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From Classrooms to Learning Environments: A Midrange Projection of E-Learning Technologies

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I Technologies

The evolution of a new technology passes through two distinct stages. In the first stage, the technology may be seen as a new way of doing an old thing. For example, when the motor was introduced to transportation, the early vehicles were known as horseless carriages. The introduction of the motor was simply seen as the replacement of an existing feature, the horse. In the second stage, however, the new technology went beyond the mere replication of an earlier technology. Horseless carriages evolved not only into automobiles but also into motor coaches and transports.

In the field of learning, a very similar evolution is taking place. The introduction of information and communications technologies is also in the process of passing through two stages. The first stage, which we are now completing, is what might be thought of as the electronic classroom. The physical environment in which teaching and learning occurs is being replaced with an electronic classroom, but the process of teaching is very much the same. In the second phase, however, we will begin to use technology in new ways, to advance beyond what was possible in the classroom.

Because we are a part of the way through this transformation, a mid-range projection is now possible. Our experience with information and communications technologies is sufficient to allow us to map the progression through the two phases on a continuum of technological innovations that are now becoming more familiar to researchers in the field. The continuum may be described as follows:

1. **Learning Objects** - the learning object is, as has become familiar to many practitioners in the field, a bit of reusable digital content that can support learning. The learning object is, essentially, equivalent to educational content used previously, such as contained in textbooks or distance learning manuals, but expressed in digital form and 'unbundled', that is, broken into small 'chunks' that may be applied in various circumstances.

In a sense, the advent of the World Wide Web was also the advent of the learning object, as instructors and other educators began almost immediately to make their course content, outlines and other documents available to students on their web sites. Learning objects, properly so-called, constitute a formalization of this process, through the expression of standard formats (such as learning object

metadata) to encourage interoperability.

As learning objects have been developed, they have been designed almost exclusively for use in a learning management system (LMS), which is a type of content management system structured according to educational requirements. Learning objects are assembled into lessons and courses, and function essentially as supports or resources to aid learning. This supportive role became explicit with the popularization of 'blended learning' in the early 2000s, in which an in-person class was supported with these electronic materials.

2. **Repositories** - the learning object repository is a system for organizing and managing learning objects. Just as a library extended the function of books, a learning object repository extends the usefulness of learning objects by creating common stores in which these resources may be deposited, organized, and easily located. Thus the contributions of numerous authors may be placed into a single, multi-purpose environment, allowing for a much greater selection and utilization of existing resources.

Early learning object repositories were confined to learning management systems (and were hence called learning content management systems, or LCMSs), and could be thought of as institutional libraries of content that course designers and instructors could use to populate the pages of an online course offered through the LMS. Later instances of learning object repositories resembled something like inter-library loans, where materials could be shared among institutions. And some learning object repositories evolved into stand-alone central libraries.

Standards and organizations developed to facilitate the storage and transfer of these learning materials, a prime example being Education Network Australia (EdNA), which manages a network of learning object repositories and provides access to resources in similar repository networks overseas. With similar projects nearing completion in Canada, the United States and Europe, learning object repositories are now available to early adopters around the world.

3. **Content Syndication** - even with the use of information and communications technologies, the content of learning object repositories today resembles the printed book (or the chapter of a printed book) more than anything else. Contents are static, the objects are carefully indexed, and learning objects are delivered and stored in local repositories, either individually or in content packages.

Content syndication is the idea that, instead of packaging and distributing content, access to original content is made available to a wider audience on an as-needed basis. The best example of this today is in the world of weblogs (or blogs) where a single website stores the content, but where information about that content, in the form of an XML file, is distributed to potential readers. Content

syndication resembles syndicated television more than it does a library system. The original news program is broadcast live from Sydney, but is repeated to network stations in Melbourne, Perth and Broome. The programs are not packaged and delivered to these remote centres for later use; the broadcast is live. In educational technology, syndicated content remains in its infancy. Repository networks, such as EdNA, have only just started experimental RSS feeds (an RSS feed is a type of XML file designed to facilitate syndication) and while many institutions are experimenting with blogs and RSS in a classroom setting, very little actual syndication of learning content is taking place.

