development to application of these systems to such complex issues as augmenting teaching and learning, computer-supported collaborative learning, supporting information retrieval and browsing, as well as incorporating experiential simulation and virtual realities (Yang, 2000). A growing body of research and discussion on the use of hypertext systems as a writing, learning, research and problem-solving tool for educational purposes can be found in the literature in such diverse fields as business, medicine, chemistry, literacy, and the humanities (Garvin and Carrington, 1997; Sanne, 1994; Yang, 1999, 2000).

Any technological artifact is problematic in accurately describing the nature of the interaction between users or learners. Inherently a communicative act, it is suggested that using constructive, phenomenological and naturalistic alternatives to the traditional empirical paradigm could provide richer, context-specific information necessary to understanding the effectiveness of this interactive media (Neuman, 1991). Furthermore, from the results of a meta-analytical study, Yang (2000) found that the perception and attitudes toward hypermedia are functionally important to promote effective learning. Therefore, there is a need for a systematic exploration of the learners' interface with hypermedia in order to reveal their interactions with hypermedia learning systems.

The effectiveness of World Wide Web-based flexible learning practices in Australia was examined by McKavanagh, Kanes, Beven, Cunningham, Choy (2003). Online vocational education and training (VET) offerings were reviewed, and two Web-based VET modules were examined in case studies that involved observations and semi-structured interviews with teachers and students. The findings suggested that Web-based programmes have the potential to support and enhance lifelong learning with an emphasis on learner-directed learning and adaptability. It was concluded that designers of Web-based programmes should take advantage of the capabilities offered by technology in ensuring that content materials encourage rich 'conversational' interactions and that student self-directedness and reflection are encouraged. The research led to development of data collection and data analysis tools for evaluating Web-based flexible learning in VET.

Armatas, Holt and Rice (2003) examined in relation to a first year, a multi-modal psychology course offered at Deakin University. In 2001, the course, which was offered to over 1,000 students studying on three campuses in three Victorian cities, and off-campus nationally and internationally, adopted an online-supported, resource-based learning (RBL) approach. Unlike the on-campus students who were less positive about working with computers and reported confusion about how and what to study for the unit, the off-campus students reported feeling confident that they had a good study strategy and were more positive about computers. The off-campus students also reported that they spent more time working with electronic resources and attached greater value to them. While all students valued the prescribed resources, the off-campus students found some of the optional, electronic resources valuable because they added to the learning experience. These students also reported greater use of the computer-mediated communication available as part of the online learning environment, and valued this functionality more highly than did the on-campus students.

Yang (2000) conducted a study to examine how the learners use Perseus to create their projects, what their affective attitude and

cognitive perceptions are towards hypermedia in general and the Perseus system in particular. The Perseus Project is an ambitious, highly visible hypermedia research project that is creating a large-scale, heterogeneous corpus of material, textual and visual, relating to the ancient Greek world. The subjects in the Perseus project were six volunteers from a mid-western university. The subjects participated individually, and were later interviewed on a one-to-one basis. Data were collected using audio-visual tapes, observations, and interviews. Think-aloud protocols involved asking the problem solvers to verbalize their thoughts while working on a problem.

The results focused on from interviews show that students spent between four and twelve hours using Perseus to complete their assignments. Users found the materials and interactive learning experiences worthwhile, valued the Perseus hypermedia features, and believed that the Perseus resources were more meaningful than traditional forms of instruction involving textbooks. Yang remarked that one of his subjects had mixed feelings about using Perseus. He felt a balance between the requirement to use it, and his desire to use it. He expressed only moderate enjoyment about his experience of using Perseus. He stated that one positive aspect about Perseus was that it provided lots of visual information. On the other hand, he did have complaints about Perseus in respect to the uneven depth of the material, and in particular, he felt that the site plans were less helpful than pictures for visualizing the architectural ruins.

When the research conducted to investigate the effectiveness of online hypermedia studies in science education and when the problems existent in science classes in Turkey are considered, it is observed that there is a need to investigate how a hypermedia programme should be designed for use in an online information system. This exploratory study provides a qualitative report on the integration of a specific information system into the curriculum using authentic tasks in a class setting. It investigates how eight grade students use an online information database and the tools to create meaning. Moreover, it investigates the affects of web-based learning on eight grade students' attitude toward Science course.

