

The Influence of Learning Styles on Achievement in Undergraduate Students' Reading Comprehension in Hypermedia Environments

Hossein Sadeghoghli¹, Davoud Amini², Nader Assadi³

^{1,2}Department of English, Islamic Azad University- Sarab Branch, Iran

³Department of English, Islamic Azad University- Ahar Branch, Iran

ABSTRACT

Hypertext is defined as a textual structure that can be accessed in a non-linear way, mainly through computer screen. When in addition to text a variety of non textual information such as images, sound files and video clips are also included in the environment, the term hypermedia, instead of hypertext is used. Research findings on the efficacy of hypermedia environments on the development of reading comprehension are often contradictory. While some studies suggest that hypermedia can provide an effective way for developing reading skills, others have not found a strong evidence to support this proposition. Moreover, it is suggested that people have different characteristics and learning styles which affect how they approach any learning task and that not all people make equal benefit out of hypermedia environments. There are different models of learning styles. Kolb's Learning Style Inventory (1985 later revised as KLSI 3.1, 2005), for example, divides people into four groups namely diverging, assimilating, converging and accommodating.

As we have different types of text, we have different types of hypermedia too. In this study 308 undergraduate students belonging to different learning styles were exposed to two types of hypermedia environments, namely structured and free hypermedia. After going through each environment, they were asked to answer a set of questions which reflected their degree of reading comprehension. Findings of this study suggest that no matter to which learning style group students belong, preference for the structured hypermedia is predominant and the achievement in hypermedia environments is irrespective of the subjects' learning styles. In structured hypermedia all subjects, regardless of their learning styles, had almost the same degree of achievement in reading comprehension. This is the same for free hypermedia environments. Moreover, achievement of all subjects, regardless of their learning styles, in structured hypermedia was better than their achievement in free hypermedia environments. This difference in achievement was statistically meaningful in all four learning style groups.

Key Words: learning styles, reading comprehension, structured hypermedia and free hypermedia.

1. INTRODUCTION

All through the history, next to verbal instruction, reading has always been recognized as a means of acquiring knowledge. It has been a means of communication and a way of sharing information and ideas with others, especially in the modern world. Kasper (2003) while elaborating on the importance of reading says, "In a society that places increasing emphasis on the importance of information and communication, strong reading skills are essential not only for students' academic success, but also for their social and economic advancement". However, with the emergence of new technologies, there have been new ways of presenting and delivering information. Computer screens, for example, have now become a common way of reading in the academic context.

Definitely, this is not a change in the medium only. It involves major changes in the way information is presented and processed cognitively. Reflecting on reading, some scholars have commented on "reading as thinking" (Maddox, R. 2005). For some people medium of presentation is as important as the message itself. The mode and medium of data presentation are crucial factors in determining the final message that emerges. This implies that even if the content of the text remains the same, the sort of mental processes involved and the meaning which is constructed will be different depending on whether, for example, you read it on paper or on the screen. This shift has important implications for the language learning process and naturally, it has become an important aspect of study in the field of ELT.

One of the major changes in the medium of study has been the introduction of computers into the learning/teaching situation. Most probably, it is the structure of the new medium, the manner in which it constructs and presents a text, which challenges the reader. This new structure, called hypertext, is an electronic environment in which the content is delivered in a non-linear, non-sequential way. As such, it is a de-centered text; a text which has no beginning or end. Here, the reader has the opportunity to choose a path that most interests him or most meets his preferences. Looked at this way, hypertext is a series of text chunks connected by links which offer the reader different pathways. These chunks and paths are created around associative links to tie the items together into networks of related information. Dunser and Jirasko (2005) go on to say that in hypertext "one does not read (the) document, one navigates through it".

As we have different types of text structures (description, sequence, problem and solution, cause and effect, and compare and contrast, each requiring a different type of cognitive activity), we have different types of hypertext structures too. The two most common linking structures in hypertext research are called structured and free hypertext. By structured hypertext we mean an environment in which the links to text chunks and their branches have been introduced in an introductory page sequentially. Free hypertext, on the other hand, means an environment in which the links to text chunks have been embedded in an introductory passage located at the beginning of each topic. The assumption is that as we might employ different cognitive processes while reading different types of paper text, the kind of cognitive activities we adapt while reading any one of these hypertext environments might also be different. As such, the meaning which is constructed and the comprehension which is achieved might be different depending on the structure of the environment.

