STUDENTS' PERCEPTIONS OF A HIERARCHICALLY-DESIGNED HYPERMEDIA LEARNING ENVIRONMENT

HİYERARŞİK OLARAK TASARLANMIŞ ÇOKLU ÖĞRENME ORTAMINA İLİŞKİN ÖĞRENCİ ALGILARI

Dr. Zahide YILDIRIM Assoc. Prof. Dr. M. Yaşar ÖZDEN
Middle East Technical University
Faculty of Education
Department of Computers Education and Instructional Technology

ABSTRACT

This study aims to assess the distinctive characteristics of a hierarchically-designed hypermedia learning environment through students' perceptions. The study design included a total of seventeen 9th grade high school biology students in Ankara, Turkey, and lasted for 15 hours. The results of the study showed that the material promoted a feeling of empowerment. The freedom of choice and an individualized learning environment resulted in increased student motivation. The screen design, text sizes, graphics, videos and colors used in the program were very convenient. The learners were navigating in the program according to their own learning pace and choice. Their initial interest in the units did not affect their attitudes towards the hypermedia learning environment used during the experiment. Learners suggested that the hypermedia learning environment should be used together with a traditional learning environment and with the teacher.

ÖZ

Bu çalışma çokluortam (hypermedia) yaklaşımı dikkate alınarak hazırlanan öğrenme ortamında oluşan öğrenme durumlarına ilişkin öğrenci algılarını değerlendirmeyi amaçlamaktadır. Çalışmaya Ankara'da bir lisede Lise 1 Biyoloji dersini alan 17 öğrenci katılmıştır. Bu öğrenciler Biyoloji dersinde yer alan iki üniteyle ilgili toplam 15 saat çoklu ortamda öğrenim görmüşlerlerdir. Çalışma sonuçları çokluortamda öğrenmenin öğrenciye güven ve başarma duygusu verdiğini ortaya koymuştur. Ayrıca öğrencilerin istediği kavram ve bilgileri seçebilme özgürlüğü ve bireysel öğrenme ortamı öğrenci motivasyonunu artırmıştır. Programda kullanılan ekran tasarımı, metin büyüklüğü, grafikler, videolar ve renkler öğrenme ortamının etkililiğini artıran önemli unsurlar olarak görülmüştür. Öğrencilerin programı kendi öğrenme hızlarına ve seçeneklerine göre kullanabilme olanağı öğrenmenin anlamlı olmasına katkıda bulunmuştur. Öğrencilerin ünitelere ve derse karşı olan öntutumları öğrencilerin çalışma süresince kullandıkları çoklu öğrenme ortamına olan tutumlarını etkilememiştir. Son olarak çoklu öğrenme ortamının geleneksel öğrenme ortamı ile birlikte kullanılmasının da etkili bir yaklaşım olabileceği ortaya çıkmıştır.

INTRODUCTION

With the recent developments in information technology, computer-based instruction has evolved from simple and linear applications to user controlled complex simulations and virtual environments. "Hypermedia" is one of these capabilities that technology offers us to use in various ways to promote learning. The significance of hypermedia for learning and its motivational effect are stressed in many studies. Bergin, Ford and Hess (1993) claim that certain characteristics of hypermedia, such as nonlinear presentation, immediate feedback, animation, sound, active interaction, individualization, and learner control, are more likely to motivate students and foster learning than traditional learning environments. Since hypermedia applications offer learners a visually rich environment, with more control over the learning experience and nonlinear presentation, it is viewed as more effective than other instructional environments.

* This article was presented as "A Qualitative Assessment of WWW-Based Learning Environment" in the 11th World Congress on Educational Multimedia and Hypermedia and Educaitonal Telecommunications, Seattle, Washington, USA, as a paper and the abstract of the paper was printed in the Book of Abstracts of the Conference.

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According to Yang and Chin (1996), designing an effective instructional control strategy has become one of the key issues in computer-based instruction. Learner control means that the important paths and the amount of instruction are controlled by the student through specifying choices among a range of designer-embedded options. In particular, learner control permits a significant degree of self-directed learning and motivation.

