

Exquisite complexity

Rethinking the learning process and the learning environment in the Information Age

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Abstract: Schools are based on organisational patterns and on beliefs about how learning occurs. Both are grounded in a community's social, economic, political and cultural values. As the School of the Future is planned attention must be paid to the powerful influences exerted by those values. Sharing plans, examining practices, and discussing policies within and across communities will be important as School of the Future advocates begin their reform efforts.

Key words: Curriculum development, politics, economics, culture

“Oh what a tangled web we weave.” Wm. Shakespeare

1. INTRODUCTION

Schools are defined by organisational patterns and by beliefs about how learning occurs. Those patterns and beliefs are rooted in social, economic, political and cultural values, a mix that provides ‘exquisite complexity’ when it comes to designing, implementing and institutionalising the School of the Future. Different values, held at different times by different countries, have resulted in different models of schooling. Some types, the academy and the trade school/vocational school for example, have persisted because they continue to serve felt needs, while other models have left few traces, in part because their values and practices were not continually viewed as consonant with social, political, economic, or cultural values. So the School of the

The original version of this chapter was revised: The copyright line was incorrect. This has been corrected. The Erratum to this chapter is available at DOI: [10.1007/978-0-387-35403-3_29](https://doi.org/10.1007/978-0-387-35403-3_29)

H. Taylor et al. (eds.), *Information and Communication Technologies in Education*

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Future must confront those complex social, economic, political and cultural forces.

This paper is based on the following points of view:

1. We can only go forward by looking backward, by reviewing different organisational patterns and different theories of how learning occurs, and by examining the social, economic, political and cultural factors operating to support or oppose patterns and theories;
2. We should think about Schools of the Future and not The School of the Future given the differences in social, political, economic and cultural patterns in different countries. Schools of the Future will probably be based on several different models, each created in the crucible of a country's conflicting and competing goals, existing resources and general climate for acceptance of change.
3. Conditions in some countries may perpetuate existing models, while in other countries existing patterns may be broken by internal or external forces. The specifics in this paper are American. While many other countries have different histories for their educational system and so will have different issues to deal with in envisioning schooling, the ubiquity of the "factory" model in many countries and the perceived need to be competitive economically will yield conflicts and challenges similar to those experienced by American educators.

Technology has often been treated as an innovation and so sociological approaches, looking at how and why technology has not been adopted, have been at the forefront of many discussions. While this approach may elucidate some problems it is also important to view technology within the framework of a learning community and focus on the organisation and conceptualisation of learning, so beliefs about how learning occurs and is assessed, and how learning is organised within schools should be addressed when we discuss Schools of the Future.

2. ORGANISATIONAL PATTERNS OF SCHOOLING

Discussions of Schools of the Future must be based on ways of delivering content and process to large numbers of children and adults if the challenges of the future are to be met in each country. But since the Industrial Revolution school has been viewed as an instrument of social control where students are taught prescribed social mores.

Mass schooling was in the first place set up and paid for by societies to see that cultural imperatives, and especially knowledge, skills and forms of behavior demanded by the Industrial Revolution, were transmitted and that certain characteristics such as social strata, were constantly reproduced and renewed (Owen, 1985).

Prior to the Industrial Revolution many schools in America were not compulsory, locally based and grounded in religious values. They emphasised the canon of western thought. Students were judged by the quality of their thinking and reasoning; other schools aimed to produce workers skilled in crafts or specialised skills and, again, the emphasis was on the quality of students' work.

But the Industrial Revolution, with its need to organise and control workers, led to significant social, economic, political and cultural changes, not only in the way work was produced but also in the way other social agencies were organised. The factory system, suiting the needs of employers, was designed for the production of materials quickly and cheaply, and was adopted in classrooms as well as in factories because, according to Ure (1835), the benefits of the Industrial Revolution are derived less from mechanisation and more from the social control of those who stood at the machines. Ure and other social commentators saw that such a system of control and standardisation must occur across society and not just on the factory floor. Frederick Taylor's strategies for improving efficiency — centralised control of manufacture, breaking down the process into discrete steps, separating concepts (the role of management) from execution (the role of the worker), and standardising the process — began to serve as a model for delivering learning.