Another area of study that has impacted teaching as well as the mode of presentation is learning styles. People prefer and adapt some particular methods and techniques of interacting with, taking in and processing information. Coffield *et al.* (2004) claim that “Knowledge of learning styles can be used to increase the self-awareness of students and tutors about their strengths and weaknesses as learners” (p.37). During the last few decades, the field of learning styles has been adequately and abundantly investigated and now we believe that we have an almost clear picture of how individual differences and learning styles affect the learning process.

There are different ways of approaching the notion of learning styles. Kolb (1984), for example, divides people into four groups according to their preferred learning style. These four learning style groups are: Diverging, Assimilating, Converging and Accommodating. In this model Kolb states that there is a four-stage cycle in every learning situation. This theory is based on a model with two dimensions: perception and process. The first dimension (horizontal axis) is based on an individual's preferred way of learning a task. The left end of this dimension identifies a preference for doing tasks, whereas the right end indicates a preference for watching a task. The second dimension (vertical axis) is based on an individual's thought and emotional processes. The top end of this dimension indicates that an individual prefers to learn through his or her feelings, whereas the bottom indicates a preferred learning process based on thinking.

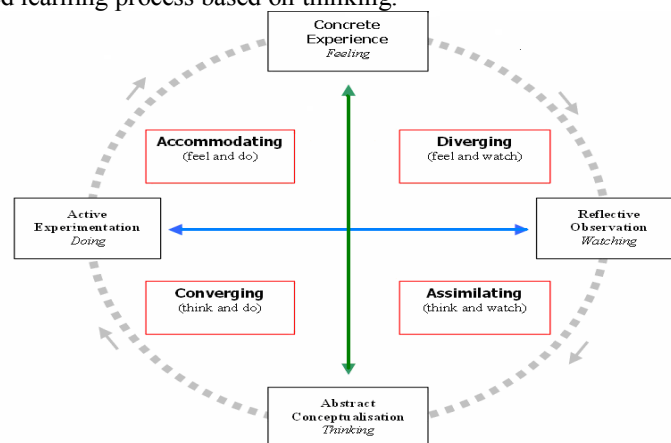


Figure 1: Different aspects of Kolb's learning style model

Kolb's learning style has already been used in the context of research on hypermedia by researchers like Diseko, R. & Van der Westhuizen, D. (2006), Lu, H., Jia, L., Gong, S.H., & Clark, B. (2007), Alessandro, S. *et al.* (2005) among others. What follows are characteristics of each learning style group based on Kolb's classification.

Diverging: Divergers are able to look at things from different perspectives. Their approach to situations is to observe/ watch rather than take action. They tend to gather information and use it to solve problems. Their strengths lie in an imaginative ability. They tend to be interested in people and in emotional elements. They also enjoy brainstorming sessions and working in groups.

Assimilating: Assimilators are best at understanding a wide range of information and putting it into concise, logical form. They are less focused on people and more interested in ideas and concepts. They prefer readings, lectures and thinking things through. Their greatest strength lies in the ability to create theoretical models. They are often more concerned with abstract concepts and less concerned with practical applications of knowledge. These people require good clear explanation rather than practical opportunity.

Converging: Convergers are best at finding practical applications for ideas and theories. They would rather deal with technical tasks and problems than social and interpersonal issues. They like to experiment with new ideas, simulations, laboratory assignments and practical applications.

Accommodating: Accommodators prefer to learn primarily from 'hands on' experience. They are likely to enjoy carrying out plans. Their strength lies in doing things and involving themselves in new and challenging experiences. Accommodators may act on intuition rather than logical analysis. They prefer to work with others and prefer to take a practical, experiential approach. (Adapted from Kolb, 1984).

