NEW PARADIGMS IN DISTANCE LEARNING

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ABSTRACT

This paper examines the affordances and potential of emerging technologies to support and enhance each generation to see that the ubiquitous capacity of the Internet is creating very profound opportunities for enhancing the effectiveness and efficiency pedagogical models. The new generations of technology enhanced teaching are cognitive/behaviourist, social constructivst and connectvist. It also further looks at recent developments in emerging educational technology and discusses the ways in which these tools can be used and optimized to enhance the different types of learning that are the focus of distance education theory and practice.

Key words: Paradigm Shift, Distance Learning, Educational Technology.

Introduction

The emergence of modern multi-media distance education in the last decades of the 20th century had several causes. Governments wanted to expand access to higher education. They assumed this would require the use of new technologies and methods, because an essential aim was for students to learn wherever they were, without having to assemble in classrooms. Teaching and learning would occur at distance Technology enhanced education, like all other technical-social developments, is historically constituted in the thinking and behavioural patterns of those who developed, tested and implemented what once were novel systems. The designs thus encapsulate a world view (Aerts et al., 1994) that defines its epistemological roots, development models and utilized technologies – even as the application of this world view evolves in new eras. The past century witnessed the fastest and greatest evolution of technical capacity known in human history with profound consequence to all human activity. Though hardly an original observation, it is interesting to note that distance education evolved from a Gutenberg-era print and mail system to one that supports low-cost, highly interactive learning activities that span both time and distance with equal facility. Significantly, the constraints of the correspondence model simply did not allow educators to employ highly interactive educational models and processes. No doubt, noting the futility of trying to predict the impact of technologies on teaching, modern educational pundits are more likely to disguise deep animosity to technology by putting technology in a more subservient role to that of pedagogy. Thus we hear the familiar line that "technology is just a tool". Such a cavalier attitude denies the professional responsibility to use available tools both effectively and efficiently. The technology is the music setting the tempo, the beat, the timbre and the compelling melodies. The pedagogy defines the choreography, directing the dancers sweeping motions, graceful extensions and enduring embraces. Together, technology and pedagogy reveal and develop our human creativity and responsiveness and allow us to learn effectively and enjoyably. it is possible to think of pedagogies (considered as the processes and methods used in an attempt to bring about learning) as technologies, integral parts of a technological assembly that must work together with all of the other technologies to bring about a successful outcome(Dron,2012).

Distance education, as practiced today, does not follow a single paradigm worldview, rather, as Dills and Romiszowski (1997, p.18) described the field of educational technology, distance education is "a loose confederation of fields that are quite independent of each other and yet that are not merely different

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aspects of the same field". These paradigm discussions often ignite into controversy especially when standards organizations attempt to define quality in distance education. Different generations of pedagogy describe, define and defend divergent notions of quality (for example the need for peer-to-peer interaction) while sharing many common descriptions (such as opportunities for some type of student-student, student-content or student-teacher interaction). This paper focused on typical learning activities associated with each pedagogy and examine the affordances (Conole & Dyke,2004,Gibson,1977) (and potential of emerging technologies to support and enhance each generation. We will see that the ubiquitous capacity of the Internet is creating very profound opportunities for enhancing the effectiveness and efficiency of all three pedagogical models.

Cognitivist/Behaviourist Pedagogy

Cognitive and behaviourist (CB) pedagogies focus on the way in which education was predominantly defined, practiced and researched during most of the 20th century. Behavioural learning theory is based on the notion that learning occurs when learners adopt new behaviours or demonstrate a change in behaviour as the result of an individual's response to stimuli. Note that in this definition the focus is on the individual and the necessity for measuring actual behaviours and not attitudes, intentions or capacities. This first generation of distance education pedagogy gave rise to a new profession – that of the instructional designer – a professional who designed learning activities that would be enacted by students alone, or with an instructor, at a time, and/or place apart from the designer. Instructional systems theories developed to guide creation of often directed and tightly orchestrated "events" and the learning results were rigorously assessed generally using positivist research paradigms and methodologies. Behaviourist notions are especially attractive in training (as opposed to educational) contexts as the learning outcomes associated with training are usually clearly measured and demonstrated behaviourally.

