IS HYPERTEXT A MORE FLEXIBLE TEACHING TOOL FOR EDUCATION?

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Hypertext (HT) is nonlinear and nonsequential text. The paper gives a brief overview of HT, its definition and salient features. It also describes why HT is required for teaching and what are its strengths and weaknesses for using it as a teaching tool in education. It also points out the important reasons for using HT as a teaching tool and its impact on education.

INTRODUCTION

Human thinking is not sequential, though it becomes sequential when it is written for a speech. Since the birth of paper and book, the literature has been recorded in sequential and linear fashion and this practice is still continuing today. In reality, there are many cognitive lines between topics and subjects, because the entire Universe of knowledge is inter-linked and inter-related. Hypertext (HT) is nonsequential text, which offers the possibility of representing and exploring knowledge more originally and naturally.

There are about 100 different types of HT/Hypermedia (HM) systems developed by different people for various purposes. At present about a dozen of organisations/institutions/universities are working full time in developing such systems. HT is one of those softwares, through which one can develop courseware from kinder garden to advanced research. It has got a lot of potentialities which any good teaching technique must have. Therefore, a number of schools, colleges and universities have already started using it for designing their courseware, presentation of information and developing both interactive video and computer based instructions.

HYPERTEXT AND HYPERMEDIA

The concept of Hypertext was originated by Dr. Vannevar Bush, when he was working as Science Adviser to Roosevelt, President of the USA, in 1945. During those days he foresaw the problem of future information explosion and developed a mechanical recording device, which he called ‘Memax’ to cope with his own information needs.

Afterwards, in 1950s, Douglas C. Engelbart, a pioneer in computer science picked up the same idea and developed a system called ‘Online System (NLS)’ with all those features. He also invented the mouse and five key chord input devices and many more things related to HT.

The third pillar of HT is Theodor H. Nelson, a computer guru who first coined the word ‘Hypertext’ in 1965 [2] and also many other words and new concepts related to this field. It may be that Bush is the originator, Engelbart is the developer, and Nelson the disseminator of the idea to the world. Nelson defined HT as follows:

“HT is the combination of natural-language text with the computer’s capacities for interactive, branching or dynamic display...... of a nonlinear text........... which cannot be printed conveniently on a conventional page......” [3].

This lead to the modern definition of HT as follows:

“A large number of information fragments/chunks (such as text, graphics and images) linked together electronically forming a multifaceted indefinite shaped database in which one can write and read the information non-sequentially and non-linearly”.

Hypermedia (HM) is simply an extension of HT with which authors can create a linked
A corpus of materials that includes text, static graphics, animated graphics, video, sound, music, etc. [4]. The difference between HT and HM is that an HT system allows authors to link together only textual information blocks, whereas an HM system provides linking capabilities between heterogeneous blocks of information created with different applications. So HM is a framework for non-linear representation of text, graphics, images, sound and animation in the computer.

PRINT MEDIA vs HYPERTEXT

In spite of many disadvantages of paper media for structuring text, its use has continued for the past seven centuries. It is, of course, very convenient and one can place all the books, periodicals, reports, notes, and other forms of information sources on the same table and read, compare and work with them. Whereas with other media like audio, video, magnetic and optical media, it is yet not possible to store heterogeneous formats of information on one platform/base, and even if it is possible, comparing would not be so convenient as in the case of print media. Perhaps easy to use, store, read etc. are very strong advantages of the paper media because of which it was not replaced by any other media for a long time.

Many HT systems differ from their print versions on paper in many ways including its structure, organization and functionality. Reading full text in HT is much slower than printed version but other advantages like interactivity, browsing, navigation through a great volume of text must be set against its disadvantages. In print version also, one can create HT features in a document by creating nodes in the linear text, but this is not as effective as in the electronic form. Ben Shneiderman’s ‘Hypertext hands-on! an introduction to a new way of organising and accessing information’ is an example for both the print and the computer version of the book in HT format. There are two and a quarter inches disks coming with it which contain Hyper TIES (a HT system) version of that book. Print version of the book is not found as effective as the computer version.