There are conflicting views as to what happens when people with different learning styles encounter hypertext environments. Sometimes it is claimed that people with a certain dominant learning style gain more advantage from hypertext environments than others. “the benefits of hypermedia in education ... are differentially distributed across learners depending on ... their preferred learning styles” (Dillon and Gabbard, 1998, p.332). However, others have not claimed such a relationship. “The original idea of there being a strong relationship between students' learning styles and attitudes to the use of hypertext documents appears to be without foundation”. (Hart, undated). So, it is worth investigating the issue in depth.

It has to be mentioned that in the context of research on hypertext, different models of learning styles have been used. (Lin and Davison-Shivers (1996), Ellis et al. (1993), Ford and Chen (2000), Bajraktarevic, Hall and Fullick (2003), Graff (2005) have used various models of learning styles in their researches). In this study, the relationship between undergraduate students' learning styles (based on Kolb's model) and the degree of their reading comprehension in two different types of hypermedia environments, namely structured and free hypermedia was investigated. The purpose of the study was to explore which groups of students get maximum benefit out of which hypermedia and their preferences while reading in any of the hypermedia environments. More precisely, this study tries to answer the following question:

Is there any significant relationship between undergraduate students' learning styles and the degree of their reading comprehension in hypermedia environments?

Based on the above question, two hypotheses are formulated as follows:

1. There is a significant relationship between undergraduate students' reading comprehension in hypermedia environments and their learning style.
2. The degree of undergraduate students' reading comprehension in hypermedia environments is significantly higher for assimilators and lower for accommodators.

2. METHOD

2.1. Subjects

A total of 353 Iranian EFL students were involved in the study. These students were third year English majors, studying either English Literature or Teaching English as a Foreign Language (TEFL). These two fields of study are offered in many of Iran's universities; however, subjects of the study were selected from eight universities across the country on the basis of cluster sampling. The assumption is that there is no difference between English Literature and TEFL students in terms of their language proficiency.

Out of 353 students, a total number of 45 students were excluded from the study for various reasons and the data obtained from these students was not analyzed. This reduced the number of students included in the study to 308 students. Out of 308 remaining students, 90 students belonged to the Diverging group; 71 students belonged to the Assimilating group; 80 students belonged to the Converging group and finally 67 students belonged to the Accommodating group.

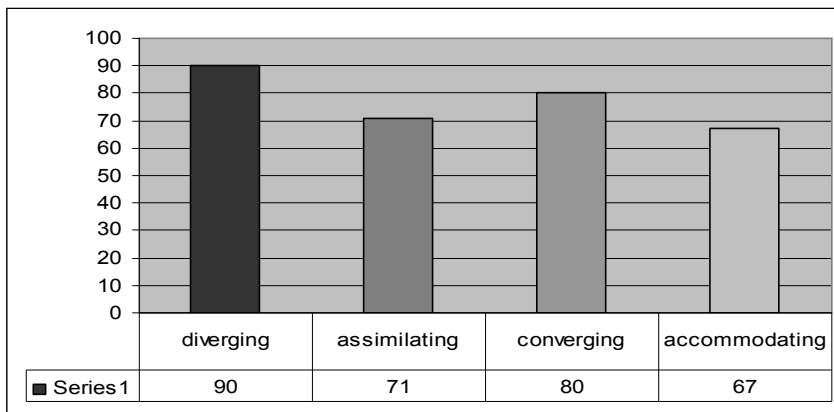


Figure2: Screening of the sample across their learning style

Subjects of the study i.e. third year English majors are considered to be at upper-intermediate level of language proficiency. All subjects of the study had studied English in junior and senior high schools as a subject (usually 2 to 4 hours a week). In university, all the subjects had already passed 14 credits related to reading comprehension. As for experience of on-screen reading, it should be mentioned that all of the students have access to the Internet facilities either at universities or at home (There might be, of course, some exceptions) and for some assignments, they exploit such facilities.

2.2. Instruments

Two different instruments were used throughout the experiment:

2.2.1. Kolb's Learning Style Inventory (KLSI 3.1)

Kolb's Learning Style Inventory is based on the experiential learning theory, earlier proposed by Kolb himself in 1984 (Kolb, 1984). Already five versions of the Inventory have been published over a period of 35 years. The

latest version is KLSI 3.1 which was released in 2005. “This revision includes new norms that are based on a larger, more diverse and more representative sample of about 7000 LSI users” (Kolb, 2005).