From behaviourist pedagogy emerged the cognitive learning theories that focus on how processing within the individual brain effects comprehension, understanding, storage and retrieval of information. Cognitive pedagogies arose partially in response to a growing need to account for motivation, attitudes and mental barriers that may only be partially associated or demonstrated through observable behaviours – yet they are directly linked to learning effectiveness and efficiency. Cognitive models are based on a growing understanding of the functions and operations of the brain and especially of the ways in which computer models are used to describe and test learning and thinking. Much research using this model proceeds from empirical testing of multi-media effects, cognitive overload, redundancy, chunking, short- and long-term memory, and other mental or cognitive processes related to learning (Mayer,2001). Although learning was still conceived of as an individual process, its study expanded from an exclusive focus on behaviour to changes in knowledge or capacity that are stored and recalled in individual memory. The tradition continues with the successful application of experimentally verified methods like spaced learning(Fields,2005) and applications of brain science, as well as more dubious, scientifically unsound and unverifiable learning style theories (Coffield,Moseley,Hall & Ecclestone,2004) that achieved popularity towards the end of the twentieth century and that still hold sway in many quarters today. The locus of control in a CB model is very much the teacher or instructional designer. Such theories provide models of learning that are directly generative of models of teaching.

It is notable that CB models gained a foothold in distance education at a time when there were only very limited technologies available that allowed many-to-many communication. Audio teleconferencing was perhaps the most successful means available but came with associated costs and complexity that limited its usefulness and scalability. The postal service and publication or redistribution of

messages was very slow, expensive, and limited in scope for interactivity. Methods that relied on one-to-many and one-to-one communication were really the only sensible options because of the constraints of the surrounding technologies. CB-based distance education is often developed in the suggested order and all but the evaluation phases are done before interaction with students and perhaps with teachers. The model begins with designers selecting instructional goals. Instructional designers identify goals in discussion with subject matter experts with an eye to finding deficiencies in learners' behaviour that can be rectified by new learning. CB based learning models and learning activities that are net-based dramatically increase the transparency of these activities – opening them to analysis, visualization and remediation by both instructors and the learners themselves. This openness becomes a key component of all net-based pedagogy but has a larger impact when applied to the activities of individual learners, which when delivered with earlier technologies (notably printed correspondence) left almost no means to observe, much less understand actual learner behaviour. This is particularly salient when applied to a new generation of large scale MOOCs (Massive Open Online Courses) where the application of analytics tools can provide a great deal of significant data about how learners are interacting with and using content.

CB pedagogy relies on the use of high quality text and usually multi-media learning content. The effort and cost of "developing and selecting instructional materials" continues to plummet in response to lower cost tools for recording audio and visual (pod, video and screen casts), creating graphics (chart, graphing and visualization tools) and producing animations. Although debate still rages over the necessary degree of professional adherence to high "production standards" in educational media, it is clear that materials produced by designers, teachers and even students are being used to supplement if not totally replace commercial-quality media production.

The Internet greatly expands the capacity and affordability of most of these instructional design and production activities through its capacity to document and create artifact of discussion, observations and agreements amongst members of the development team. Wedman (1989) in developing strategies to overcome subject matter and teacher resistance to CB models of design argues for the creation of "tangible products" that mark movement through phases and serve as objects for reflection, evaluation and ongoing guidance of the process. For example, Wedman recommends the creation of brainstorming lists of possible goals, documentation of subject matter priorities, flow charts, gathering of lists of instances and non-instances of appropriate behaviours and more. If we consider the logistics of this collaborative teamwork, taking place at a distance in pre-Internet days, we can envision only a largely underused and mostly inaccessible, file of papers – not an effective tool set.

Today each of the instructional design activities is enhanced by a host of Web 2.0 tools. Of primary use are distributed text tools such as Google Docs, DropBox and wikis. Prior to the Internet, collaborative work consisted of annotating and re-working the efforts of others with long delays between edits. Modern systems allow multiple authors to edit text and owners to manage multiple versions, turning back to previously overwritten work if required. These edits may be made in real time or asynchronously. As importantly, collaborative work and negotiation is not confined to text. Collaborative graphic tools, concept and mind mapping tools allow graphic representations of ideas and processes. Voice tools operating synchronously (Skype) or asynchronously (Voice Thread) allow for richer forms of interaction, enhancing social presence among collaborators. Finally, the coordination of distributed content producers requires considerable skill of at least one project manager. Low cost distributed project management tools allow teams to design, create, produce and distribute content at costs much lower than in pre internet days.