Advantages of syndicated content, as opposed to packaged content, include immediacy and flexibility. Content may be changed on a moment's notice to take into account changes in circumstances. And syndicated content may be used in a wider variety of educational settings, not only in a learning management system. Experiences elsewhere on the World Wide Web, and especially in the field of online journalism, show that syndication represents a powerful tool for the wide distribution of online resources. It also extends the range of potential content providers from a small number of centralized institutions to a large number of syndicated content sources.

4. **Personalization** - if content syndication is the first step away from the limitations inherent in printed texts, personalization is the first step away from limitations inherent in the classroom. As access to a wide range of resources becomes easier, and as the number of resources multiplies, it becomes possible to tailor this access to the needs and interests of the individual learner.

Personalization is often depicted in terms of content selection, and while there is no doubt that the selection of particular materials will be based on individual needs, personalization is a much wider phenomenon. A number of early technologies are instances of the personalization of other aspects. For example, the increasing trend toward what is today called 'accessible' materials is also a type of personalization, but one in which the display medium is adapted to the reader. The use of syndication technologies (and specifically XML) allows the same content to be presented in plain text, large print, or audio.

In a similar manner, we are beginning to see content made available through a wider range of devices. Another emerging trend, called 'mobile learning', foresees the delivery of learning content through mobile devices such as personal telephones, PDAs and similar tools. The impact of wireless learning is that, because content is available anywhere, learning is no longer tied to a particular location. As XML encoded content and syndicated content delivery becomes entrenched, there will be little, if any, limitation on the place or manner in which learning may be available.

5. **Learning Environments** - there is already discussion and

development around the idea of using simulations to support learning, but the concept of the learning environment takes this further and is essentially the idea of merging learning content with other forms of content in order to create an integrated environment. Thus, for example, when writers such as Papert and Prensky talk about the use of games in learning, what they mean in essence is the location of learning content within an environment where participants pursue game-driven goals. Learning content is presented as one type, but not the only type, of information available to the user.

In a similar manner, other writers, such as Cross, talk of workflow learning. This type of environment is a productivity environment, such as a document management system or control interface, into which learning resources are embedded. Hence, for example, a bank clerk processing loan applications makes use of an application developed by her bank, and embedded in this application is not only a set of productivity tools, such as a calculator, but also a set of learning resources (which were once called learning objects).

The learning environment is, in essence, the removal of the classroom entirely from the learning, and the use instead of whatever environment the learners happen to find themselves in. Learning, when viewed in an environmental perspective, may be predicted to accompany other forms of information (for example, learn about cyclones as a part of accessing the weather report), products (for example, a jar of strawberry jam may broadcast instructions on how to make pie to any local mobile learning device). The characters in Bruce Sterling's novel, Distraction, for example, built a hotel from a kit that taught them how to build the hotel as they went along.

II Opportunities and Challenges

The quick survey in the first part of this paper suggests the gradual evolution of a significant transformation of learning. It is difficult to imagine a world in which classrooms are abandoned, since so much of our understanding and idea of learning is invested in the idea of a group of learners working on a common curriculum under the tutelage of an instructor.

But even today, as technology infiltrates the classroom environment, it is important to recognize that the shift away from teacher-led classroom instruction is already happening, albeit in an unobtrusive manner. Each new introduction of a game, a simulation, a self-paced learning package, or writing software, increases the ability of learning to be tailored to the individual learner and lessens the learner's dependence on the physical environment, and in some cases, the human instructor.

Numerous commentators, indeed, have commented on the manner in which the instructor's role is already changing in this new environment, from being the "sage on the stage," as the popular slogan has it, to the "guide on the side." That such a slogan is today

already trite is an indication of how far along the road described in the first section we have already traveled. Knowing where that road leads, in the end, creates opportunities for the development of new technologies and new pedagogies, but it also raises the challenges that inevitably lie ahead.