Browsing is an important aspect of information search even in electronic environment. There are a number of effective browsing techniques in HT, but the prominent ones range from random and informal to systematic and formal. Since HT is always dynamic, the organization of a document is such that the reader is not at all limited by only nodes but there are also so many other advantages. HM/HT system allows users to browse and navigate quickly through any complex networks of information, and find explanations, references, comparisons, definitions etc. from the nodal points created in the system which gives a HT a considerable potential in developing and using the courseware for the students.

SALIENT FEATURES OF HYPERTEXT

In HT, knowledge (information) is represented in frames (Knowledge Management Systems or KMS), cards (Hypercards, Notecards), nodes, i.e. Geographical Issue Based Information Systems (GIBIS), etc. The information may be a paragraph, a diagram, a graphic or a combination of any of these items. By interlinking all the small chunks/fragments of information, a HT database is formed.

Following are the salient features of a HT database.

- Users can rapidly navigate within a HT database, moving from one chunk to another by selecting/clicking on them is easy.
- A user can create, edit and rearrange the chunks according to his interest and needs.
- The user is able to see even a small fragment of information at any time even in a large HT database.
- In HT, there are no hierarchical page boundaries like a conventional book.
- In a HT systems, the user can navigate by moving rapidly in either direction between the nodes of the HT database.
- In a HT environment, the computer brings the user close to natural human knowledge processing. Even though HT does not incorporate an artificial intelligence (AI) concept like an Expert System (ES), it is
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more useful than the ES in enhancing human skills and knowledge effectively.

- An HT system allows the user to access information by both associative and intuitive routes, irrespective of knowledge of the actual location of information or any visible database structure.

- To a large extent, HT leaves control of information in the hands of users.

- The HT database can have a changeable structure (like an amoeba) It keeps on changing according to the author(s) or designer(s) addition, deletion or editing of the text, graphics, images, etc. It does not have a clear structure like a conventional book in which the length and breadth can be defined. Moreover the arrangement of information in the HT database changes every time according to the user's interaction.

- In HT environment, there is no difference between author and reader or teacher and student. All are equal.

- Unlike a printed book, HT is multifaced with many entry points to add or retrieve information according to the need/requirement, level of interest and learning style of the user population.

HYPERTEXT AS A TEACHING TOOL

Use of movies, audio-visual (A-V) materials like transparencies, slides, audio tapes, etc., and Computer-Aided Instructional (CAI) materials was initially introduced in the educational technology to supplement the traditional teaching methods. But none of them replaced the conventional teaching methods. The teaching aids changed the position of the instructor from teacher to helper. Almost a revolution took place in the field of educational technology when videos and computers were introduced as teaching aids/tools for teaching in the schools, colleges and universities. The educationists started developing their lessons in the form of video tapes and CAI programs in which students could listen, watch and interact with the course material. When using it, if a student could not understand a particular concept, he/she could replay that part as many times as required and clear the doubts.

In the 1970s and 1980s, a number of new teaching tools/methods were introduced such as Expert systems, Interactive Video Disc (IVD), Computer Aided Instructional (CAI), Computer Based Training (CBT), Multimedia and the recent HT. HT has got powerful interactive methods. It is very simple and fast in retrieving associated information from the database. HM has gone a step further by incorporating other media elements to text. It is one of the most important recent innovations in the field of educational technology and has made a lot of impact on students in their learning processes. Because of its non-linear writing and inter-linking of information fragments, called 'seamless information', it provides random access to a piece of information in a database. A major problem is that both HT and HM require good data modelling to interlink the data files, The beauty of HT for teaching is customizing and developing personal links inbetween the information fragments in a hypertext database.