Since high quality content defines CB models of distance education, its effective management and control is extremely important. The costs to construct and maintain currency of high quality content creates a need for distance education student numbers/courses to be much larger than for comparable campus courses(Bates,2005; Rumble,2004). Thus, explaining the generally lower costs per student of the world's mega universities – almost all of which make extensive use of CB distance education pedagogy. Large student numbers preclude economic sustainability in countries with smaller populations and those with large numbers of well-established campus universities. In these contexts, the capacity to re-use content created by others is compelling – if not without its challenges. The Internet provides the infrastructure for multiple ways of sharing content that is the key to quality CB pedagogy. There are a variety of types of distribution models that have evolved to allow for publication, search and retrieval of content. The first were learning object repositories (that stored digital learning objects and the metadata allowing them to be discovered and legally shared. Learning object "referatories" store and evaluate just links to objects. Open courseware repositories store learning objects that are aggregated and supplemented with detailed objectives and, often, assessment activities, thereby creating full courses. Finally, both institutions and disciplinary bodies are establishing repositories of scholarly content (often papers, monographs and data sets) that can be used as content in educational contexts. The importance of Creative Commons licensing with its capacity for allowing the sharing, while retaining copyright, cannot be underestimated as an enabler of effective distribution and sharing. Unfortunately, repositories and mass material re-use has not yet met its potential. In a detailed quantitative study of most of the major repositories (Ochoa Duval, 2009) identify the "contributor problem": How can contributors be motivated to upload and share their content? This problem remains unresolved, as the technical barriers fall. However, though the repository-oriented approach has not been a huge success, there is more high quality and reliable learning material than ever available across the Internet, not necessarily in purpose-built repositories but authored and hosted everywhere from blogs to Facebook to YouTube and content management systems. Perhaps of deeper concern is the reluctance of distance educators to consume and customize content already created by others. Many content developers define and pride themselves on the production of quality content – not by the consumption and customization of works that they did not produce.

The final affordance of the net – with tremendous, if as yet little demonstrated capacity to improve CB distance education pedagogy – is learning analytics. Building on its forbears, adaptive hypermedia and intelligent tutoring systems (Brusilovsky,2001) and drawing heavily from related fields such as data mining and web analytics, learning analytics seeks to identify patterns affecting learning in a wide range of online sources. Unlike traditional adaptive hypermedia and intelligent tutoring systems that (in most instances) work on a known closed corpus of material, learning analytics is intended to be employed across multiple, known and unknown activities and interactions internally within an educational system and across the net, mining information about patterns of behaviour in order to extract useful information about learning which can then be applied to improve the experience. In this model, CB pedagogy may be adapted to service the unique learning needs, style, capacity, motivation and goals of the individual learner. Thus adaptive CB based distance education systems strive to create instructional designs that change and morph in response to individual learner's needs and behaviours. Building from earlier work on user modelling and adaptive systems, these individual attributes are stored in a user model that drives algorithms controlling the presentation style, speed, content, difficulty and other aspects of the learning content. Sophisticated user models are not static, but respond to changes in the learning context (a host of personal, content and situational variables). Finally, there is increasing attention paid to providing access and editing capabilities

to the learners themselves to the learning model that is driving learning sequences presented to them. These Open Learning Models (Bull & Kay, 2010; Kay & Kummerfield,2006) increase learner control and understanding of the system. Open models can also be used by teachers and other support staff to better understand and respond to individual learner needs, although there are potential and as yet unresolved issues with making such models intuitive to understand and control effectively. An important source of data to constructing the model is the user's current and past activities with content in the learning context. Harvesting, analyzing, and directing appropriate responses to learner activity and goals is known as learning analytics or the older term of educational data mining. In a review of data mining over the past ten years (Baker & Yacef,2009) identify ways in which analytics can also be used to study the effect of educational interventions including automated or human tutorial support, student services, and use of resources such as libraries; thereby removing the blindness that has to date prevented educators from viewing and learning directly from distance student behaviours.

From the brief examples above we can see how technologies and especially the Net afford multiple ways in which CB pedagogies and related instructional designs are enabled, enhanced and made more cost effective. As MOOCs and other large-scale variants of the CB-model become more prevalent, we look forward to dramatic increases in the availability of high quality, affordable content, coupled with enhanced capacity for designers, teachers and even learners to customize that content for maximum learning.

Social-Constructivist Pedagogy of Distance Education

CB models are inherently focused on the individual learner. While there is a tradition of cognitive-constructivist thinking that hinges on personal construction of knowledge, largely developed by Piaget and his followers (Piaget,1970), the roots of the constructivist model most commonly applied today spring from the work of Vygotsky (1978)and Dewey (1897), generally lumped together in the broad category of social constructivism. Social constructivist pedagogies are focused on groups of learners, learning together with and from one another. Social-constructivist distance education pedagogies, not coincidently, developed in distance education in conjunction with the development of affordable many-to-many communication technologies. Beginning primarily in the 1980s and flowering in the 1990s, rather than transmitting information, technology became widely used to create opportunities for both synchronous and asynchronous interactions between and among students and teachers.

