A 3-PHASE, 3-SCENARIO VIEW OF TECHNOLOGY IN EDUCATION

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There is an ever-growing gaggle of technology visionaries, each pushing some variation of How Technology Will Revolutionize Education. But it hasn't happened, even after billions of dollars and 10 to 40 years of effort (depending on what you count as the starting point). It's time for a dose of realism to leaven the vision. We need to ask, "what's *really* going to happen?" as well as, "what *should* happen?" Strategic planners need to know the answer to both question, whether their focus is on products, facilities, or school districts. To address the question, I think in terms of a 3-phase model of technology introduction. Then I use the phases to envision three possible scenarios for how technology will *really* affect education.

3 Phases of Technology Introduction

I sometimes classify the introduction of a new technology as occurring in three phases – not necessarily in sequence:

1. The "Gee Whiz!" phase: This follows the first uses of the technology by early adopters who are geek enough to cope with the rough edges on the tools, and forgive the technology its shortcomings. Descriptions of what's being done with the technology focus on the application itself, and the challenges of getting it running. Evaluation of effectiveness, if any, is usually limited to some kind of "smile scale" to indicate that everyone had fun using the technology. If there are measurements of learning, they have no higher ambition than demonstrating that it is possible for someone to learn something from whatever was done using the technology. There are many promises of how revolutionary the technology will be, but little or no contextualization or comparison to other options. Usually there is no attention to cost, much less cost-effectiveness. Rarely is there a description of any systematic, reproducible instruction/learning model using the technology. This phase can go on for years, and many technologies never make it past this phase.

2. The "What's It Good For?" phase: After a while, one or more application models using the technology emerge as the most widely used, and users associate those applications with the technology

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(often the name of the technology is used interchangeably with the application, as in "Googling"). Applications typically are treated as additions to existing practice, or as one-for-one substitutes. Eventually, enough research is done on these models so that sophisticated users begin to understand both the benefits and the costs. Comparisons to "regular classroom" teaching (whatever that means) are fairly common, but only rarely are there well-designed comparative studies that benchmark the technology application against other means of accomplishing the same ends. Even more rarely, the research eventually leads to an understanding of what effect sizes can be expected with which student populations or in which contexts — and thus to conclusions about when — and when not to use the technology. In only a handful of cases, there has also been research on systematic design technology surrounding the application with the goal of reducing the cost and improving the quality of the application development. Typically this phase begins at least 3 to 5 years after the technology reaches the market and continues for at least 7 to 10 years. Often, this phase never happens at all, or it happens in parallel with the third phase (see below).

3. The "Transformation" phase: Eventually, basic changes in the processes of schools take place as a result of the technology. There is a mature understanding of what the technology applications can, and cannot do, and what the cost-effectiveness tradeoffs are for adopting the technology. Old ways of working are displaced, where justified, with associated changes in administrative procedures, staffing, budgeting, and facilities. A great deal of knowledge is developed on cost-efficient and cost-effective implementation of the technology application, and this knowledge drives improvements in the applications. This phase typically begins a decade or more after introduction of the technology, if it happens at all.

In schools, the third-phase changes thus far have been mostly administrative (automation of gradebook, transcription, attendance, scheduling, etc.), and have not yet penetrated instructional processes. However, there are some learning applications that are transitioning from the first to the second phase, and we can speculate about their impact in the third phase — if they ever reach that far. Some applications are attempting to go directly from the first to the third phase, with “back filling” in the second phase occurring gradually. Since it is the second and third phases that are of greatest interest for strategic planning of all sorts, including product and school facilities planning, I will focus on some predictions based on current experience and research.

Notice, incidentally, that the estimated timeline for transition from the first to the third phase is usually 15 to 20 years. This is based on experience in both business and education. In business, information and communications technologies typically are introduced first as one-for-one substitutes for existing processes, with the first- and second-phase justifications based on relatively small increments in productivity. Only much later — 15 to 20 years later — did transformative, third-phase applications emerge which created new business and organizational models not otherwise possible. As the technologies have become global, the pace of transformation has accelerated however. Tom Friedman's book, *The World Is Flat*, makes the case that the third-phase transformation of the global economy is *the* story of the first half of the 21st Century. Visionaries in education — many outside the US — have noted this trend, and are gradually developing a "critical mass" to argue for third-phase transformations in education. And it's about time: information and communications technologies have been widely available in schools for more than a decade, so you could argue that we're right on schedule.

If you look around the edges of the current educational system, you will see third-phase transformation everywhere. The first example was *Sesame Street*, which used the third truly ubiquitous information technology (TV, after radio and telephone) to effectively "raise the bar" on entry-level skills for Kindergarten. In effect, early literacy and numeracy skills (such as letter recognition and counting) are now assumed, and K-level students who don't have them are considered to be disadvantaged. A piece of the standard school curriculum was transferred to a technology-based delivery system operating outside the schools, and the schools accommodated the change (note: viewership of *Sesame Street* has recently declined, and there is now concern that more students may be entering Kindergarten at a disadvantage).

