

Chapter 21 Summarization:

User-centered design of hypertext/hypermedia for education

What is Hypertext; what is Hypermedia?

Hypertext is defined as text with links. The contents are organized into chunks, units, or nodes. The links form connections between certain nodes, which can contain anything, be of any size, and be linked to any text. The links in hypertext are active which makes it more dynamic than printed text. To implement active links, dynamic display medium such as a computer screen is necessary. Hypermedia, on the other hand, is a further development of hypertext. It uses the same techniques to link sound, graphic, and video together. The distinction between hypertext and hypermedia is arbitrary; therefore, both terms are used to refer to a set of nodes of information that are dynamically linked.

The Genesis of Hypertext

The chapter discusses three persons who contributed to hypertext, Vannevar Bush, Doug Engelbart, and Ted Nelson. Bush imagined a device called the memex. He sought to create a means of information storage and retrieval that was intuitive to users by virtue of its similarity to the workings of the mind. His need for system design was viewed as a user-centered manner; however, his idea was not developed for two decades. While Bush's ideas were based on cognitive equivalence, Engelbart developed his hypertext by basing on the augmenting of human intellect. His first implementation was NLS (oN Line System), a computer-based environment containing documents like memos, notes, reports, etc, in addition to supporting planning, debugging, and communication. Engelbart viewed hypertext as some form of cognitive artifact, extending the capabilities of the human being and offering the potential to attain performance levels in information tasks. The term hypertext is, however, attributed to Ted Nelson and his

system, Xanadu -- a docuverse in which the entire literature of the world is linked. A World Wide Web developed by Berners-Lee and colleagues at CERN comes close to this idea.

Hypertext and learning

There has been a radical shift in prevailing pedagogy between the earliest teaching machines and the latest hypermedia environment from repetitive reinforcement schedules of the behaviorists through the cognitivist movement and latterly to the constructivists.

Literatures from 1989 to 1993 concerned only the usage of hypertext with learning. Very few reported on systematic evaluation of hypertext in an educational setting. Beeman et al. (1987) reported a small positive correlation between high Intermedia use and high grades. However, the finding suggested that improvements might not have been attributed to the introduction of hypertext per se, but rather to factors related to its introduction. Beeman also questioned about the improvements of grades. The studies did not offer evidence that the style of thinking fostered in an English literature and a plant cell biology courses would transfer to other courses. However, Beeman's study was an excellent illustration of the difficulties involving in assessing the effect of introducing not only hypertext, but also any new teaching technique or technology into an educational context.

Furthermore, educational technologists knew very little about a cognitive process of learning. This would make evaluating the interactive technology to support learning process not straightforward. Hammond and Allinson (1989) suggested that hypertext could provide the basis for an exploratory learning system with more directed guidance and access mechanisms. Surprisingly, their study yielded no reliable differences between the task conditions of three groups of subjects who used hypertext with no additional facilities, had either a map or index or guided tours available, and had all three facilities. Hammond and Allinson's study revealed

contrasting result to the Beeman study in that their study was controlled and experimental nature, while Beeman's study was an applied nature. Stanton and Stammers (1990) suggested that a nonlinear environment allowed different levels of prior knowledge, encouraged exploration, enabled subjects to see a subtask as part of the whole task, and allowed subjects to adapt material to their own learning style. They reported that performance was significantly improved when subjects were trained in the nonlinear condition.

Two equally plausible interpretations could be made when saying that a hypertext environment provides greater learner control than and therefore possesses advantages over traditional paper-based learning materials. First, there is a greater control over users' access to the hypertext contents by ways of the links provided by authors/designers. The second one is the greater control by users because they are free to follow the pathways of their choice. Even though the second choice seems reasonable and attractive, in reality, the learner is at the mercy of the author, relying on his having provided suitable links. However, Romiszowski cautioned that when learners were free to select their own strategies, they did not always select wisely.