Social-constructivism does not provide the detailed and prescriptive instructional design models and methodologies of CB driven distance education. Nonetheless, there is a need for coherency among underlying psychological and philosophical assumptions, and the goals and design criteria for learning activities, if pedagogy is to evolve beyond the philosopher's chair and into the real world of distance education. Wilson (1996) defines social constructivist learning contexts as places "where learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities (p. 5). Social-constructivist pedagogy acknowledges the social nature of knowledge- its creation in the minds of individual learners but its instantiation in the practice and culture of groups. Teachers do not merely transmit knowledge to be passively consumed by learners; rather, each learner constructs the means by which new knowledge is both created and integrated with existing knowledge. Although there are many types of social constructivism (Kanuka &Anderson, 1999), all of the models have, more or less, common themes, including the importance of:

- New knowledge as building upon the foundation of previous learning

- Context in shaping learners' knowledge development
- Learning as an active rather than passive process,
- Language and other social tools in constructing knowledge
- Meta-cognition and evaluation as a means to develop learners' capacity to assess their own learning
- A learning environment that is learner-centred and recognises the importance of multiple perspectives
- Knowledge needing to be subject to social discussion, validation, and application in real world contexts

The need for social construction and representation of multiple perspectives necessitates the development of cohorts and social activities and increased "learner centeredness" within distance education, as opposed to individual studies that follow organizational or disciplinary models of instruction. As Greenhow, Robelia, and Hughes (2009) and others have argued, learning is located in contexts and relationships rather than merely in the minds of individuals. Beyond these defined needs for social interaction in learning, social-constructivist theories of learning are less prescriptive and not as easily translated into theories of teaching as their CB forebears. They do, however, leave more room for negotiation about learning goals and activities among teachers and students.

Emerging Technologies and Constructivist Models

Social-constructivist models only began to gain a foothold in distance education when the technologies of many-to-many communication became widely available, enabled first by email and bulletin boards, and later through synchronous technologies, the World Wide Web and mobile technologies. While such models had been waiting in the wings for distance education since Dewey or earlier, their widespread use and adoption was dependent on the widespread availability of robust supporting technologies. These technologies were first used to create distance education that mimicked campus classrooms. Audio conferencing, from the early 1970s, allowed students and teachers to engage in real time conversations distributed across geographic distance. These remote classrooms were later enhanced by video images (video conferencing), shared writing and display spaces (smartboards), and feedback mechanisms including polling and text chat (web conferencing). However, each of these synchronous advantages came at an obvious cost to distance learners and teachers – that being the loss of freedom associated with a commitment to meeting at a common time. Time constraint issues are especially important to distance students, most of whom are juggling employment and family concerns in addition to their formal course work. Equally challenging are issues of time synchronization across large geographic regions. In our graduate education courses at Athabasca University we rarely have a synchronous web conferencing session that doesn't involve someone participating in the middle of the night from their geographic home base. The challenges of synchronous interaction in constructivist-based models generated the need to create rich opportunities for dialogue and collaboration in asynchronous contexts. Since the 1970s and especially since the massive expansion of net-based tools in the 80s and 90s, the threaded discussion has become the staple means of learning dialogue in constructivist distance learning models. Recently asynchronous voice has become available as used in threaded list discussions especially for language learning (Stonrbrink,2008) and more recently for collaborative annotation of media in tools such as VoiceThread (Goa & Sun2010).

Data mining and learning analytics are not only used to support independent study based on CB models but are being utilized to support and enhance group work. Constructivist distance education pedagogies moved distance learning beyond the narrow type of knowledge transmission that could easily be encapsulated in media through the use of synchronous and asynchronous, human communications-based learning. Thus, Garrison (1997) and others could argue that constructivist-based learning, with rich student-student and student-teacher interaction, constituted a new, "post-industrial era" of distance education. However, this focus on human interactions placed limits on accessibility and produced more costly models of distance education (Annand,1999). Ironically, constructivist models of distance education began sharing (and even celebrating) many of the affordances and liabilities of campus-based education, with potential for teacher domination, passive lecture delivery, and restrictions on geographic and temporal access. Naturally, technological affordances of most relevance to constructivist pedagogies focus on tools to support effective establishment, operation and trust building within groups. The technologies that support rich social presence, including full range of audio, video and gestures, are associated with enhanced trust development and increasing sense of group commitment (Cyr,Hassanein,Head Ivanov,2007;Finkelstein,2006;Rourke & Anderson,2002).