KLSI 3.1 has a forced-choice format i.e. it asks the respondents to choose one out of a limited number of choices available on the inventory. It is a short questionnaire with 12 items that asks respondents to choose their preferences between the abstract-concrete orientations and between active-reflective orientations. It ranks an individual’s relative choice preferences among these four modes of learning.

2.2.2. Two Hypermedia Environments

After surfing the Internet for several weeks and seeking some EFL teachers’ ideas, it was decided to develop six topics in two different hypermedia environments, namely structured and free hypermedia. The contents i.e. passages of these environments were originally selected from distinguished web-sites but were not used as they appear on the web. Some changes were made in those web pages to suit the purposes of the study. Since the study aimed at comparison of two different types of hypermedia environments, the links were restructured in two formats, namely structured and free formats. In the structured format, the links were introduced one after the other at the left side of the main page of each topic. In the free format, the links were embedded within a short introductory passage which appeared at the first page of each topic. This introductory passage, by itself, did not have any information load; that is to say it did not provide readers with any extra information. It functioned like a board on which different links were attached. So the difference between these two environments was in the manner of providing links; otherwise, the contents of the links were exactly the same.

After deciding on the content and format of the hypermedia environments, using Microsoft Front Page program, six topics in two different formats (structured and free hypermedia) were developed resulting in twelve environments, six in the structured and six in the free format. Also, one of the ELT teachers who had native like accent, read the passages and his voice was recorded and inserted into the hypermedia environments.

2.3. Content of the Hypermedia Environments

The passages used in this study were of the kind that Iranian EFL students are expected to read and understand. Indeed they read similar passages in their reading comprehension classes. That is the levels of competence necessary here are comparable to the materials they generally use in their reading comprehension classes. All passages were informational as opposed to narrative texts. The passages, intended to be used by these English majors were at upper-intermediate level of complexity. The judgment on the level of passages and their comprehension questions was based on two factors, namely intuitive judgment of the EFL teachers as well as correlation found in a pilot study between reading section of Cambridge *Certificate of Proficiency in English* (cpe) and questions based on the passages of this study. A coefficient correlation of +0.72 was found to exist between the reading section of *cpe* and questions prepared by the researcher.

Subjects of this study were third year Iranian EFL students majoring in English. As such, it was thought that choosing topics from their course content would not be appropriate, since familiarity would affect their comprehension. So, it was decided to take passages from general and diverse fields which would challenge and reflect their comprehension. Thus, the following passages were developed.

Table 1: Contents of the hypermedia environments

Title	Field	Text type
Addiction	Wellness	Explanatory
Sign Language	Language	Descriptive
Recession	Economy	Cause and effect
Digital vs. Film Camera	Electronics	Compare /Contrast
Google	Computer Technology	Explanatory
Feminism	Culture	Discussion

These passages were almost of the same length, each, on average, having seven links of almost the same conceptual complexity. All subjects of the study went through the same *content* either in the structured or free format. This means that every individual student, with whatever learning style, went through three topics in structured format and the other three in free format. After the experiment, the sum of students' achievements in structured and free hypermedia were calculated and compared.

2.4. Reading Comprehension Questions

As for the questions, for each topic, the same questions had been designed for both structured and free formats. So, all students went through the same content and answered the same questions. Also, the questions were of the sort that it was almost impossible to answer them from background knowledge or without having to read the passages. Answering questions demanded careful attention and understanding the passages. There were 55 questions in total. To make the evaluation process more objective, it was decided to cast the questions in multiple-choice format. This format is naturally more suitable for asking factual, detailed and inferential questions, so evaluative and critical questions were in minority. For each topic, a total of eight to ten questions were given.

2.5. Pilot Studies

Before conducting the main experiment, a total of three pilot studies were conducted. The students involved in the pilot studies were not involved in the main experiment because they had already been exposed to the passages and questions during the pilot studies.