One might best consider hypertext as an information-accessing medium and learners as seekers of information before positing elaborate notions of thinking style that proves difficult to validate empirically. By looking at this perspective, one could shift the concern from theorizing about the mental activity of learning to designing an information environment that could support task performance. Several studies were cited to support this statement. Gordon and Lewis (1992) concluded that linear formats should probably be retained. Higgins and Boone's (1990) revealed study which compared the effectiveness of a hypertext study guide used either in combination with or instead of lectures that the study guide could provide some students with the practice necessary to increase quiz performance. McKnight, Dillon, and Richardson (1996)

argued that Higgins and Boone did not consider subjective preference in their study. They believed that if there were not much to choose in terms of outcome, the more attractive system would have a major advantage in terms of student motivation. The authors referred to van den Berg and Watt's (1991) study, which compared the effectiveness of a hypertext document containing materials on introductory statistics and hypothesis testing. The result revealed no significant differences in the objective performances of the groups; however, the subjective acceptance of hypertext was highest in the supplementary condition and lowest in the competitive condition. Van den Berg and Watt concluded that hypertext might be useful as a replacement for in-person instruction where teaching was not available.

Moreover, Jonassen (1993) suggested that a fair evaluation of learning from hypertext could only come from hypertext-literate learners who had developed a useful set of strategies for navigating and integrating information from hypertext. Marchionini and Shneiderman (1988) contended that hypertext was more suited to browsing than directed retrieval tasks. Jones (1989), however, hypothesized that more incidental learning would occur in a browsing task than in a task requiring the use of an index. She believed that the learner's semantic net was more likely to be elaborated or more learning would likely to occur. However, her study revealed no significant differences in terms of performance on the incidental learning questions.

The authors concluded by stating that the aforementioned studies illustrated the problem that befall most evaluations of hypertext in education -- the difficulties in controlled experimentation, in finding ecologically valid tasks, in describing process, and of defining let alone measuring the outcomes of learning. Evaluations of hypermedia-based learning should address the process and the outcomes of learning. This point of view leads to the user-centered system design and the perception of hypertexts and their users as one form of system.

User-centered design

Four basic factors that involve with the usability issues are users, their tasks, the information space in which the task is being performed, and the environment or context in which all the factors interact. The essential first stage of user-centered design methods is the analysis of users' skills and requirements. Designers should be aware that users are varied tremendously in terms of skills, habits, intentions, and other attributes that they bring to the computer when interacting with hypertext. Second, when a new information presentation medium is developed, designers should determine the nature of the tasks it is intended to support. Information space refers to documents, database, texts, etc. on which users work. It is considered the presence of a boundary rather than the size or number of items. Finally, it is essential that the contextual variables be clearly specified.

Usability and Hypertext

Jonassen (1990) stated that the most significant problem in creating hypermedia was to decide how to structure the information, and the answer depended on how the hypermedia would be used. Wright (1990) supported a strongly user centered approach to hypertext design for educational applications. She suggested that the answer should depend on the task that the learner was engaged in. However, McKnight, Dillon, and Richardson (1996) argued that there were many ways which a function could be provided and which a database could be searched. Though hypertext could support activities impossible or difficult to perform with paper, one should be certain that a particular design was introduced in order to improve or to enable valid learning tasks.

Beyond media differences Information structures and knowledge representation

Readers form mental representations of a linear text structure in terms of spatial location and overall organization. Experienced academic journal readers can predict the location of isolated selections of materials with a high degree of accuracy, even when they do not read the target materials in detail. Such representations are derived from years of exposure to the information types or from a quick scan of the material. Therefore, consideration of existing models is vital in the design of new versions.

The qualitative differences between the models readers possess for paper and electronic documents can easily be appreciated by considering what one can tell about at first glance. A paper text is extremely informative where hypertext is not. Hypertext may appear to be a completely new presentation format and free to establish new user models based on the radically new technology. However, for the creative system designer, the current generation of potential users approaches the new technology with expectations that are grounded in print. Experienced readers have acquired expectations of how information spaces are organized, and designers need to be aware of this in their designs.

Conclusions

The authors suggested three options for creating hypertext in an educational setting – a reduction in expectations, a switch from process to outcome, and a concentration on an evolutionary approach to development, building on user models rather than trying to make a step-function change.