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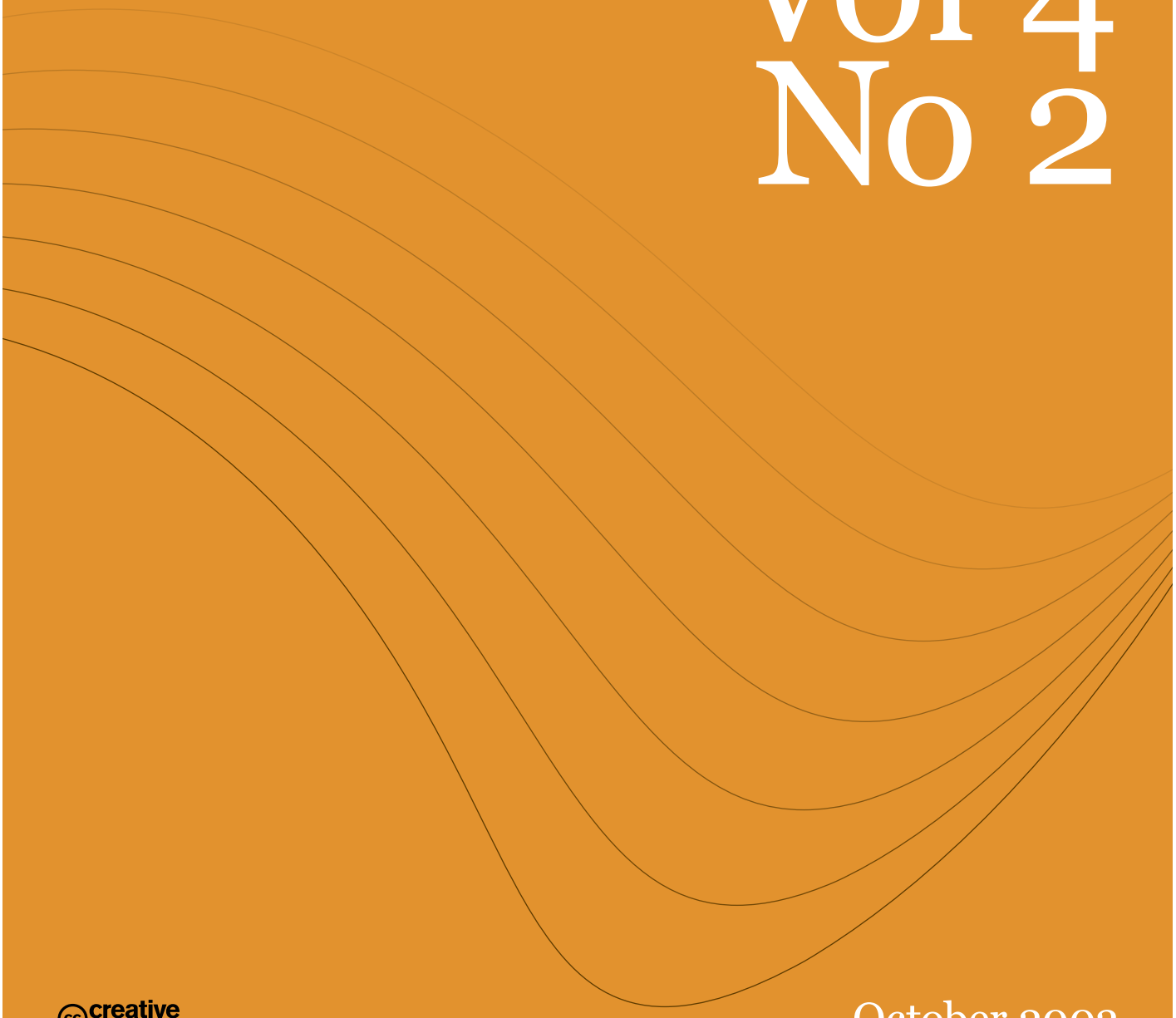

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Editorial

Does "lean thinking" relate to network-based distance education?

Peter S. Cookson

Pointing to the "objectivised, rationalized, technologically-based interaction," Peters (1973) referred to the then prevailing correspondence forms of distance education as "the most industrialized form of education" (p. 313). With such features as assembly line methods; division of labor; centralized processes of teaching materials development, production and dispatching; student admissions enrollment systems; automated registration, course allocation, and student support, and personnel management systems, distance education institutions demonstrated management structures and practices utilized in industrial and business organizations. Large numbers of courses and students were thus "processed" in correspondence, radio, and television-based distance education systems.

Over the past decade or so, there has been a major worldwide expansion of distance education systems, particularly online, Web-based systems. Unlike prior distance education systems, however, network-based distance education models do not so readily accommodate industrialized forms of education. Indeed, the interaction that network-based models enable between students and course content, teachers and peers, sets practical and attenuates the extent to which such teaching-learning transactions may be regarded a form of industrialization.