REVIEW OF LITERATURE ON USE OF HT

HT has got lot of potential and flexibility in the ways of presenting the teaching materials. The students may change it as they want and understand fully. Moreover, as compared to other teaching tools, it is easier to experiment and reorganize the information in the reading materials. HT offers innumerable possibilities for teaching and learning to both the students and the teachers of any subject. Research on this topic suggests that HT cultivated among the students, the habit of critical thinking, skilled reading and logical linking of related fragments of information [5].

It is a good tool for the students because they can assimilate a large portion of information while reading and developing links. Thus it is not only possible to use HT to present the basic information on a subject, but also to encourage analytical thinking about the presentation and linking of that information. The capacity to allow multiple links to an individual chunk of information may encourage the students to cultivate the habit of approaching any information fragment from multiple directions and thinking critically to add their comments. Moreover it makes the students par-
ticipate in the teaching and learning program rather than the passive type of learning in traditional teaching.

In an HT environment, when a student is given a selected list of readings (hypertext courseware materials) for doing an assignment, normally without going through all those materials, the student cannot complete the assignment satisfactorily. Whereas in traditional teaching, the students may do selective readings for completing their assignments or coursework, with the result that the students are not reading even the prescribed syllabus. As a result they do not understand the subject fully, which ultimately effects the basic purpose of education. This is one of the strongest factors of HT which achieves one of the main objectives of education, which other CBT systems or A-V tools could not achieve from ages together.

Another advantage of HT is that during learning process the student develops authoring skills and also start contributing his views as notes, new thoughts, arguments, comments, etc. which ultimately affects the growth of HT system. The student may feel more responsible because his contributions will be referred to by other students and teachers. This does not only help the students in establishing a communication link between the learning community of the system but also provides them chance to present their ideas.

HT has got multifaced instructional applications in all areas of curriculum. The teachers would have an infinitely greater range of choice over what to teach. Many instructors in different schools, colleges and universities have started developing HT systems for teaching.

Brown University’s English and Biology departments were the first to use the hypertext for teaching at the University level and found that the students who used these materials were not only quick to grasp the subject, but also developed analytical thinking and designing skills [6]. So during the teaching process, HT as a teaching tool reflects on students’ thinking and improves their meta-cognitive skills.

In the University of Southern California it was observed that the students of Freshman Writing Program “Project Jefferson” felt difficulty in accessing information in the library for their composition class which resulted in poor quality of their research papers. To overcome this problem, Clark started the ‘Project Jefferson’ using Hypercard for teaching the fundamental research skills like how to get information and utilize it for their academic writing. Eventually, she found that HT made profound impact on the students in improving their academic writing [7]. Kay E. Vandergriff of the State University of New Jersey has selected Edna St. Vincent Millay’s poem “Justice Denied in Massachusetts” and designed a Hypercard stack for teaching. Since Poetry is the neglected area in the literature, he took a poem as an example and experimented in developing a Hypercard courseware for teaching his students. He also suggested the librarians to build the stackware collection in the libraries and the ways to overcome the copyright problems but has not reported the impact of that courseware on the students [8].

A number of departments at the University of Toledo, such as Department of Educational Technology, Biology, Foreign Languages and some others are developing their courseware in the form of Computer-Based Instructional materials and Interactive video programmes using Hypercard software. The response of the students seems to be noticeable [9].

In a class, after some exposure to the system, the students were observed to develop the stories on art education and needed a little intervention by the tutor to guide them in extending their abilities [10]. They liked to submit their assignments in hypertext form rather than traditional form.

At Wayne State University, John Camp and Mare Cogan have developed “The School of Athens”, a stackware for the art students with the help of Hypercard. The art lessons in the form of stackware influenced the students’ participation and created interest in teaching to a great extent [11].

At Coventry Polytechnic, Alan Dyer has investigated a number of problems related to HT and art & design teaching. They found that the students’ creative capabilities were expanding after using the HT courseware both in...
The most interesting observation was that several students were enthusiastic in submitting their assignments (i.e. essays, thesis, etc.) in the form of HT documents. The department is now investigating the impact i.e. special cognitive skills and educational benefits of HT on the students while authoring their course work.