There are other examples of the third phase: some alternative schools, virtual high schools, online universities, some charter schools, some home schooled children, and some supplemental tutoring. In many work environments, we are seeing increased emphasis on seamless integration of "just in time" information and training. In each of these categories there are examples of third-phase educational systems that leverage the technologies now available to fundamentally restructure the system. There are a few early adopter "lighthouse" schools and districts in the US — and more in other countries — that also are seriously attempting a third-phase systemic transformation. However,

in only a few cases is the necessary second-phase understanding of cost-effectiveness tradeoffs of the applications available, so the popular perception is still that these transformative applications are "risky" and lack credibility at the policy level.

3 Scenarios for Technology and School Facilities

Given this state of affairs, what does the "crystal ball" show for strategic planning of products, school facilities and school districts? I think we can envision three scenarios that are likely to happen more or less simultaneously over the course of the next 20 to 30 years.

Scenario #1: Small Scale Adaptations: Schools are beginning to figure out how to use technology to do existing instructional work more efficiently within the context of the current system. For example, schools are using information and communications technology to standardize and disseminate curriculum (a consequence in the US of No Child Left Behind), and there is a great deal of interest in automating testing for use by teachers to guide and individualize instruction on a monthly or weekly basis. There is also considerable interest in replacing textbooks with online information sources (electronic textbooks, the Web, etc.). Simulated laboratories are beginning to gain attention. Graphing calculators are ubiquitous. This scenario will surely continue, as applications emerge that directly substitute for existing teacher or student tasks and automate them to reduce cost or save time. However, this scenario does not lead to systemic transformation, and productivity gains are relatively small. In business contexts, this was the kind of technology adoption that was predominant in the period from the 1960s through the mid-1980s (or later in some industry sectors).

Scenario #2: Parallel Service Models: In this scenario, the systemic transformations do occur, but outside, and in parallel with, the "mainstream" school. These can range from supplemental services (such as online tutoring or homework helpers), to technology-based alternative schools and charter schools (for special populations), to online schools or courses (to overcome limitations of distance, or staffing, or facilities). As these services gain credibility, and the second-phase evidence of their cost-effectiveness tradeoffs accumulates, then we can expect larger-scale repeat of the *Sesame Street* scenario: certain kinds of learning tasks come to be normally handled using a parallel system, and "mainstream" schools no longer provide the service. In effect, more and more of the whole task of educating will be transferred to service delivery models that are

perceived as credible and more cost-effective. This might happen as a coordinated policy decision, but it is more likely to happen in an uncoordinated way, driven by market forces (and political stakeholders looking for economies). There is a real danger in this scenario of a "digital divide," in which services are available only to middle-class parents with discretionary income to spend on educational services. There also is a danger that at some point a crisis of confidence in the public schools will occur, which precipitates a loss of support of public education by the majority of voters — who perceive the available alternatives as more attractive (this has already happened for middle class parents in large urban districts, and is beginning to spread to inner-ring suburbs — but as yet the technology-based options are rarely perceived as the most desirable alternative).

Scenario #3: Alternative Service Models: Radical new models will emerge, with methods of service delivery, staffing, financial structures, and facilities that are incompatible with conventional school models. Currently the best examples are in adult education: online universities, military and corporate training. However, there are calls for such new models for secondary education, and there is some regional, state, and local experimentation with such models. Often they emphasize decentralized, small and specialized facilities, differentiated staffing, automated instructional management, a mix of individual and small-group learning activities, and virtual communities of learners, in a 24/7/365 environment. For the most part, the Phase 2 research on these models has yet to be undertaken, and as a result only a few practitioners have a good understanding of how quality should be defined and managed, or what the cost-effectiveness tradeoffs are for such models. However, this will change, and the models gradually will be perceived as viable alternatives to the traditional systems. As this happens, political stakeholders in the education system will demand adoption of the new models where they are cost-effective (or at least, cost-efficient), and a trend will develop toward wholesale replacement of parts of the current system.

All three of these scenarios are already happening — somewhere. The implications for school facilities of each of these scenarios are quite different. The question of which scenario is likely to dominate in a particular region, state, school district, or sector of education/training should be a matter of considerable study by strategic planners regardless of their focus. In the US, there is currently almost no national-level policy in support of any of the three scenarios, so all three scenarios are playing out at the state and local levels. In some other countries (e.g., Korea, Japan, Singapore, Australia), *Scenario #3*

is beginning to gain some traction as part of reform movements for secondary and post-secondary education.

Note also that only *Scenario #1* envisions updated versions of today's large "factory schools." *Scenarios #2* and *#3* project that much of the growth and evolution of educational service delivery will be decentralized in small, specialized facilities — or at home, or in the workplace.

Most education futurists tend to advocate some variation of *Scenario #3,* often without serious consideration of the market and political forces that so profoundly influence the education space. Most conveniently ignore the lack of Phase 2 evidence, and trust that their favorite applications will prove out once the Phase 2 evidence is available (if ever). At the other extreme, many facilities planners and school planners implicitly assume that the past will predict the future of educational processes, and by default seem to envision *Scenario #1*. In my view, both positions represent a narrow perspective to change that will not serve well their communities. We need to do better.