This divergence from industrial patterns of mass production is further reinforced by, currently in vogue, psychological approaches to learning that encourage abandonment of traditional teacher-directed exposition and passive student assimilation of the structures of objective reality. Constructivism calls for teaching that encourages students' active engagement in the construction of their own cognitive structures and perceptions of reality. To encourage constructivist thinking in the context of network-based distance education, teachers encourage active teacher-student and student-peer dialogue. However, there are practical limits to the number of students with whom an instructor can teach. The finite capacity of teachers to conduct and monitor these different forms of student interaction imposes limits on the capacity of institutions to match the massive numbers of students served by correspondence and mass media-based distance education systems.

Notwithstanding these logistical and practical limits to applications of industrial mass production methods to online distance education at the stage of implementation, such applications continue to be relevant for other stages of distance education design and development. When reliant on print-based course materials, large distance education providers, for example, usually maintain large stockpiles of course materials to be shipped as needed to enrolled students. Production of such materials incurs costs of printing, stockpiling, and warehousing. Printing presses and warehouse facilities occupy space. Materials need to be stored, moved, and processed; sometimes

they become out of date and must be discarded. Dispatching also involves costs for personnel and scheduling of peak periods associated with inception of classes, followed by periods of inactivity. When classes are scheduled to begin and end on a uniform term schedule, again peak activity for staff members is followed by periods of less activity. In such institutions, scheduling, administration, marking, recording and posting results of admissions and course examinations can be so slow that these procedures keep students in a dispiriting state of limbo for many months. All of these activities involve the common "batch and queue" method of producing in spurts, followed by periods of relative inactivity. Network-based distance education models offer just-in-time alternatives.

In the move away from mass media- and correspondence-based distance education systems toward online distance education programmes, a more relevant management approach referred to as "lean thinking" offers guidance for distance education program managers. Owing its origin to the innovative leadership of Taichi Ohno at Toyota Motors in Japan, and popularized by Womack and Jones (2003), lean thinking has enabled industries and public service organizations in many countries to eliminate waste, i.e., "any human activity which absorbs resources but creates no *value"* (Womack and Jones, 2003, p. 15), lower costs and, at the same time, to increase production. Lean thinking provides "a way to do more and more with less and less – less human effort, less equipment, less time, and less space – while coming closer and closer to providing customers with exactly what they want" (Womack and Jones, 2003, p. 15).

Five core values of lean thinking represent criteria that may be applied to the improvement and evaluation of network-based distance education systems:

1. Identifying those aspects of the educational service learners regard as value is the starting point for lean thinking. Open and distance education programs are in the business of introducing or reinforcing students' connections with learning and opportunity structures. While cultivating meaningful social relationships within a virtual learning community, students are able to improve the quality of their lives and advance their life chances by increasing their knowledge, skills, and other qualifications. From the convenience of their own home or workplace, students may access formal education and continuing education courses without being required to accommodate the location and schedule requirements of educational institutions.

2. Mapping the value stream focuses on tracking the route by which all of the different educational services provided by the institution are transformed from ideas to reality. Increased awareness of how value is produced can enable detection of areas where processes may be simplified, streamlined, and thus become free of waste.

3. Services should flow continuously; the more common "batch and queue" method of service delivery must be avoided. Although in order to assemble networked learning communities of fellow learners, network-based systems often group students in fixed term-length courses, thus retaining the "batch and queue" method, other distance education institutions retain open enrollment arrangements whereby students may begin their courses at any time. In other areas of distance education administration, some institutions have adopted a "just-in-time" approach to printing and testing; they are thus able to produce quick turn around of assignments and test scores. Even just eliminating all forms of "batch and queue" can result in a steady flow of educational services without the periodic strain of responding to peak periods followed periods of relatively low levels of activity.

4. "Pull" refers to the increased speed with which the educational services flow from the institution to the learners. As examples of non-productive activity are identified and eliminated, the time to produce the educational services is reduced, sometimes dramatically.

5. Perfection in terms of high quality of educational services, with the correspondingly heightened satisfaction of the learners with the value of the services received, becomes attainable for the lean thinking distance education institution.