"The Living Textbook of Pathology" is an interactive HT system developed to provide a framework for interactive growth and updating of an undergraduate pathology curriculum. The living text system utilizes a database which is a database about the databases. This system consists of various types of information like what type of users, how and where, can get and save the information, and who is (are) the author (s) of those information fragments, etc. A number of important lessons were developed on this system and the use of the system by the students was also recorded, which was very significant i.e. 3600 hours for all lessons. At that time they could not measure or find any direct impact on the undergraduate medical students because of its prototypeness, but found its usefulness for the continuing education of practicing physicians, even at the beginning of its development [13].

"Training the Trainers", an HT based training package was designed by Philip J. Gartshore, school of Architecture, Portsmouth Polytechnic to study various methods of students learning. The package was designed with HyperCard software and implemented on an IVD. It was also found that this training package motivated the students in using it more and more [14].

In 1989, Drexel University has developed HyperCard based HT instructional software tool called 'Drexel Disk' for distributing the day-to-day required basic information about the University, its departments and facilities available to all the newly joined students. They found that the distribution of disks are comparatively cheaper than the printed brochures containing the same information. In a study it was found that the students were satisfied with the disk except its up-to-date ness [15].

In another case at Rentgers University's library of Science and Medicine Department has also designed LSM Infomaster: a HyperCard based CAI program for giving introductory training for all the freshly joined engineering students. It was found to be quite useful but they have not studied the impact of that software on the students [16].

General Electronics Corporation's Unit at East Cleveland (GE-Lighting) has developed a prototype Machine Adjuster's Helper (MAH), a PC based HT system for training their mechanics. MAH system was designed with two subsystems, i.e. an HT subsystem with textual and graphic information intended for training and another diagnose subsystem which has an expert system to diagnose the troubleshooting production problems. During their experimental stage itself, it was found to be very much useful in boosting both the parameters, i.e. the materials efficiency and the machine uptime [17]. It was also found that the system is very much user-friendly and none of their mechanics pointed out any negative criticism about the system.

It is generally regarded as difficult and time-consuming to design a good training programme. The teachers who design courseware should envisage the needs of slow learners as well as the intelligent students. In general, the designer of machine learning system unlike HT, should undertake expensive experimentation and debugging. Linking of fragments in the web must be tested and all those sequences should be easily available to the student to understand the subject/topic effectively. Misunderstanding of the students should also be anticipated and prevented carefully while sequencing and linking the thought contents.

REASONS FOR USING HYPERTEXT AS A TOOL FOR TEACHING/LEARNING

Following are some of the reasons for using HT as a teaching tool.

1) The main reason of using HT for teaching is that a student will use his/her optimum freedom according to his/her choice because the text in HT is presented more
naturally than sequentially. Moreover the boundaries of the subject fields are arbitrarily unlike the printed book.

2) Normally while browsing a conventional printed book, people do not read the entire book. They generally read the required portion from the book in their own way. HT provides connections and relations between the information fragments scattered at various places.

3) HT makes it possible for the students to make marginal notes or highlight the portions of text.

4) Since the information in HT is arranged in associative linked form, one can retrieve additional depth of knowledge on a specific aspect just by clicking on an active node with the mouse.

5) Publications are conventionally aimed at a particular level of audience, for example, text books are for students, articles are for researchers and so forth. In HT, a single form could serve the purpose of the elementary reader to the adult/advanced researchers; depending upon the level of user's interaction and the approach to the database.

6) In HT, one can present the teaching materials, with a combination of graphics, animation, sound and text in a dynamic form which is better than any other existing teaching aid such as CAL, Computer Based Education (CBE), CBT, A-V materials, etc.

7) One of the aims of HT is to improve the existing learning practices. So in HT, the main strategy of learning is by exploring the information by the learner, which is a powerful capability. Here learner is completely independent to move, learn and to take independent decisions.

8) HT also allows individual instructions to the learner which is normally difficult in traditional teaching.