Connectivist Pedagogy of Distance Education

The third generation of distance education pedagogy emerged recently and is known as connectivism. Canadians George Siemens (2005,,2007) and Stephen Downes (2007) have written defining connectivist papers, arguing that learning is the process of building networks of information, contacts, and resources that are applied to real problems. However, like behaviourist/cognitivist and social constructivist models, there are several variations and flavours of the general model that might include those relating to networks of practice (Wasko & Faraj,2005), networked learning (De Laat, 2006), and emergent Learning (Kay &Sims,2006), and it draws heavily from fields such as distributed cognition (Pea,1993), constructionism (Papert & Harel,1991) and communities of practice(Wenger,1998). Connectivism was developed in the information age of a networked era (Castells,1996) and assumes ubiquitous access to networked technologies. Connectivist learning focuses on building and maintaining networked connections that are current and flexible enough to be applied to existing and emergent problems. Connectivism also assumes that information is plentiful and that the learner's role is not to memorize or even understand everything, but to have the capacity to find, filter and apply knowledge when and where it is needed. Connectivism assumes that much mental processing and problem solving can and should be off-loaded to machines, leading to Siemens' (2005) contentious claim that "learning may reside in non-human appliance". Thus, connectivism places itself within the context of actor-network theory, with its identification of the indiscriminate and overlapping boundaries between physical objects, social conventions, and hybrid instantiations of both, as defined by their initial and evolved application in real life (Latour,1993).

While a great many speculative and theoretical papers have been written on the potential of connectivism (see for example special issue on Connectivism in IRRODL,2011, edited by Siemens and Conole), most reports of experience so far are equivocal and cater to a wide and often ill-defined diversity of learner needs. There is a clear need for a richer means of establishing both networked and personal learning environments that offer appropriate levels of freedom, control and constraint (Dron, 2007) when needed in both pedagogical and organizational terms. The crowd can be a source of wisdom (Surowiecki,2005) but can equally be a source of stupidity (Carr,2010), with processes like preferential attachment that are as capable of leading to the Matthew Principle (where the rich get richer and the poor

get poorer) and rampant bandwagon effects as to enabling effective, connected learning. We also note the criticism of connectivism as being merely an extension constructivist pedagogy and those who argue that it is not really a complete theory of learning nor of instruction (Wade,2010). However, taken as a family of theories rather than one particular flavour, there are some general principles that help to distinguish this from previous pedagogical generations of distance learning: distributed cognition; collective intelligence distributed across a network; a multiplicity of tools, methods and goals; an emphasis on an individual and the individual's connections; an assumption of ubiquitous social connection; a decentralization of teaching roles; a focus on creation in a social context as an active constituent of learning.

Instructional designs for connectivist learning, are as yet only loosely described and still evolving. Two essential characteristics though define connectivist pedagogies. The first is the need to gain high levels of skill using personal learning networks that provide ubiquitous and on demand access to resources, individuals and groups of potential information and knowledge servers. The second is the focus on creation, as opposed to consumption, of information and knowledge resources. As we shall see, the revised listings of Bloom's (1956) cognitive taxonomy place creation at the highest level of cognitive processing assuming understanding, application, and evaluation as component pieces of the creative process. There are also strong parallels with constructionist approaches that emphasize creation as playing a central role in the construction of knowledge (Papert & Harel, 1991).

Conclusion

It is clear that we are in stage of rapid technological development and profound new discoveries of life and learning in connected contexts. The emergence of collective understanding formed by the selective use and analysis of the networks, sets, behaviours and activities within which we engage promises much deeper understanding of our knowledge construction and application. It seems at least possible that the next generation of distance education pedagogy will be enabled by technologies that make effective use of these collective entities. It is concluded that all three current and future generations of distance education pedagogy have an important place in a well-rounded educational experience. Connectivism is built to some degree on an assumption of a constructivist model of learning, with the learner at the centre, connecting and constructing knowledge in a context that includes not only external networks and groups but also their own histories and predilections. At a finer granularity, both constructivist and connectivist approaches almost always rely to a greater or lesser degree on the availability of the stuff of learning, much of which (at least, that which is successful in helping people to learn) is designed and organized on CB models. The web sites, books, tutorial materials, videos, and so on, from which a learner may learn, all work more or less effectively according to how well they are designed and implemented. Even when learning relies on entirely social interactions, the various parties involved may communicate knowledge more or less effectively. It is clear that, whether the learner is alone, part of a learning community or a learning network, learning effectiveness can be greatly enhanced by applying, at a detailed level, an understanding of how people can learn more effectively: Cognitivist, behaviourist, constructivist, and connectivist theories each play an important role.

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