The purpose of the first pilot study was to find out the difficulty level of each and every single question. Items with facility indexes of below .35 and above .65 were either modified or replaced by other questions.

The second pilot study was conducted when the final form of the passages and questions were ready to be used in the experiment. Here, along with going through the passages and questions, subjects were, also, exposed to the reading section of Cambridge *cpe* test. As mentioned earlier, a correlation of +0.72 was observed between researcher-made questions and reading section of Cambridge *cpe* test.

The third pilot study was concerned with whether or not links of the hypermedia environments worked properly on computer systems. This final pilot study was also necessary to have a rough estimate of the time needed to complete the experiment.

2.6. Experiment

The core of the experiment was done in multiple sessions (within each university). In each session, students were introduced to the topics of the hypermedia environments and were required to go through them. They covered three topics in structured hypermedia and three topics in free hypermedia. (Topics for all subjects were the same). After going through every structured or free hypermedia environment, the students were asked to answer a set of questions which reflected their degree of reading comprehension. On the first day of the experiment, students covered three passages, and the subsequent day, they covered three others. On the third day, Kolb's Learning style Inventory was administered. There was no time limit for the Inventory and the subjects had enough time to reflect on the Inventory's items. In case of any ambiguity, the researcher was present for clarification. The total time needed to complete the experiment (within each university) was about 100 minutes on the first and second days of the experiment each and 30 minutes on the third day.

2.7. Data Analysis

Analysis of the data obtained through the main experiment was done both manually and by machine. To ascertain the learning style of the individuals involved in the study, the researcher followed the instructions provided by the publisher of the KLSI 3.1 and analyzed the data manually. However, analysis of the statistical data was done by machine using SPSS software.

3. RESULTS

3.1. Achievement of the Subjects in Structured Hypermedia

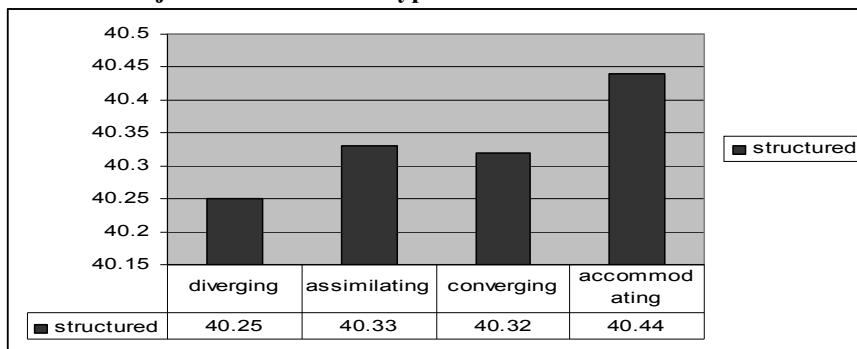


Figure 3: Means of all learning style groups in structured hypermedia

Table 2: ANOVA for structured hypermedia

		Sum of Squares	df	Mean Square	F	Sig.
structured	Between Groups	1.428	3	.476	.047	.986
	Within Groups	3067.127	304	10.089		
	Total	3068.555	307			

Based on the above ANOVA, (Sig \geq 0.05), it is obvious that the achievement of all subjects of the study in structured hypermedia environments, regardless of their learning styles, is the same. That is to say, the difference observed in their achievement is not statistically meaningful and can be ignored.

3.2. Achievement of the Subjects in Free Hypermedia

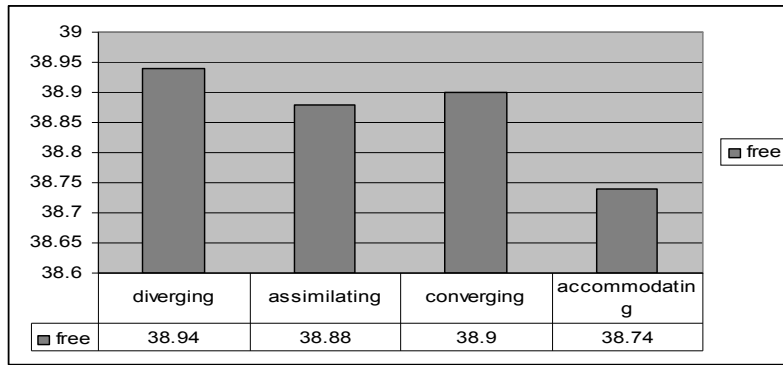


Figure 4: Means of all learning style groups in free hypermedia

Table 3: ANOVA for free hypermedia

		Sum of Squares	df	Mean Square	F	Sig.
free	Between Groups	1.604	3	.535	.046	.887
	Within Groups	3551.707	304	11.683		
	Total	3553.312	307			