2. RESEARCH SIGNIFICANCE (ÇALIŞMANIN ÖNEMİ)

The majority of the literature on the use of hypermedia as a tool for mediating learning in context is generally more promotional and assumptive than investigative and research based. As Yang (2000) points out:

The extensive use of large-scale hypermedia databases in actual class settings has not yet been thoroughly explored and there is a need for these systems be examined through observations of the ways in which students approach them in an ecologically valid learning situation. (pp:452)

Any technological artifact is problematic in accurately describing the nature of the interaction between users or learners. Inherently a communicative act, it is suggested that using constructive, phenomenological and naturalistic alternatives to the traditional empirical paradigm could provide richer, context-specific information necessary to understanding the effectiveness of this interactive media (Neuman, 1991). Furthermore, from the results of a meta-analytical study, Yang (2000) found that the perception and attitudes toward hypermedia are functionally important to promote effective learning. Therefore, there is a need for a systematic exploration of the learners' interface with hypermedia in order to reveal their interactions with hypermedia learning systems.

3. METHOD (YÖNTEM)

3.1. Design of the Research (Çalışma Modeli)

This is an exploratory case study to investigate the perceptions of eight grade students about a web based learning tool in science education and to investigate the attitude of students toward science learning. The problem in case studies is to establish meaning rather than location. For the purpose of the study, a science course enhanced with a web-based learning tool was developed. The activities of the students were recorded with a web site log system. The attitude scale toward science learning was administered as pre and post test.

3.2. Sample (Örneklem)

The sample of the study was 17 eight grade students in a secondary school in Turkey. They had knowledge about using computer, the Internet, WWW, and e-mail. They had a computer connected to the Internet in their homes.

3.3. Attitude Scale (Tutum Ölçeği)

The Attitude Scale was developed to investigate the subjects' pre-attitudes and post-attitudes toward Science courses. Some of the questions in the scale were adapted from Delialioğlu's (2004) subjects' attitude scale about computer networks and communication topics, and some of the questions were developed by the researcher. There were at least 2 statements for each opinion. The Attitude scale had 31 items in a 5 point Likert scale from Strongly Disagree to Strongly Agree. There were positive and negative statements on the scale. The reliability coefficient of the attitude scale was measured as 0.81.

3.4. Procedure (İşlem Basamakları)

For the purpose of the study, a science course enhanced with a web-based learning tool was developed. The content of the science course was: Changes in matter and Energy, Matter and Energy for Living, and Genetic. In the beginning of the semester, attitude test was implemented as a pre-test to the sample. During the treatment period (approximately six months), students' activities were observed and the activities of students' were recorded with a web site log system by AUTHOR. At the beginning of the 2004-2005 academic year, in one class hour, a short orientation about how to use the web site and its components was given to the students. In this orientation, students were informed about what the Url of the web site was, what was expected from them, how the web site was functioning, what their usernames are and how to choose their passwords. In addition, a short orientation about how to use online assessment tool was given to the students. Web-based learning platforms provide an ideal environment in which to implement the principles of constructivist learning. The web site of this study was implemented on such a basis. Constructivists assert that students construct their own learning in meaningful ways when they participate in individual and social activities, encounter and solve problems, interact with others, exchange information, and evaluate their understanding. Accordingly, different kinds of resource tools such as videos and situational problem solving exploration methodologies were provided to assist students in achieving high-order learning objectives.

Students were involved individually in many real-life problem-solving activities through self-tests, exercises, and discussions. Through social interaction, facilitated by e-mail and discussion boards, students could learn others' points of view and assess their own understanding. To increase the interactivity and the number of

visit of the web site, Microsoft Class-Server© 3.0 packed programme was used, and 19 Class-Server examples (containing objectives, short description of the topic, tests) were produced by the researcher and they were given as homework. Deadlines were given to the students. The feedback about the assignments was immediately given to students. The activities of each student were controlled.

At the end of the year, the students were post-tested with the same attitude test. After the web-based learning tool had been used by sample at the end of the 2004-2005 academic year, the students were interviewed in groups of three to get their perceptions about science courses enhanced with a web learning tool. Each interview lasted for about one class hour. The interviews were recorded by using audio tapes after permission was taken from the students. The recorded data was transcribed and analyzed to find out students' perceptions about science courses enhanced with a web learning tool. The students' responses were interpreted and categorized into the dimensions. Data reduction, data display and conclusion were carried out for each interview result. Then results were organized for conclusion drawing in the data display.