Callahan (1962) points out that Taylor's efficiency movement was adopted by American schools in the early 1900's as waves of immigrants arrived and threatened to flood the marketplace with cheap labour. Since the early 1900's the factory model has become a "template" for Americans of how schools should be organised and how learning should be delivered, both for "academic" studies and for "vocational" studies.

As a result what is to be learned was broken down into short segments, teacher directed learning was emphasised over the imperative for students to read and synthesise on their own and assessment by means of short answer quizzes instead of essays became the norm in American schools, educational procedures fostered by the growth of behaviourist psychology. The model has since been adopted in other countries and, with the growth of the World Wide Web (WWW) and the globalisation of educational publishing promises to become an Internet norm.

In contrast to the factory model John Dewey and others proposed a “community” model, which emphasised personal and social development within school and viewed the work place as offering more than factory based jobs. The model, rooted in a psychology of learning and thinking that is fundamentally opposed to behaviourism, has been tried in different ways over the last century but has never replaced the factory model.

In the late 1950’s a new method of organisation, the school as “shopping mall” (Powell, Farrar & Cohen, 1985), and a new approach to learning, enquiry across a wide range of topics, gained currency because of social, economic and political factors operating at that time. School was viewed as a place to keep students from flooding the workforce and, since students rebelled against traditional schooling and many subjects were viewed as irrelevant, courses outside traditional curricula were offered. Students were encouraged to set their own goals for what they learned and how they learned. Teaching and learning theory was basically instrumentalist, whatever was thought to work was tried even though many approaches seemed to have no theoretical basis.

But, over time, the majority of the models of schooling emphasise “tightly bound” course content, i.e., traditional curricular subject matter presented via textbooks. Content is taught with teachers lecturing and students listening during 45 - 60 minute time blocks.

Now, in the late 1990’s, “wired” versions of schooling are being devised. Online courses, offered primarily but not exclusively to fulfil work preparation goals, are becoming more frequent. Some are based on the factory model of moving students quickly through courseware; others are a form of web-based school as shopping mall, where students construct their own course schedule. Table 1 shows several different types of schools and their essential features.

Some “wired” school models attempt to replicate the community model by explicitly building in assignments that call for student-to-student collaboration. Other ‘wired’ school models are based on the factory system, delivering discrete bits of material and testing via short answer quizzes while ensuring the isolation of each student from the others who are working on the same materials.

When economic conditions call for rapid training of large numbers of students, it is difficult to resist adopting the behaviourist/factory model but if economic forces pull away from the model of tightly bound schools in order to emphasise collaboration and divergent thinking, it may be difficult for the public at large to accept loosely bound schooling.

When computers were first introduced into schools, some educators believed that the very nature of computing would change schools, i.e., providing for individualised work, automating routine tasks, enabling

teachers to introduce new topics or teach old topics in new ways. Instead, Becker (1983; 1986) and others have found that schools, especially secondary schools, have shaped computer use to fit existing organisational patterns and prevailing belief systems about learning. Most American high schools continue to work with tightly bound courses based on textbook topics, teacher dominated instruction and short quizzes.