Literature indicates that human beings retain roughly 20% of what they hear, 40% what they see and hear, and 75% of what they see, hear and do. With hypermedia, texts, graphics, animation, sounds and videos can be integrated into a single source. Moreover, these media can be combined to produce a visually enriching environment that has the potential to achieve the highest rates of retention in students. If properly applied, it may contribute to student understanding of the subject matter knowledge and skills in manipulating knowledge in various ways. Since hypermedia is a learner-directed and a visually rich learning environment, it has a high potential for motivating the learner during the learning process and a nonlinear way of thinking.

Besides advantages, hypermedia has some limitations. One of the problems mentioned very often is "distraction" that may result from a high level of learner control. The richness of nonlinear representations carries a risk of potential intellectual indigestion, loss of goal-directness, and cognitive entropy. Another problem is "disorientation" which learners may face while using the hypermedia learning environment. Users may get lost in hyperspace. If the knowledge base is unstructured, it is difficult to navigate and integrate information into personal knowledge structures because of the cognitive overload.

There are many studies that support hypermedia's positive effects on learning and motivation. Crane and Mylonas (1988) from Harvard University developed a hypermedia program on Greek Civilization to support learners. Even though the researchers did not carry out a formal evaluation, they indicated that this kind of environment could enhance creative, individualized, and active learning. Seven years after Crane and Mylonas' study, Numan and Marchionini (1995) discussed the same project. They conducted both a quantitative and qualitative assessment of the program. Results of the evaluation indicated that the program had significant potential as an information rich learning environment. Harris and Cady (1988), two teachers in a high school in Maryland, developed a hypertext literature lesson. They found out that students were motivated and even inspired to search at deeper levels of the program. Lohr, Ross and Morrison (1995) designed a study to evaluate a hypertext model for teaching writing at the junior and high school level. They determined how three different age groups of students used and reacted to the program they developed. Their study results showed that older students benefited more from many of the features of the program. Harding, Lay, Moule and Quinney (1995) developed multimedia mathematics modules consisting of texts, sounds, still images and animation. It was developed for a freshman mathematics course to provide students with self-study materials without or with little supervision. Even though they did not carry out a formal evaluation of the program, they observed that Renaissance Mathematics materials were warmly received at workshops, especially by 18 year-old students. Yang and Chin (1996) designed a study to find out the motivational effect of a learner-controlled and a program-controlled strategy in a hypermedia learning environment. They found out that the instructional control strategy did not cause any difference in students' motivation, but the program control strategy resulted in higher performance. In addition, both groups' satisfaction was significantly higher than their confidence. Studies discussed above show that students were motivated and satisfied with learning through the hypermedia and multimedia learning environments they used. This shows that hypermedia has a good potential for efficient and effective learning.

The influence of hypermedia learning environments has been investigated mostly through experimental studies in which a group of students who are subjected to a hypermedia learning environment are compared to another group of students who go through traditional classroom instruction. The literature examined above indicates that the hypermedia and multimedia learning environments produce

higher levels of achievement and higher motivation towards learning the subject matter. Many such studies have shown its positive impact in various subject areas and with different groups of students. However, the literature falls short in explaining why and how a hierarchically-designed hypermedia learning environment, and the expository and scaffolding learning strategy used in the hypermedia learning environment cause higher levels of achievement and motivation. How do students perceive various aspects of a hypermedia learning environment? How do students interact with a hypermedia learning environment? In what ways do they learn through a hypermedia learning environment and how are different types of learning affected by various aspects of a hypermedia learning environment? Questions like these need to be explored in order to understand better what processes the students go through as they learn in hypermedia learning environments, how students experience the hypermedia learning environment, and what the outcomes of their experiences are in terms of learning and motivation. Therefore the purpose of this study is to describe the students' experiences in depth with a specific hypermedia learning environment through interviews. Studies employing interviews may provide important insights into what goes on in these types of environments, how students respond to these environments, and how they compare these environments with traditional learning environments.