Explaining how these steps merge in an overall management strategy, Womack and Jones (2003, flyleaf) write:

> *. . . Lean thinkers go back to basics by asking what the customer [learner] really perceives as* ***value.*** *. . . The next step is to line up value-rating activities for a specific product [service] to line up value-creating activities for a specific product [service] along a value stream while eliminating activities (usually the majority) that don't add value. Then the lean thinker creates a flow condition in which the design and the product [service] advance smoothly and rapidly at the pull of the customer [learner] rather than the push of the producer). Finally, as flow and pull are implemented, the lean thinker speeds up the cycle of improvement in pursuit of* ***perfection.***

The concept of "lean thinking" presents a challenge for distance educators. Now that so much of open and distance education is delivered by network-based systems, with their attendant limitations on industrialized forms of education, and the increased application of constructivist approaches to learning, is it time to advance beyond regarding distance education in terms of mass production forms of industrial management? Does lean thinking have a place in the way we administer and manage network-based distance education systems? Does it offer insights for improving the quality of all of our distance education programs, not just those that are network-based models? How we answer these questions will have lasting consequences for the institutions in which we work, as well as the tens of thousands of students we collectively serve.

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From Cognitive Landscapes to Digital Hyperscapes

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Abstract

The widespread diffusion of e-Learning in organizations has encouraged the discovery of more effective ways for conveying digital information to learners, for instance, via the commonly called Learning Management Systems (LMS). A problem that we have identified is that cognitive variables and pedagogical processes are rarely taken into consideration and sometimes are confused with the mere use by learners of "diversified" hypermedia resources. Within the context of widespread dissemination of multimedia content that has followed the emergence of massive information resources, we discuss the need for more powerful and effective learner-centered tools capable of handling all kinds of design configurations and learning objects.

Keywords: cognitive profiles; learning styles; mind mapping; multimedia and hypermedia content; hyperscapes; e-Learning; learning objects; Learning Management Systems (LMS)

Introduction

In the development of educational products and systems, learner variables are often neglected. It is common to find the emphasis on the multimedia technology itself. One must ask: When e-Learning solutions are applied, why are cognitive landscapes not taken seriously? In our view, any learning system should address the issue of different individual learning abilities. However, regardless of the interaction potential they offer, cognitive representations may vary so widely that a single system will not be able to cope with such variation (Rogers and Scaife 1997). Aspects such as learning ability, developmental issues, memory organization and capacity, and the nature of cognitive representation are crucial. There is also some evidence (Hay et al., 1994) that educational technology affects students differently. While it works effectively for some, it fails for others. The same is true for teachers and tutors. These research issues have yet to be resolved through more in-depth observation and evaluation of subjects that come into contact with e-Learning systems.

While those researchers working at the frontiers of knowledge might disagree about how the human mind works, there seems to be agreement on some basic principles (Kahneman, Slovic, and Tversky, 1982). According to Kahneman et al., the mind:

- Is an inference machine that actively imposes order on highly ambiguous situations
- Works to keep internal core beliefs consistent and unchallenged and thus will deny, distort or ignore signals that contradict core beliefs
- Prefers simplicity
- Is constrained by reality in important ways (effect of the circumstances)
- Prefers stable and enduring relationships among its core beliefs

In other words, where nature is ambiguous, people tend to develop strong beliefs and act upon them. Reflective practice and critical thinking also match this strategy. People tend to simplify complexity and make the inconsistent seem consistent. These characteristics have strong implications for the design of multimedia and hypermedia learning materials.

Our mental processes make rapid estimates of what information is valuable to notice and what can be treated as background – phenomenon that is extensively addressed by Gestalt Theory. Furthermore, when we look at a composition of images on a screen, the mind takes some of these images and creates something that fits existing mental schemas. In other words, we see every image we come across with theory-laden vision. Each and every one of us assigns meanings differently.

Cognitive Profiles and Learning Styles

Perhaps because mental schemes are so important and so necessary for orderly interaction with others, people are reluctant to change them. In fact, people tend to hold on to that self-achieved order and often fight to retain their individual "mind maps." Because of this human tendency, we argue that in the design of multimedia and hypermedia learning materials, the input of individual cognitive preference naturally becomes an important factor.

Although it is a historically situated approach, four types of "cognitive profiles" identified by Jung (1960) are still worth revisiting:

1. Intuitive (integrates patterns, possibilities, ideas)
2. Feeler (is concerned mainly about people and life)
3. Thinker (focuses on cause and effect)
4. Sensor (is concerned with activities and events)

Another quadrilogy that we should refer to has been suggested by Uys (1998), that was based on Kolb's Model of Experiential Learning (1984), and acknowledges that every student has a mixture of four basic "learning styles" (see Figure 1):

1. **Reflector:** This student learns best by reflective observation. Learners can be provided with appropriate exercises in course pages, and because a large proportion on the Web is asynchronous, this caters naturally to the needs of reflective students.