9) Collaborative writing is one of the features of the HT which is useful for education in which a number of people could share the ideas, works, designs in their development. KMS is the best example for this.

10) Inter-linking of ideas and concepts is one of the useful aspects of HT for teaching. Almost all the HT systems support the easy creation and inter-linking of the information fragments which will be useful for easy navigation and browsing the HT databases by the students.

11) Continuous creation and updation feature of HT is one of the many advantages for teaching which is a bit difficult and also time consuming process in case of books and other teaching materials.

12) In HT, one can write new ideas/concepts and add individual views for the existing ones and also link them with the other ideas/views.

IMPACT OF HYPERTEXT ON EDUCATION

The impact of HT may be mainly envisaged in three areas:

a) The replacement of traditional oral medium by the dynamic visual media with graphics, images etc.

b) Specialized training course for the HT courseware developer by incorporating areas like HCI, graphics, programming, educational psychology, cognitive studies, etc.

c) The development in analytical/thinking and skills of students.

Research results indicate that after using HT, students have developed their critical thinking skills comparatively more in their teaching process [18]. The student who had access to HT course materials was found to grasp and understand better than others.

DISADVANTAGES OF HYPERTEXT

Poor designing is one of the most common problems in many of the HT systems. The text in the HT is in the form of broken fragments. Therefore, if the links are not successful or logical, it will be neither attractive nor effective. So, the HT author or developer should be a good designer with a good bit of knowledge in HCI, cognition studies, computing, education
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Another major problem of HT is that the bigger the system, the possibility of getting lost in the system is greater. In general, if the number of nodes/chunks increase from a certain level, the complexity of hyperspace which is proportionate to the user's chances of getting lost in the system is also increased. Even though different systems are providing different methods to keep track of the user's path, the possibility of getting lost is not ruled out. Unless the user knows the reading skills and knowledge organization of HT system, he cannot make an optimum use of it. Following are some of the drawbacks of the HT system.

1) The systems are incompatible due to lack of standardization in HT systems.
2) According to theoretical definitions, so far no full fledged ideal HT system is built, with the result that the idea is not very much popularized.
3) The HT database is generally very large and a new learner finds it difficult to keep control of it and hence loses interest.
4) Lack of good designers of HT databases.
5) In case of bigger HT systems, they are neither portable nor easily accessible like books by everybody.
6) Designer's or author's copyright for the software is not well protected.
7) Learner has to put some extra efforts in remembering/concentrating on the system to maintain several tasks at a time which causes some strain on him. This is called 'cognitive overhead' problem.
8) Reading of HT courseware materials is more slower than books and also causes lot of strain on reader's eyes and mind.

CONCLUSIONS

Even though the idea of HT was introduced earlier than the development of the computer, it did not popularize just because people did not clearly understand its main theme. It started becoming popular only from the last four years. It was when Apple Computers started supplying its HyperCard system free of cost with the purchase of any of their Macintosh computer that the idea of HT started gaining popularity.

Now HyperCard, an HM system has made amazing impact on people's thinking and the concept is spreading day-by-day and is being used for teaching in schools, colleges and universities throughout the world. Inspite of its few drawbacks, HT has got tremendous potential for any application in which information has to be retrieved and presented effectively to the users. Since the main output of this media is in visual form which is very familiar to the general public, it will definitely become more popular in future.

Now the main task is to develop good vocabulary, syntax, structure and behaviour of various forms of text, etc. in order to get maximum benefits out of it. HT has profound influence on education and scholarship, especially during the past six years. It was clearly observed that after using HT, students improved skills such as creativity, flexibility, decision making, evaluation and synthesis of information, confidence building etc. Designers of HT system are trying their best to eliminate its drawbacks and improve their usability. Comparatively, the number of people involved in conducting research in this field has increased in multi-folds during the last four decades. If these systems over come the problem of incompatibility, the mass introduction of hypermedia materials in education through out the world is expected very soon.

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