Development of a Hypermedia Learning Environment

The medium-size hypermedia learning environment developed by the researchers for this study includes circulatory and excretory systems of the human body for a 9th grade biology course, and runs under WEB browsers such as Internet Explorer and Netscape Navigator. It was developed using the Hypertext Markup Language (HTML) format. In developing hypermedia, texts, sounds, still pictures, graphics and videos were used, and an instructional system development (ISD) process and a hierarchical linking approach were followed.

The hypermedia learning environment consisted of 166 screens. It had 4 introductory screens, 2 main menu screens, 2 advance organizer screens, 62 information screens, 32 practice screens, and 64 feedback screens. In the hypermedia learning environments, the subjects were provided with 3 different types of navigation paths in addition to the Web browser's back and forward navigation choices. The users had a chance to navigate through the path structured by the researchers, or from the menu (partially structured) provided on each screen, or to determine their own paths through the hierarchically-designed main menu within the program according to their own interest. So the users were provided with a good deal of flexibility in their navigation choices.

The hypermedia learning environment was developed in three phases: preparation stage, development stage, and the evaluation stage. These phases are described below.

Phase 1

a) Determining the users' characteristics: The literature indicates that characteristics of learners are one of the most important factors affecting the design of hypermedia learning environments. Specifically, it seems necessary to examine the level of prior knowledge the learners have of the subject. If the learner has prior knowledge, it is easier to integrate the new knowledge into the existing knowledge structure, and decide on meaningful choices. In addition, the age and maturity of the users are other important aspects to be considered. First of all, the users who participated in this study had no previous knowledge in the two units selected for the study. The students had taken a Biology course in the previous semester, but it did not include the selected units. Secondly, the researcher consulted four subject matter experts (one university instructor and three Biology teachers) about the subjects' age and maturity level, and concluded that the two units selected for the study would be appropriate for this group of students.

b) Identifying the objectives of the units: The objectives of the two units covered in the instructional materials were determined based on the curriculum guidelines of the Ministry of Education.

c) Conducting a content analysis: A content analysis was conducted and concepts, interrelated concepts and procedures were determined based on the objectives of the units determined. A subject matter expert

evaluated the semantic relationships of the concepts determined. In the light of this evaluation, the semantic relationships between the concepts were reorganized.

d) Determining the learning strategies: According to Shunk (1996), meaningful learning is gaining ideas, concepts and principles, and relating new knowledge to existing knowledge. Considering the characteristics of the users and units, Ausubel's "deductive learning strategy" was adopted. First general and simple and then detailed and specific knowledge was given. In the beginning of the each unit, short video episodes that explained the units overall were used as advance organizers to help users relate new knowledge to the existing knowledge in their memory and to provide scaffolding.

e) Identifying knowledge organization approaches that best suit the learning strategies: At this stage, the issues of knowledge organization and linking nodes to each other were dealt with. In this material, hierarchical links were used. First basic concepts, then subordinate concepts related to the basic concepts were considered. In addition to hierarchical links, an elaboration approach was used to explain the concepts from simple to complex and from general to specific. Both approaches were consistent with the learning strategies used in this material.

Phase 2

a) Concept mapping: In order to determine the concepts that form the content and interrelations between those concepts, concept maps of the units were constructed. This stage was important to show each node and links between the nodes.If this stage is skipped, the programming stage can be too time consuming.

b) Story-boarding: Story-boarding was the last step before the programming stage. Story-boarding is showing each navigation window on a page as it should appear on the computer screen. Each window to be designed was shown on a separate page. Active keys, the names of linked windows, links, texts, visuals, videos, sounds, and graphics to be used were shown on that page.

c) Programming: Microsoft FrontPage 2.0 as an HTML (Hyper Text Markup Language) editor was used for programming.

Phase 3

a) Evaluation: After developing the material, it was given to an instructional technology specialist, a subject area expert and three subject area teachers to be evaluated. Based on the feedback received from these experts, the material was revised and improved.