Table 1. Types of school organisation

Type of school	Organisational/learning features
Academy/dame school	Individual or small group settings; mix of age and ability groups; curriculum emphasises religious values and/or mastery of the “canon”; reading, recitation and repetition; written and oral presentations for qualitative and quantitative grading; some collaborative work arrangements but most situations are ‘tracked’ and competitive.
Factory type schools	Large groupings; grouping by age; tracking by ability level; curriculum emphasises reading, writing and arithmetic, with “lower ability” students often tracked into low skill vocationally oriented courses; competitive; reading, repetition, some recitation; worksheets and standardised exams emphasis on quantitative grading.
Vocational school	De-emphasises “academic” subjects and either presents a range of skills needed for entry into the labour force or teaches sets of highly specialised skills in an apprentice-type program; manual dexterity emphasised over mastery of traditional subjects such as reading and writing; assessment tends to be performance based; group instruction with some time for individual work/consultation; competitive.
Community school	Mix of ages and ability groups; curriculum emphasises personal and social development; collaboration emphasised over competition; project method often used in teaching/learning situations and as a basis for qualitative assessment of students.
Wired school	A wide range of options currently available—factory model, community model, vocational model and shopping mall model; each model may replicate itself completely on the WWW; organisation into discrete classes or options for widely distributed sources of information, collaboration and dissemination; quantitative and qualitative assessment.

The economics of information delivery over distances may lead to many different types of course offerings but the politics of centralisation and standardisation may mitigate against more complex types of courses being supported by government. At the same time, some social forces may call for conformity in curriculum while other social forces, like those of the 1960's, may demand a diverse set of options, which may be opposed by segments of the community on cultural or religious grounds.

Similarly, the economics of delivery and certification mean that some courses will be designed so that students acquire specific information delivered in a step by step fashion and the economics of grading will call for short answers to multiple choice or fill in the blanks type questions as a means of certification; on the other hand, the almost inexhaustible resources of the World Wide Web offer many course developers the opportunity to pose novel and challenging problems, the answers to which require significant time to assess and the implications of which diminish rather than support social conformity. What this bodes as the global village shrinks, competition for resources rises and demands for a highly skilled work force increase is interesting to contemplate. Surely many countries will adopt wired school procedures consistent with their own successful past practices in non technology settings without examining the implications of such decisions.

Question #1. How does each of the organisational models provide a framework which best achieves a country's goals for technology?

Question #2. Which model most accurately reflects one or another country's prevailing social, economic, cultural, political and religious forces currently prevailing?

Question #3. How does a country alter its prevailing models of schooling to accommodate to technology's contributions?

Question #4. How do the belief systems about learning in each country — especially with regard to discrete vs. systems approaches — affect goals for learning about technology and learning with technology?

Question #5. Which set of beliefs is consonant with each country's goals and objectives for schools or initiatives for technology and implications for change efforts?

3. SCHOOLS' ATTEMPTS TO MOVE TOWARD THE FUTURE

Over the last twenty-five years many large and medium scale initiatives for using technology to change what is taught and how it is taught have been implemented. Some of those efforts were evaluated, some were not but we can glean some ideas about the problems the initiators faced through both print and anecdotal records.

The IBM Model Schools Project, 1983 - 1984, was based in the 24 largest school districts (mostly urban districts) of America. The project was designed to encourage the use of tool software across a wide range of school subjects. At least one high school per district participated.

Within and across districts several interesting and exciting applications were developed by teachers. For example, one secondary school science teacher created a database of the periodic table for his students to analyse, add to and study from. The database stimulated interest in the topic and seemed to aid students' learning since the use of the database was viewed by students as an aid to study and as an organisational principle for information acquisition and retrieval. In another school the entire staffing of English classes was changed to allow one teacher, skilled in 'process' writing, to model teaching strategies in tandem with other English teachers. As a result, the entire secondary school began to emphasise writing in all subject areas. Neither application/innovation was adopted by other secondary schools in the district, and few of the individual and interesting applications of technology developed by other teachers survive, in part because many of the districts at the same time adopted Instructional Management System software programs that were viewed as the districts' preferred technology solution. Hadley and Sheingold, who interacted with Model Schools Project members during meetings at Bank Street College, make interesting observations on some of the teachers in the project that they followed over time (Hadley & Sheingold, 1993) but the evidence shows that the project did little to shift American teachers away from drill and toward the use of more open ended educational activities.