Based on the above ANOVA, ($Sig \geq 0.05$), it is obvious that the achievement of all subjects of the study in free hypermedia environments, regardless of their learning styles, is the same. That is to say, the difference observed in their achievement is not statistically meaningful and can be ignored.

3.3. Achievement of Each Learning Style Group in Structured and Free Hypermedia

At this point, we will investigate how well individuals within each learning style group performed in structured and free hypermedia environments and whether there is a meaningful difference in their performance. Figure 5 compares the achievement of each learning style group in structured and free hypermedia environments.

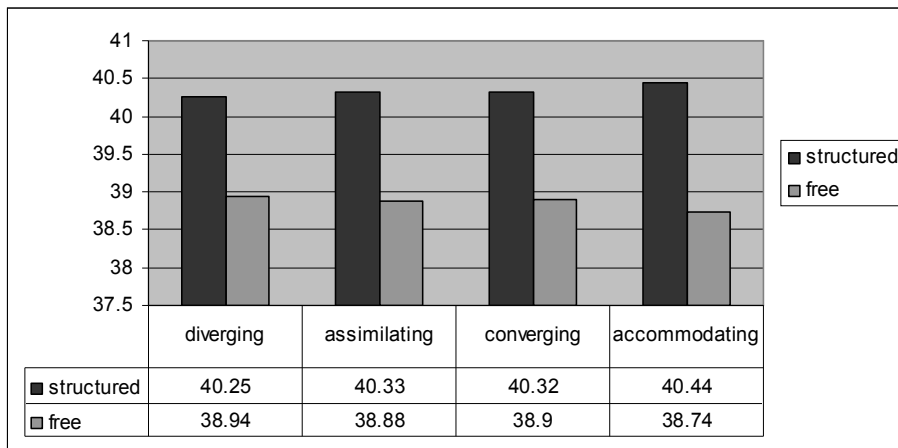


Figure 5: Means of each learning style group in structured and free hypermedia

3.3.1. Achievement of Diverging Group in Structured and Free Hypermedia

Table 4: Mean differences between structured and free hypermedia in Diverging group

Environment	Mean	SD	df	t	Sig.
Structured	40.2556	3.13573	89	2.636	.010
free	38.9444	3.36993			

3.3.2. Achievement of Assimilating Group in Structured and Free Hypermedia

Table 5: Mean differences between structured and free hypermedia in Assimilating group

Environment	Mean	SD	df	t	Sig.
Structured	40.3380	3.23350	70	2.543	.013
free	38.8873	3.44984			

3.3.3. Achievement of Converging Group in Structured and Free Hypermedia

Table 6: Mean differences between structured and free hypermedia in Converging group

Environment	Mean	SD	df	t	Sig.
Structured	40.3250	3.20512	79	2.606	.011
free	38.9000	3.44431			

3.3.4. Achievement of Accommodating Group in Structured and Free Hypermedia

Table 7: Mean differences between structured and free hypermedia in Accommodating group

Environment	Mean	SD	df	t	Sig.
Structured	40.4478	3.13477	66	2.949	.004
free	38.7463	3.41717			

The above t-tests based on the collected data show that achievement of all subjects, regardless of their learning styles, in structured hypermedia environments well exceeds their achievement in free hypermedia environments. That is to say no matter which learning style group they belong to, they will do much better in structured hypermedia environments than in free ones.