1. **Unbundling** - commentators such as David Noble criticize the trend toward the use of ICT in learning as it constitutes the 'unbundling' of the traditional learning task. The development of learning content is done in one place, by one person, and the use of that content to support learning is done in another, by another person. This disaggregation of the teaching process reduces it to a series of parts which, when considered separately, are less than the whole.

Teachers, for example, approach the modularization of instruction with some concern, as individual learning objects cannot in themselves embody larger themes or semester long learning objectives. For example, the fostering of critical thinking is an objective often implicit in the learning of other topics, but is not contained in the topic itself. It is a context, or interpretation, placed on the topic by the instructor. Hence, if learning is disaggregated, these wider objectives may be more difficult to meet.

It seems evident that such large scale learning outcomes cannot be instantiated in smaller, self-contained learning resources, a fact that has prompted some to insist on a linking of these resources through the use of sequencing, learning design, and 'isPartOf' elements in learning metadata. A longer term solution to this issue will need to be found, however, as such solutions negate the benefits of learning objects almost entirely. It seems clear that , as objects are situated in a learning context, care and attention to wider learning objectives must inform the design of this context.

2. **Foundations** - other commentators have argued that, as learning becomes more personalized, content delivered to learners will tend to emphasize what they want to see and hear, and not necessarily what they need to see and hear. This has already become a concern in non-learning communities, such as politics and media, as clustering around particular topics or particular political points of view is observed. Yet, in learning, there are some things that everybody must learn, such as mathematics and literacy, whether they opt for such content or not.

Asked just such a question at a forum recently, a long time proponent of personalized learning, Seymour Papert, responded that foundational learning will be presented in the end, just because it is foundational. It could be argued that, for example, a person may not be interested in math, but will eventually learn math as a means to learning how to do the things in which he or she is actually interested. Indeed, the response continues, such learning is actually deeper since it occurs at a time when the learner wants to learn the subject in question, as opposed to when he or she is being required to.

But such a response presupposes several things. It first assumes that such learning is available and accessible in the context in which it is needed. Learning geometry in the process of designing your house is certainly foreseeable, but it requires that the house design software actually provide access to the foundational learning in question. Second, it assumes that all such learning can be undertaken at the time required.

However, in certain high risk or high velocity activities, such as performing heart surgery or flying an aircraft, the foundational knowledge must be available in advance, as there is not time to learn it during the progress of an operation or landing procedure. And third, it supposes that learning be available for a much wider range of things than at present. Foundational learning is useful for the mastery of numerous skills and knowledge for which no subsequent learning is readily available.

The personalization of learning cannot mean an end to foundational learning. Some skills, such as literacy, numeracy, and critical thinking, are too fundamental to be left to the hope that the learner's interests will eventually take them there. Instruction in such foundations must be explicit, no matter which direction an individual's learning takes, and mechanisms must be put in place to ensure that this is the case.

3. **Commodification** - another concern expressed by numerous commentators is that the gradual trend away from a centralized, teacher-led system of learning is in the same breath a move toward a system of learning in which vested interests may flourish. The paramount (though by no means the only) instantiation of this may be described under the heading of the 'commodification' of learning—the subsumption of the objectives of a public education system to corporate or commercial interests.

The protests that accompanied the implementation of Universitas 21, a public-private online university network, offer evidence of this concern. And there seems little doubt that the public system is already pressed around the edges by commercial interests, as the spread of Channel One in the United States, which provides advertising supported news broadcasts to classroom audiences, demonstrates. The provision of educational materials, such as texts and other resources, is already a large industry, and as the role of educational material is realigned there is ample opportunity for a commercial presence to be felt more widely through the system.