The Apple Classroom of Tomorrow (ACOT) project (Dwyer, Ringstaff & Sandholz, 1991) was another attempt to create a nation-wide laboratory for developing and implementing technology based learning experiences. While the evidence shows that some participating teachers did make changes in what they taught and how they taught, the larger school in which each ACOT classroom was located seldom adopted the changes, and the project's effects, both in terms of teacher behaviour and student learning, have not spread very far beyond the confines of the immediate ACOT classrooms

because of the deeply held beliefs about classroom management and learning theory.

The JASON Project (OTA, 1989) was designed to explore the ocean floor and promote data analysis and evaluation activities between members of the science community and the school community. The wealth of data is stimulating some contacts but analysis and evaluation is limited to a small group of students and calls for collaboration that current organisational patterns and belief systems about what is to be learned and how it is to be learned cannot support.

A major state-wide project, Nebraska's plan to connect schools to the Internet (Topp & Grandgenett, 1996), is an important component of the state's Systemic Initiative in Mathematics and Science. While viewed positively by participants, the project did not generate the widespread use of the Internet envisioned by developers. In part this was due to the hardware and software problems that compromised so many other change initiatives but also because principals did not believe in Internet use by students, another example of the mismatch in learning goals and methods of achieving those goals. Such results have been found in other states in spite of government and industry's attempts to increase schools' Internet access.

In each of the cases cited above the tradition of schooling in the participating schools was modelled on the factory — where subject matter is tightly bound, where education is directed from the teacher to the student, where short blocks of time are available, where social conformity is valued, and economies of measurement are the norm — exerted powerful influences to contain the movement toward change and retain policies and practices that are consonant with the “template” of schools as factories.

4. FACTORS EXTERNAL TO SCHOOLS AFFECTING POLICIES

Given the within school and within community expectations of what schooling is and should be, the problem of forecasting what Schools of the Future will look like is complex. Governments are increasing centralisation of education. So curriculum development, professional development, assessment, planning and procurement are being centralised in state operated schools while cultural and religious groups are opting out in greater numbers than before to establish small schools that resemble the home or village schools of a previous century.

On the social side, the competitive, one size fits all isolation of students from one another in the classroom model based on the factory, has been

shown to be less effective in promoting learning than collaborative work. Business and industry are abandoning the traditional model of factories in favour of team-based operations, flexible organisation and flat not hierarchical structure. But here a dilemma exists. One goal of schooling is the creation of socially conforming individual. That goal is assumed to be achieved in the factory mode of the school. Collaboration can produce workers skilled in creating and producing in teams, the latest corporate mantra, but collaboration may also lead to a rejection of social conformity, a major goal of schooling for many community groups. So the public at large is equivocal when it comes to calling for changes in school patterns.

The advent of the World Wide Web may not change the situation. The availability of small or large communities on the Web creates a powerful pull away from topics/issues associated with “school” and towards the interests/goals of adolescents disenchanted with traditional schooling. But fundamentalist groups and many community leaders are opposed to organisational patterns and curricula that promote social and personal development. Instead, they opt for “mastery of the canon” models that emphasise social or intellectual conformity, although there is little agreement about who should conform to what. Each day there is a call for librarians and school personnel to “block” WWW sites to students. Blocking is not merely based on fears of access to pornography but also access to issues deemed unsuitable for students. Witness the latest set of school board decisions abandoning the teaching of evolution in several states!

Such has been the situation in America. Other countries, with more stable histories may not experience the same pressures, although it is interesting to note that England has moved away from “Open Classrooms” and investigative learning situations to a more structured and hierarchical plan; some countries, with less stable histories than America’s may have experienced either wider swings or the perpetuation of one and only one model, regardless of its utility.

As the World Wide Web and the networking of the world becomes a reality one might expect greater destabilisation with the concomitant possibility of government imposing increased standardisation as members of the public seek one, two, three, four or more options depending on the social, religious and cultural entities represented.