METHOD

The study design included a total of 19 ninth grade biology students from a public high school located in a middle socio-economic neighborhood in Ankara, Turkey. These students had basic knowledge in using Windows 95 and MS Office 95 programs such as MS Word, MS Excel and MS PowerPoint. Based on their gender and prior achievement scores in biology, the subjects were selected to represent both males and females, low, average and high achievers. Before the study started, the students in the group were given a one-hour introductory session in using Internet Explorer 3.0. The study lasted for 3 weeks, amounting to a total of 15 hours. The students used the hypermedia learning material individually in the computer lab with IBM-PC compatible computers.

As a qualitative data collection method, interviews were used to determine students' perceptions about learning through hypermedia learning environments. An interview form was developed to collect descriptive data concerning the group's opinion about the biology course and the hypermedia learning environment used during the implementation. The interview schedule included questions on the attractive characteristics of a hypermedia learning environment; a comparison of the hypermedia learning environment and the traditional instruction in terms of quality; design characteristics of the hypermedia learning environment, such as fonts, font sizes, color, design, images and video episodes used; hypermedia's impact on learning; types of knowledge learned through hypermedia; difficulty and ease of using a hypermedia learning environment and implications for the learning process; most effective ways of using a hypermedia learning environment; and finally, recommendations for use of the hypermedia learning environment. In addition, several questions concerning students' attitudes towards the biology course and the biology

teacher were included in the interview schedule in order to learn how these attitudes are influenced by the hypermedia learning environment.

14 students who completed the whole phases of the material were interviewed at the end of the study. The subjects were interviewed within groups of three to four students, so a total of four small-group interviews was carried out. There were several reasons for preferring focus group interviews to individual interviews. First of all, the group interview is highly efficient as a qualitative data collection technique. Second, it provides some quality controls on data collection. Third, the group dynamics typically contribute to focusing on the most important topics and issues relevant to the study. Finally, focus group interviews can be used to identify a program's strengths, weaknesses, and necessary improvements (Patton, 1987). For these reasons, the researchers chose to carry out group interviews and the results showed that the interviews produced a rich data base to inform the study's research questions.

Before the interview started, students were informed of the purpose of the interview. Each interview lasted about on hour and all interviews were tape-recorded with the permission of the subjects.

As Figure 1 displays, the interview data were transcribed and were subjected to a content analysis. The content analysis involves searching for meaningful phenomena in the data, assigning them descriptive codes and exploring their relations to arrive at themes, and to describe the data as a meaningful whole (Miles and Huberman, 1994). First, the interview data were transcribed and coded using a predetermined set of categories produced by the researchers, according to the conceptual framework of the study. Second, the themes were identified. Third, the descriptive codes were grouped in categories which fit together meaningfully. These categories allowed the researchers to identify the main themes present in the data. Finally, the coded data were presented and described under these main themes, and then the interpretation and discussion of the results was offered.

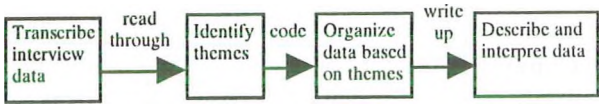

Figure 1. Data Analysis Process

RESULTS

The interviews with the students who used the hypermedia learning environment reveal certain patterns with regard to the use of the hypermedia learning environment and its impact on students' learning and motivation. These patterns are presented thematically below.

Attitudes towards the biology course, the biology teacher and the biology textbook before and after the study: The students stated that they generally enjoyed the biology course more than the other courses they were taking. Most of the students in the group perceived that they performed well in biology. While most of the students found the topics in biology easy to learn, some found that the course content is related to real life and they used what they learned in their daily life. They indicated that the hypermedia learning environment they used for three weeks for the human circulatory and excretory system units did not change their perception about the biology course, which was positive to begin with anyway.

All students indicated that the biology teacher had a positive impact on developing their positive attitude towards biology. They found the teacher friendly and effective in teaching. They indicated that their attitudes towards the biology teacher did not change after using the hypermedia learning environment. They stated that they wished their teacher were with them during the implementation as a facilitator, and that would make a positive influence on their performance in using the hypermedia learning environment.