4. RESULTS (BULGULAR)

4.1. Quantitative Results (Nicel Bulgular)

To test this sub-question, a t-test was carried out on the pre-attitude and the post-attitude scores in the attitude scale of the 8^{th} grade students. Mean scores on the pre-attitude and the post-attitude were compared using a t-test at a significance level of .05. As shown in Table 1, the post-attitude mean score (M=91.94) was slightly higher than that of the pre-attitude mean score (M=87.24). The t-test result showed that this difference in the mean score is statistically significant at a significance level of .05. There was a significant difference between the pre-attitude and the post-attitude scores in the attitude scale of the 8^{th} grade students at the end of the study.

Table 1. Comparison of the Pre-attitude and the Post-attitude Scores in the Attitude Scale of the 8^{th} Grade Students
(Tablo 1. Sekizinci Sınıf Öğrencilerinin Öntest-Sontest Tutum Puanlarının Karşılaştırılması)

Test	N	Mean	SD	T value	df	2-tail prob
Pre-Attitude	17	87.24	3.17	4.58	16	.00
Post-Attitude	17	91.94	4.25			

4.2. Qualitative Results (Nitel Bulgular)

During the interview, the students were asked questions to understand their perceptions about the usability of web-based learning tool used in the science course.

Students were asked to describe how often they used the course web site. The majority of the students (15) stated that they used the web site at random intervals, whenever they had time and wished. The above information was triangulated with the log-system and it was seen that most of the students connected to the web site at the weekends. Sixteen students stated that they could relate what they learned in the course with what they knew before. Ten students indicated that they had a strong background in the science subjects and that they could build everything they learned from the course web site onto their previous knowledge.

Interesting results were found in student interviews on the question related to the components of the science course enhanced with web-based learning. Students were asked to state which features of the

science course enhanced with web-based learning tool. Almost all students (14) agreed that the assignments through the course web site were the most effective activities supporting their learning. One student's comment reflecting the students' perceptions: '*While doing the assignments one had to re-study the related subject of the content. In addition, we could also find additional information resources (web sites) related to the course content*'. The assignments were administered by using Microsoft Class-Server program. The assignments were made of five sections: objectives, brief notes about the topic, applications, tests, and references and related links.

To understand student preferences in terms of learning resources students were asked whether they used other information sources than those supplied on the course content, reading materials, assignments and additional links in the course web site. Twenty students said that they only used the supplied information on the course web site. Eleven students used both the course content and announcements. Eleven students said that they used the course content, assignments and additional links.

One student said: '*From the written objectives, I could determine how deeply I was expected to learn each topic*'. Students' perceptions about the learning theory of the science course with web-based learning were parallel to their perceptions about the pedagogical philosophy. Although there were written behavioral objectives, some of the features in the course web site, the assignments were based on constructivist epistemology and cognitive learning theory. According to students' perceptions, the structure of the course material on the web site was evaluated from a behavioral perspective. Students found the objectives given at the beginning of each unit useful in understanding what is expected from them.

An important feature on which 12 students agreed to be effective in supporting their learning was homework and additional web links on that topic. Students agreed that the pre-determined web sources enhanced their learning. In general they liked to have different information sources which they could choose to study from. They could either study directly from the provided content or they could choose to study from the source most appropriate for them.

Most of the students (15 students) liked to have online exams on computer. One of the students stated '*Before the online exam, I was afraid. Because it was the first time I had an exam in this manner. When I sat in front of the computer and started to read the questions, I felt comfortable. The nice thing about it is this; you do not need to wait for exam results and mistakes. If one made a mistake, s/he could easily see his/her mistake and learn the exam grade. I wish I could take all exams in this way'. Another student indicated 'I agree with my friend, but in some questions I needed paper and pencil to solve questions that required mathematical calculations*'.

To understand what difficulties students faced they were asked what problems they had to deal with while studying the web-based instruction of the science course. The common criticisms of the students were on availability of Internet access. One student said: '*The only disadvantage of reading the course material from the computer screen was that one should use dial-up connection to the Internet*'.