Changing schools is not an endeavour to be undertaken without forethought about the multiplicity of factors involved. It may be necessary to consider the literature of school change for guidance in solving within school system problems that will be encountered but that will not be sufficient to ensure productive change. External to school factors may loom as large, if not larger, than within school factors. For example, in commenting on “The

Great School Wars” that roiled New York City during attempts to change school governance during the 1960’s Diane Ravitch captured the situation.

The public school operates on behalf of the community, but how ‘community’ is defined is the source of political and ideological controversy. A child lives simultaneously in many communities: his (sic) neighbourhood, city, state, and nation; his ethnic group, race and/or religion; his parents’ occupation and interests may place his family in other communities as well. ... Respecting common values and common humanity need not imply the pursuit of homogeneity; no one wants to be a faceless figure in a mass society (Ravitch 1974, p. 402).

As mobility increases and even the most homogeneous societies become increasingly diverse the strains of accommodating to different social and cultural mores will pose a major challenge for educators as they decide what is to be taught and how it is to be taught.

Designers of Schools of the Future must grapple with the exquisite complexity of balancing the schools’ goals for students with, on the one hand, the ever expanding possibilities offered by telecommunications and, on the other hand, the competing social, economic, political, and cultural forces in mass societies. Overarching all of these issues is the fact that in the past the move toward change has often neglected the question of what is to be taught and how is it taught, becoming bogged down instead by the issue of who or what should be in control. The centrality of the schools’ mission — to teach meaningful material in ways that increases students’ knowledge and understanding and makes them thoughtful, productive, responsible members of society — must not be lost in the move toward creating Schools of the Future.

Question #6. Given a country’s history of curriculum development, which current economic, social, political, and cultural values will serve to promote which kinds of technological integration/infusion in schools? And which values will work to constrain which types of technology use?

Question #7. How will each country work with the prevailing social, economic, political and cultural values to move toward Schools of the Future?

Question #8. What is central, in terms of what is to be learned and how it is to be learned, for each country’s Schools of the Future?

5. RECOMMENDATIONS

Given the discouraging results of curriculum building and reform based on IT use in American high schools, making recommendations about curriculum and change for the 21st century is risky business. But a few ideas can be gleaned from past successes and failures.

Examples of successful uses of technology in other countries' schools should be made available to all participants in the educational decision making process — government, business, school administrators, teachers, students and parents.

The implications of successful uses of technology must be discussed within and across countries as widely as possible, with both the positive and negative aspects as they apply to social, economic, political and cultural issues studied carefully.

The means by which successful uses of technology were planned, implemented and institutionalised must be specified, carefully studied and discussed across communities.

Discussions of “technology” in the abstract must be replaced by carefully considered models and methods of technology where the match between organisational patterns of schooling and belief systems underlying the use of technology on the one hand and the outcomes of technology use on the other hand is addressed.

The implications of current models of schools and current ideas about how learning occurs must become part of a national discussion. British newspapers, for example, are presenting “snapshots” of the ways different schools are using technology with brief but interesting discussions of rationales and outcomes.

Learning goals and outcomes must become a central focus of technology based planning and delivery. It cannot be assumed that technology use will automatically ensure achievement of a country's or a community's goals. Instead, the steps needed to ensure the best use of technology for each student must be analysed and implemented.

Planning for Schools of the Future must anticipate social, economic, political and cultural shifts that will impact how technology is used and what impacts, realistic or not, are expected as a result of technology use.

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BIOGRAPHY

Gail Marshall has taught Latin and World History in secondary schools in New York City, New York. A graduate of Marymount Manhattan College and Washington University in St. Louis, Missouri, she obtained a Ph.D. in Child Development and Psychometrics, and has worked for the St. Louis Public Schools both as a member of their Division of Research and Evaluation, where she evaluated Career Education programs, and as the director of the IBM Models Schools Project. She also worked at a federally funded educational laboratory (CEMREL) as an evaluator of the Comprehensive School Mathematics Program, the Midwest Regional Exchange and similar reform efforts. Currently she is consulting with the Evergreen Project on distance learning courses.