Most of the students stressed that the textbook they were using for the biology course was not well designed. It was not visually attractive and the relationships between the concepts were not clear. It was dull and boring. They stated that if they had better designed textbooks and if they had access to hypermedia learning environments like the one they used during the study, the biology course would be more enjoyable and effective.

The most attractive characteristics of the hypermedia learning environment: Subjects mainly reflected that the most remarkable characteristics of the program were the combination of texts, graphics, images, sounds and video episodes in the program. They found the hypermedia learning environment attractive, easy to use and clear to understand. The presentation of the content through motion pictures, sounds and images in addition to textual information made it rich and interesting. They indicated that some important aspects of the content and related concepts were highlighted. So it was easy for them to focus on and learn them. In addition, it was possible to browse different concepts in the program that allowed students to review the concepts and see how they relate to each other in a meaningful way. Another attractive feature of the hypermedia learning environment was that the students were learning according to their own learning pace and interest.

The quality of the material in comparison to the textbook and the traditional instruction: Students believed that the material was clear, simple, sensible and easy to navigate. They found out that all of the navigation windows in the material were consistent. With the main menu, and each menu in every navigation window, it was easy to go through different parts of the program. Only one concept was used in one window and scrolling was not allowed. Topics were arranged sequentially and related meaningfully to each other. They stated that even though they had occasional confusion about where they were in the program, it was easy to find out the related concepts from the main menu. When they entered the main topic page, they would find the main topic was presented as the main concept from which it would be possible to reach its components. For example, the place of the related organ in the body was given as the main concept from which one would easily reach its functions and then the detailed information about the concept given in the windows elsewhere by clicking on the appropriate buttons. It was possible to find both the summary and detailed information about the concept presented in the program. Students mainly reflected that topics were arranged sequentially and the concepts were related to each other within an overall framework. The main concept was presented in a general way first and then detailed information about the concept was given. Users had the chance to reach either the summary or detailed information about the concept they were dealing with. However, students suggested that it would be better if more visuals such as animations, simpler images and graphics were included in the program.

They indicated that the program was superior to the textbook they were using in many aspects. They found the textbook boring and inconsistent in presenting the concepts and it was difficult to navigate through different sections meaningfully. Students emphasized that the concepts were not clearly identified in the textbook and it was not visually attractive. The relationship between the ideas and units in the textbook was found to be weak.

They stated that both the teacher and the program had both advantages and disadvantages in creating an effective learning environment. They liked the social aspects of traditional classrooms and the teacher's experiences while they enjoyed the richness, flexibility and control of the hypermedia learning environment.

The fonts, font sizes, colors, designs, images and video episodes used in the program: They found out that the colors used in the hypermedia learning environment were well matched with each other. They stated that they felt comfortable with the colors used in the program. Specifically, they indicated that their eyes were very comfortable with the colors used in the program. The size of fonts used in the program was appropriate and easy to read. The design of the navigation windows in the program was consistent. The images and video episodes used in the program were appropriate. While two students would prefer full screen video episodes, the others stated that it was more helpful to read the explanation and watch the video episode in the same window. Some of the students stated that it would be better if more diagrams or simple images and animation were provided in the program.

Learning through the hypermedia learning environment and its impact on learning: Some of the students indicated that in the beginning of the implementation, they were not so willing to participate because they did not want to change their learning

environment they were used to. However, when they started using the hypermedia, they realized that they liked the hypermedia environment. They reflected that they had "good" time while learning the subject because the learning environment was enjoyable and they had freedom in determining their own course of learning. They indicated that they felt in control since they had flexibility of navigation in the program.

