INFORMATION SCIENCE PUBLISHING
701 E. Chocolate Avenue, Suite 200, Hershey PA 17033, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.idea-group.com
ITB9846

Chapter XX

Precursors to Web-Based Methodologies: Lessons We Can Learn from Teaching Machines, Automatic Tutoring Devices and Learning Hierarchies

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ABSTRACT

Many of us are using the World Wide Web in ways that are similar to the teaching machines and automatic tutoring devices of the 1950-1960s, yet we are moving ahead without building upon a base of knowledge that already exists from that era. This chapter reviews the basic ideas of the original automatic teaching and tutoring machines of those two decades — a linear programmed learning model and a programmed branching model — and compares these to hypermedia methods that are now enabled via web technology. Some classic ideas in assessing the cognitive and affective learning outcomes of teaching — somewhat analogous to usability issues of utility and likability — are reviewed. Greater emphasis on considering the educational outcomes is advocated when we use new online teaching technologies in programmed instruction.

This chapter appears in the book, E-Education Applications: Human Factors and Innovative Approaches, edited by Claude Ghaoui.

INTRODUCTION AND BACKGROUND

With the rapid advances in technology in the last few years, it is important that we explore the use of technology in education. The mechanical and computerized teaching machines and automatic tutoring machines of the 1950-1960s experienced a natural death, perhaps in part because they were so expensive and cumbersome (except in programmed textbook form), prohibiting large-scale implementation. The Web and hypermedia-based dynamic HTML now gives us the same programmable capabilities as the programmed instruction devices of the 1950-1960s. However, it has additionally provided us with much more flexibility, much greater standardization in programming methods, much lower cost, and infinitely greater distribution across the Internet with lower barriers to participation than we had even with the rise of PC use in the 1980s. Given the current ease and low cost of both developing online programmed instruction methods by the teacher and using these methods by the learner, it is only natural that so many of us have begun to experiment with the use of these methods. Programmed instruction methods were abandoned in the early 1970s before a full assessment of their pedagogical value, and we now have the opportunity to pick up where we left off in the 1960s.

Unfortunately, our increased use of various modes of technology in teaching since the 1960s has been technology-led, rather than theory-led, and has rarely addressed issues of the effectiveness of the chosen technology in achieving some particular outcome with regard to student learning and achievement (cf., Fernald & Jordan, 1991; Jones & Paolucci, 1999; Ravenscroft, 2001; Seidel & Park, 1994; Tergan 1997; Wang & Sleeman, 1993; Zane & Frazer, 1992). For example, Zane and Frazer (1992) conducted a study in which the producers of 95 educational software programs were asked to supply "any evaluative data, research findings, or field-test results" concerning educational outcomes and usability issues, and no company provided reference to any empirical documentation of these issues.

With regard to the educational outcomes of online programmed methods of instruction, particular interest in the present chapter is in the hierarchical cognitive and affective outcome factors proposed in a body of work that has come to be known as "Bloom's Taxonomy" (A Committee of College and University Examiners, 1956; Krathwohl et al., 1964), an idea that was gaining in research interest at a time when the programmed instruction methods of teaching machines and automatic tutoring devices were being abandoned. The present authors hope to revitalize interest in programmed instruction designs that use the *linear programmed* methods of Skinner (e.g., 1954, 1958) and the *programmed branching* methods of Crowder (e.g., 1959, 1963) because they are so closely analogous to designs that are easily used in web-based hypermedia technology. We hope to revitalize attention to the cognitive and affective learning outcome domains of the "Bloom's Taxonomy" because these propose a hierarchical structure that might help us to think about what we might gain or lose in educational outcomes as we shift between traditional classroom instruction and web-based programmed instruction applications. The measure of "learning outcomes" is somewhat analogous to the measure of "usability," where "cognitive outcomes" might be somewhat related to the idea of "utility," and "affective outcomes" might be related to the idea of "likability."