Chapter 3.21
Technology of Formal Education

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INTRODUCTION

Internet distance education is a natural consequence of *fin de siecle* industrial transformations from a manufacturing economy, in which standard educational practices are based, to an information economy, in which greater autonomy, collaboration, flexibility and a project orientation to work are the norm. The Internet did not cause changes in education, but rather enabled educators to meet new demands for instructional practices and outcomes and adapt to a rapidly changing economic and social environment that was beginning to outpace the academy. Today, just as 100 years ago, educational institutions and practices are modeled on prevailing industrial examples of work and organization. This is especially the case in the United States where an overriding intended effect of formal education is to prepare students to fill roles within the prevailing economic system. Against this backdrop, it is only those components of education that reflect and reinforce the prevailing industrial system that are incorporated into the technology known as formal education. Components of education such as teaching machines and distance learning existed throughout the 20th century but never became standard educational practice until fairly recently because they were not acceptable in terms of preparing students to enter the prevailing industrial system.

BACKGROUND

Educational institutions customize many of their services according to what is dictated by industry, "manufacturing" employees who are suitable for the workplace (Jacques, 1996), thereby, completing a system of supply and demand. The classroom was designed as an industrial entity as it mirrored organizational practices and education emulated the factory. Straight lines of desks (often bolted to the floor), uniform curricula, standardized forms and procedures for evaluating students and faculty, strict scheduling, student achievement indexed according to hours worked and units completed all bear more than an accidental resemblance to the manufacturing process. As formal education grew in the United States in the early 20th century, the scientific management movement informed and inspired educators to view schools in the same terms as manufacturing

businesses (Spring, 2001), or as "…essentially time- and labor-saving devices, created by us to serve democracy's needs" (Cubberly, 1919, p. 355). Education satisfied these industrial "needs" with a standard "product"—a graduate who not only was trained in the basics of reading, writing, and arithmetic (skills of practical usefulness), but who was also socialized to industry (Robbins, 1997). Educators were trained to consider themselves as administrators or managers, seeking the most efficient ways to teach attendance, punctuality, attentiveness, conformity, rote learning and an acceptance of standardized work, piece-meal production and adherence to a hierarchical order (Spring, 2001). These were the lessons to be learned so that the "industrial capabilities and character" could be shaped (Cubberly, 1909, p. 41). Principals were akin to factory managers, setting general policies and procedures under which teachers—shop managers of their own classrooms—made the process work. Thus, it is not surprising that the physical design of school buildings and their interiors reflected the design of factories; the practices occurring within them attempted to replicate, as closely as possible, the prevailing industrial order.

With the concurrent rise of both formal education and the factory system, it might be reasonable to assume that various technologies would have been quickly applied to produce more efficient education. However, this was not the case. Despite the prevailing machine age, schools for the most part did not adopt mechanized methods of education such as teaching machines. Instead, a more teacher-driven, craft model of education was the norm. Within the constraints of the classroom, teachers as skilled craftspeople assembled education from centrally approved and provided pieces in a custom shop. The craft of teaching was realized through regulating the flow and progress of students through mass-produced mandated material by explaining, illustrating, and answering questions. Teaching filled in the gaps between a standard curriculum and the individual needs of the students. Technologies such as the overhead projector, which could be easily incorporated into the classroom under the teacher's control, were accepted because they did not threaten the status quo (Kipnis, 1994). Table 1 summarizes some of the major educational technologies that had bright promise but were never widely adopted.

The classroom/factory in which the compliant worker-consumer is the end product is no longer acceptable because factories are no longer the dominant models for most business organizations. The transformation from an industrial economy to an information economy has altered the way that organizations are run and the way education is configured (Sumner, 2000). Flat organizational structures, a project versus job orientation to work, less-centralized control and flexible scheduling are current configurations that enable rapid response, new innovations, and the development of new global alliances (Alavi, Wheeler, & Valacich, 1995). In this new economic model, outcomes depend not on goods but on information, and technology is the normative tool. We have seen a precipitous decline in the importance of spatio-temporal constancy; people commonly are not in the same place at the same time when "work" occurs. Because of globalization and the rapid pace of technological change, there is now an imperative to redraw the physical boundaries of the classroom, allowing learning to be continuous and education to occur in any place or at any time. With the rise of knowledge work and increased autonomy, the work model emerging is one of collaborative, rather than individual effort. Because knowledge work requires more flexibility and adaptability, individual employees have freer reign to determine how tasks will be performed. Part of this self-direction is the ongoing option to seek assistance and to reciprocate when the opportunity arises. Because computer technology is now ubiquitous in industry, computers are no longer the tools of the few. Combining the technological imperative with the nearly appliance-like nature of computers, the social and structural determinants are in