Types of knowledge learned through hypermedia (visuals, texts, relationships): Students found out that motion and visual knowledge in the program were nice and interesting, but in order to learn the subject, all types of knowledge such as texts, images, graphics, sounds and videos were necessary for effective learning as it was the case in the program. Texts and visuals in the program were in support of each other, and video episodes were very valuable in drawing the users' interest and giving them an overall idea about the learning episodes that would follow. Especially, video episodes were combined with real life scenes, and this feature helped students retain more efficiently what they learned. The video scenes strengthened cognitive learning as they presented conceptual images in an interesting way. Some of the concepts were presented more than once in the program and that made the users learn these concepts more effectively and relate them to what they already knew.

Difficulty and ease of using the hypermedia learning environment and its implications for learning process: Students all stressed that they did not face any difficulty while using the hypermedia learning environment. The program was easy to use both in the beginning and at the end of the experiment. Since the content of the program and the paths to be followed were given in detail, it was very easy to find the concept they wanted to study. Users perceived that all parts of the hypermedia were logical and this helped them use the program easily. It was easy to navigate by using the main menu and the menu presented on each window. Students stated that the hypermedia learning environment was flexible and appropriately designed for easy navigation. All elements of the hypermedia supported each other.

In addition, the students indicated that the limited capacity of the computers used in this study created some problems while they were using the hypermedia. Slow motion of video episodes, occasional loss of sound and delays in navigation from time to time frustrated them a little. They stated that these problems did not affect their performance much, but the learning process would be more enjoyable when they had better computers running the programs smoothly without problems.

The differences between the hypermedia learning environment and the traditional instruction: Most of the students perceived that the main difference of the hypermedia learning environment and the traditional learning environment was that they had a chance to review the material back and forth. Whenever they did not understand the topic, or had a question in their mind, it was easy to go back and check. This feature of the program allowed flexibility in learning the concepts depending on individual decisions. They found that individualization in the hypermedia learning environment was an important aspect of the program and that they paced according to their own learning speed and ability. They thought that the traditional instruction led them to passive learning most of the time whereas the hypermedia learning environment got them involved in their own learning process actively.

Most effective ways of using the hypermedia learning environment: Most of the students indicated that the hypermedia provided an effective learning environment for learning the course content. It was a rich learning environment and it allowed flexibility in learning depending on the learners' pace. Even though it was rich in providing useful learning experiences, computer-based learning was found to be incomplete without a teacher present in the learning environment. Students mentioned that the teacher could help them further in improving what they learned and could serve as a source of help when they had problems or they would like to discuss certain points. Therefore, it would be better when the hypermedia was used with a teacher present in the computer lab. Out of 14, only two students stated that the hypermedia learning environment could be used alone as a learning environment as long as it contained all the kinds of knowledge they needed. Most of the students also stated that they would remember most of the topics they learned

through the hypermedia learning environment since it had rich visuals and important concepts were highlighted. However, they still preferred the presence of the teacher. They suggested that the teacher should present the topic in traditional and laboratory sessions, and after that they should use the hypermedia learning environment as a self-study material.

Recommendations for use of the hypermedia learning environment: Few students stated that as long as the program had all the information about the topics to be learned and was well designed, it could be used as a learning environment alone. However, most of the students stated that like the traditional instruction, the computer environment had both advantages and disadvantages. Therefore, the hypermedia learning environment was not sufficient to be a learning environment on its own. Both traditional and hypermedia learning environments should be used together and should mutually support one another. They stated that unlike a traditional instruction setting, hypermedia was a flexible environment where it was easy to navigate and it was possible to learn according to their own learning pace. Although they had the flexibility in the hypermedia learning environment, they would also like to have the teacher present in the hypermedia learning environment.

DISCUSSION

The results of this study show that students find the combination of texts, graphics, images and videos as the most attractive characteristics of the learning environment. In addition, providing opportunities for learning at their own pace and according to their interest makes the hypermedia learning environment attractive for the students. The program is of good quality and well designed in comparison to the textbook and the traditional learning. Using hypermedia seems to promote a feeling of empowerment. The freedom of choice and an individualized learning environment provided by the hypermedia learning environment result in increased student motivation. Student found that the concepts were clearly identified in the material, and that the screen design, text sizes, graphics and videos used in the program were conveniently organized and presented to the learners. The most effective aspect of using the material appears to be the navigation in the program according to individual preferences and learning speed. Even though the students found the hypermedia learning environment superior to the traditional instruction, they suggested that the hypermedia learning environment should be used together with the teacher.