4. CONCLUSION AND DISCUSSION

The findings of this study suggest that no matter to which learning style group students belong, preference for the structured hypermedia is predominant and the achievement in hypermedia environments is irrespective of the subjects' learning styles. In structured hypermedia all subjects, regardless of their learning styles, had almost the same degree of achievement in reading comprehension. That is to say, the difference in their achievement is marginal and not statistically meaningful. This is the same for free hypermedia environments. The difference observed in the achievement of all subjects, regardless of their learning styles, is not statistically significant and can be ignored.

Moreover, achievement of all subjects, regardless of their learning styles, in structured hypermedia was better than their achievement in free hypermedia environments. This difference in achievement was statistically meaningful in all four learning style groups.

Based on the above mentioned findings, both hypotheses of the study are rejected because no significant relationship was observed between Iranian EFL students' learning styles and the degree of their reading comprehension in hypermedia environments. And though the mean of Assimilators in free hypermedia environments is higher than that of Accommodators, this difference is not statistically significant and can be ignored. Moreover, in structured hypermedia, unlike research hypothesis, achievement of accommodators is higher than that of assimilators. Of course, here again the difference is not statistically significant.

Although a major bulk of literature on learning styles suggests that learning styles have a bearing on performance, there is a lot of evidence in the literature which is in line with the findings of this study. These studies suggest that irrespective of the learning style, the structured hypermedia will be preferred over the free hypermedia. According to Jonassen (1988), hypertext documents with explicit linking structures, such as hierarchical or linear, help users find and understand information more efficiently. Schneiderman, et al. (1991) also says that structured links will control information flow and lessen cognitive overload. Foltz (1996) while discussing the structure of hypertext claims that "since one of the concepts of hypertext is to permit more flexibility for the reader in choosing where to go, a low knowledge reader may not be able to accurately choose the relevant text sections. Thus, low knowledge readers may have additional problems of navigating through the hypertext structure ..." He continues, "Well structured hypertext which does not impose a large navigational load on the reader may be an advantage for poor readers. On the other hand, poor readers may have great difficulty with a less structured hypertext...". Mohageg (1992) and Edwards and Hardman (1989) reported that users of hierarchical linking structure perform significantly better than those using web linking structure. The multiple paths inherent in a hypertext cause a greater navigational load on the reader than a linear text. In addition to comprehending text, readers of hypertext are also responsible for navigating the text. The more attention readers give to navigating the hypertext, the less they devote to integrating the information.

Subjects of this study, as already has been mentioned, were 308 Iranian EFL students. Coming from high schools with strict disciplined environments and accustomed to reading highly structured paper texts, they probably found structured hypermedia more convenient and advantageous and achieved statistically better results compared to free hypermedia. This perspective highlights the importance of background and previous experience in working with hypermedia environments. It suggests that no matter what the learning style is, if one is accustomed to performing in a structured environment, one would probably feel easier working in the structured rather than the free hypermedia.

This might overshadow the concept of learning styles. Though a controversial issue, 'learning styles' is an established area and in spite of several decades of debate on the notion, nobody denies its existence. It can be probably said that learning styles are not fixed traits and people facing specific tasks may adapt a way of

confronting a situation which is not in line with their prevalent learning style.

One more argument is concerned with the type of tasks the subjects of this study were required to perform. After going through the hypermedia environments, they were supposed to answer some comprehension questions. These questions were in multiple choice format which is similar to the type of questions they are exposed to after reading paper texts. Their preference for structured hypermedia might be an imitation of the classroom procedures.

4.1. Implications

The first implication of this study is that learning styles should not be treated as fixed characteristics. This means that people facing specific tasks may have to or prefer to adapt a way of approaching them which is not in line with their prevalent learning style. So, it is important that the teaching/ learning situation takes care to develop all the possible skills or strategies which they might need in future. This would also help the students to choose and decide which strategy would be helpful for which purpose.

The second implication is concerned with hypermedia designers. To provide text comprehension in hypermedia environments, authors should provide well-structured environments that do not impose a large navigational load on the readers. Additional tools like maps show the text structure and the relationship between text nodes. Structural cues, headings and connectives, also, facilitate comprehension and reduce the effect of cognitive load which is inherent in hypermedia environments.

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