The computer-based environment in the web-based component of the science course was stated as problems by several students (indicated by nine students). The interview results were investigated and the common problems were selected. One student stated: '*The internet connection from home was too slow. I could not have watched videos prepared in the web site of the course because the Internet*

connections from home disconnected from time to time, it was not reliable'.

Three different perceptions about the chat room were observed. Students agreed that they did not use the chat room effectively for information exchange. Some students (12) indicated that they were together from 8:30 to 16:00 at school already. Students preferred to communicate face to face with their peers and the teacher.

From students perceptions it could be seen that the students preferred taking exams online. They stated that '*it was fun to take exams on the computer. There was no need to wait for the announcement of the grades. As soon as the exam finished, one could have learn the mistakes and their correct results. In traditional exams, however, we had to wait minimum for a week. At that time, I would have forgotten my responses to the questions*'.

5. CONCLUSION AND RECOMMENDATIONS (SONUÇ VE ÖNERİLER)

The quantitative results of the study indicated that there was a significant difference between the pre-attitude and the post-attitude scores in the attitude scale of eight grade students at the end of the study. Choi, Lim, and Leem (2002), and Beard, Harper, and Riley (2003) reported that web-based learning develops a positive attitude towards science education. Findings of this study added an empirical support for the positive effect of web-based learning. Reaching to the content easily and less effort to obtain the knowledge can explain the difference in attitude toward science course. The web site of the course provided students with opportunities to read, and analyze the content. In the web site the students could use many links in which they could find related information. These conditions affected the progress in their attitude. As literature suggests, the development of positive attitudes is related to the easy involvement of the students in activities in the web site of the course (Manual, 2001; Matuga, 2001).

The students' perceptions about the science course enhanced with a web-based learning tool inherent in the current study were important in understanding the effective dimensions of students' science learning. The students were interviewed to reveal their perceptions in groups of three. The findings and conclusions on the students' perceptions are listed below:

Almost all students agreed on the support of the classroom meetings to learn especially abstract content. This is understandable as they are accustomed to lectures from their previous school experience. Students cannot be blamed for their difficulties in getting used to new instructional approach in the science courses.

Usability refers to the factors in the web site that make the experience for the learner simpler and stress free. The usability factors were especially important for the course web site. The download time was also important since most of the students stated that they preferred to connect to the internet from their homes with a modem. The usability and simplicity of design is given special attention to in the web based course design literature. One of the researchers in this area is Jacob Nielsen, who advocates web design not to include graphics and sounds unless they are absolutely essential (Palloff and Pratt, 2001, as cited in İnan, 2003). However, the web site in this study contained photographs, graphics, and films. Students were sometimes criticized for accessing some of the links in the web site.

While students' stated their primary source of information was the course content bar, which was closer to objectivist theory, they also used other components of the course web site for supporting their

learning like cognitive tools, films and additional links which were closer to cognitive learning theory and constructivist philosophy (Jonassen, 1999, p.221). The findings of this study are parallel to those of previous studies. Armatas (2003) found the "related links" to other online study resources to be useful.

Hanafi, Zuraidah, and Rozhan (2004) indicated that the respondents perceived the high degree of necessity of the online support services to be provided for them. They perceived that the information regarding examination procedures should be made available online. One of the strengths of Computer Assisted Assessment (CAA) is that students can receive feedback quickly as they progress through the assessment. McKenna and Bull (1999) showed that this is among the main advantages of CAA. Hargreaves (2004) indicated that the computer based tests were found to have an overall positive effect on children's performance.

Rasmussen, Northrup and Lee (1997) and Yıldırım, Özden and Aksu (2001) indicated the importance of demonstration provided at the beginning of the course. Our results indicated that given information about the features and usage of the web site were enough and helpful to the students.

In summary, to make effective use of web-based learning, the features of the web site should be designed in a manner that they are parallel to the goal of the related utility. As well as navigation support, the content should be kept in summary to minimize reading from the computer with enough graphs and pictures without having download problems. In terms of visual design, each web page should be designed in a way that minimal information on each page is provided with as a mixture of instructivist and constructivist elements. Moreover, it is found that using self-assessment tools for students played an important role for students' motivation and interaction which is a key to success in web-based learning.

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