Some of these findings discussed above support the postulations reflected in the literature. Bergin, Ford and Harris (1993) states that nonlinear presentation, immediate feedback, animation, sound, active interaction, individualization and learner control are likely to motivate students. The hypermedia learning environment used in this study increased students' motivation through the use of different ways of information presentations, such as texts, graphics, sound and video tools at the same time. As Pavio (1986) states, hypermedia makes use of all learning channels such as hearing, seeing, reading, doing, etc. and more active and different tools like pictures, figures, highlighted points enrich the learning process. Since hypermedia allows students to process the content through different cognitive codes in a verbal or imaginary code, subject matter contents may be processed by the students more effectively. Tergan (1997) also states that multiple coding in presenting the subject matter might contribute to students' effort in developing adequate mental representations. Students who used the hypermedia learning environment in this study indicated that all types of knowledge such as texts, images, graphics and videos were necessary for effective learning to occur and the hypermedia learning environment they used provided students with all these types of knowledge.

The flexibility and multi-modal presentations provided in the hypermedia learning environment are not very common in traditional learning environments where students have to follow what the teacher wants them to do and they may have no control over their own learning process. Since the subjects made use of multiple channels while using the hypermedia learning environment and had flexibility in learning, they benefited from and enjoyed the hypermedia learning environment more than they did in the traditional learning environment.

Hannafin and Hooper (1989 cited in Stemler,

1997), mention that the highlighting of the texts helps to control selective perception and focus attention on identified information. Similarly, students in this study indicated that the highlighting of important concepts helped them learn these concepts easily and effectively.

Stemler (1997) states that the screen should be kept as simple and uncluttered as possible since presenting too much information at a time may be confusing and overwhelming. Learners may become easily confused and disoriented in complex interactive multimedia modules. In hypermedia and multimedia systems, the interface should help users navigate effectively through the program. Navigation features of hypermedia serve to enhance learning and make the program easy to use. Park and Hannafin (1993 cited in Stemler, 1997) state that clearly defined procedures for navigation should be provided within the system. The location of the navigational item should be consistent throughout the program so that the users do not have to search for buttons. In the hypermedia program in this study, easy access to the main menu was provided in each navigation window and this appeared to be effective for students in navigating through different parts of the material. Search (1993 cited in Stemler, 1997) suggests that a map should serve as the table of contents for the entire program and provide an opportunity for students to jump back and forth from one screen to another. In addition, screen designs should be kept simple, consistent and easy to navigate. The main menu provided in the hypermedia learning environment used in this study was designed as a map of the table of contents and students indicated that the main menu helped them a lot in navigating. Even though the students who used the hypermedia learning environment indicated that the program was easy to use and navigate, they also pointed out that they preferred simpler images. Their preferences in this case should be considered in designing future materials.

Interview results indicated that the hypermedia learning environment could be more effective if it were used together with the teacher. In further studies, it can be tested whether the use of hypermedia will have similar effects when used together with the teacher. In other words, a regular classroom environment versus a hypermedia environment with a teacher can be compared through an experimental research study.

Using technology-integrated learning environments in instructional settings is an important aspect of efforts to improve student learning today. One of these environments is the hypermedia learning environment. Since it is a relatively new application in the field of instructional technology, it needs to be studied from many perspectives. This study offers some insights into the distinctive characteristics of hypermedia learning environments, students' reactions to these environments and possible promises to enrich student understanding of the subject matter and motivation in the learning process. In this sense, the results of the study may offer significant suggestions and guidelines in designing hypermedia learning materials and presenting them to the students' use. The result of this study may help designers/developers of hypermedia instructional materials and those who use such materials in educational settings in understanding and considering their potential contributions to and limitations for learning.

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