Another aspect of commodification is the potential stratification of educational delivery. As online learning becomes less expensive and more streamlined (particularly if supported by commercial interests) there is a danger that learning, like most consumer goods, will be offered at varying levels of quality, with the best education being provided to those willing to pay, a more common and less palatable industrial grade learning being provided for most, and none

at all for those without the means to access it. The dictates of the marketplace pay little attention to the public good, and while society may prefer that every student be provided a quality education, this may not be in the best interests of corporate providers.

It will be important, as new technologies and new means of learning are implemented, to be acutely aware of the social impact of learning as well as the commercial impact, and to ensure that standards of quality, both in terms of content and accessibility, are met. Though the commercialization of learning is inevitable (it is already well in progress, with product-specific certification examples, in-store cooking classes, and private schools and colleges) it will be necessary to ensure that the interests of society as a whole inform every person's education, even those who may otherwise 'opt out' of the public system.

4. **Community** - a common criticism of ICT supported learning, and one which is found in frequent commentaries and criticisms, is the isolation imposed by the substitution of technology for teachers. As learning becomes more personalized, this trend is only likely to become more exaggerated, as the commonalities that define classes of students become less and less prevalent.

The supposition that the use of ICT in learning means chaining a student to a computer must be resisted. As mobile learning becomes more prevalent it will become easier to enable students to move more freely through society. This sort of activity—the integration of computer assisted learning with 'real world' activities—must be planned for and extended.

In various learning centres we are already seeing some evidence of this. For some students in Hawaii, for example, online learning means more than just using the computer, it means getting out of the classroom and, as a group, undertaking expeditions to study marine biology. Field trips, study tours, and other external activities are becoming increasingly common as computer support allows students to be away from the classroom for extended periods of time.

The use of computers to assist learning also enables the formation of social contacts that would otherwise be impossible in learning. Students from widely dispersed groups are able to form online groups. And a student's contacts may extend to more than just classmates; a student at the Institut St-Joseph in Quebec City started a conversation with a circus performer he had reviewed in his blog. Such contacts are themselves not without risk, however, and the greater capacity for wider social contact must be attended with a greater awareness of the potential dangers of such contact.

III Impacts and Implications

If there is an over-riding theme in this discussion, both in the

discussion of the changes in technology that will occur over the next decade, and the challenges that arise from such changes, it is this: that the world of learning will become more integrated with the other parts of our lives than ever before.

In one sense, this will be the case because it is necessary. It has been widely observed that learning does not end with graduation, that employment in a profession carries with it an ongoing need for professional development, and that this learning must be conducted in such a way as to minimize the impact on productivity while at the same time maximizing learning effectiveness. It is widely argued that learning is most effective when that which is learned is immediately used, and hence, it is no surprise to suggest that learning will therefore become more and more closely integrated with work and with life in general.

And in a second sense, this will be the case because it will be possible. In the years before the introduction of information and communications technology, it was not possible to place the benefits of the classroom into the console of a machine or the support system on a computer. But as learning resources, mentoring, collaboration, and other forms of learning become more widely syndicated and more deeply personalized, it will be easier to enable just this sort of direct access to learning, making the infrastructure necessary to support classroom learning seem like a needless expense.

As such learning is implemented—and provided that care is taken to ensure the learners have the opportunity and incentive to obtain a deeper and broader education that the just-in-time world of learning provides—the primary impact will be greatly empowered workforce, one able to adapt and react to changing circumstances very quickly. As others have observed, this will have an impact in unrelated areas, such as corporate management and governance. It will also have an impact—perhaps one that cannot be completely understood—on the lives of these new learners.

Especially if learning is subsumed by other interests—largely on the assumption of governments and business that the purpose of learning is to increase productivity—and as it is integrated into everything else, there is a danger that there will, quite literally, be no escape, that a person's home, work and leisure life will all become aspects of this great, integrated endeavour. But it should be understood that one of the major attractions of professional development, as it exists today, is to 'get out of the office'—to learn, perhaps, but mostly, to escape and to take stock. We need, as we move toward making learning more efficient, to be aware to the ancillary benefits of learning, and to ensure these, too, are available, not just to some, but to all.

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