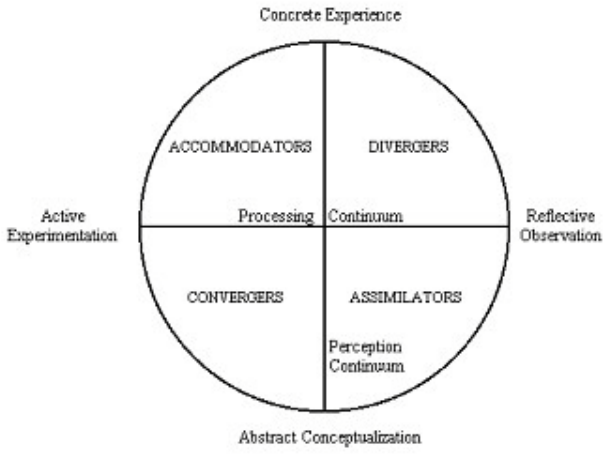
2. **Pragmatist:** This student learns best by engaging in practical applications. Practical exercises are assigned within a problem solving structure, with theoretical support of images and sound used to contextualize this student's learning experience.

3. **Theorist:** This student learns best by abstract conceptualization. As instructional pages of (information-giving) course material are readily available, relevant narrative modules can be easily digitized and made available in course pages.

4. **Activist:**This student learns best through activities and concrete experiences. The Web naturally lends itself to "discoveries" through the use of hyperlinks, and the main assets are its random navigation possibilities, a high-level of interactivity via email, message boards, and chat rooms, and, of course, the use of graphics, colors, sounds, and movement.

This differentiation suggested by Kolb (1984) stresses the need in a group or individual learning environment for flexible support of these styles, along with the possibility of effortless transition among them. Figure 1 shows the interactions among the relevant factors that make up the profiles within the Model of Experiential Learning.

Figure 1. Kolb's Learning Styles: Model of Experiential Learning (Kolb, 1984, p.58)



Cognitive characterizations are also important to define precise design concepts. More specifically, we are concerned with the issues designers need to consider in the development of interactive material. The "design concepts" outlined by Rogers and Scaife (1997) seem appropriate and relevant:

- Explicitness and visibility: How may aspects that are more salient be displayed so they may be perceived and comprehended appropriately?
- Cognitive tracing: What are the best means to allow users to externally manipulate and make marks on different representations?
- Ease of production: How easy is it for the user to create different kinds of external representations – e.g., videos and animations?
- Combinability and modifiability: How may the system and users be enabled to combine hybrid representations – e.g., enabling animations and commentary to be constructed by the user, which could be appended to static representations?

These design concepts may be applied at a more detailed level by means of technical parameters such as the use of graphics, navigation aids, or types of media that may be implemented at the interface.

Redundant visual coding may be used to constrain the way information is interpreted. The coordination of elements and the cueing for certain aspects are also important. Regrettably, these tasks are often impossible to establish when we use commercial learning management software.

Design considerations cannot just rely on cognitive characterizations. The domain knowledge that needs to be learned by students has specific didactic characteristics that suggest how we may use different representations. For example, a chronological sequence of historical events may be illustrated by a series of relevant still images (e.g., paintings, photos, etc.); a poem may be more adequately illustrated by audio; and those learning from a physics experiment may benefit from slow motion video.

This issue is further complicated, because in many cases the formal representations are not merely explanation aids – they are an essential part of the domain of knowledge itself. Accordingly, we must differentiate between multiple representations as a system, and by this we mean representation systems such as, for instance, algebra plus graphs, and augmentations of a representational system – e.g., 3D images to show complex data.

The Multimedia Experience

Although it is desirable that learners be allowed and encouraged in a creative and purposive way to engage with multimedia and hypermedia materials, we must ensure they have access to learning experiences that both support and go beyond what may be achieved with print. To find out how this objective might be achieved, it is necessary to look in a broad perspective first at the user interface to distinguish between the mainly ergonomic aspects of access to multimedia materials and learners' subsequent interaction with them. According to Whalley (1997), "the extra resources involved in creating and accessing multimedia materials have to be justified in terms of improved learning, which is unlikely to result from simple issues such as the speed of information access, or to the large quantities of text that can be squeezed on to a CD" (p. 3).

On the other hand, judging from the numerous CD-ROM and websites surveyed, a "more is more" philosophy has become pervasive. Many think that quantity and sophistication of multimedia information are important indicators of the value of educational materials. For example, adjectives such as "eye catching," "mind boggling," "powerful," and "dynamic" are used. However, based on observations of learners exploring multimedia materials (both on CD-ROM and the Web) we discovered that too much time is wasted by students wandering about, playing video clips and animations, whilst skimming through accompanying text or static diagrams. Rogers and Scaife (1997) reported a typical example that concerned the evaluation of a CD-ROM on design called "First Person," written by Don Norman, in which students consistently admitted to ignoring the text in search of clickable icons. Moreover, the selection of one icon would present an animated video of Don Norman explaining some aspect of design. According to Rogers and Scaife, rather than improve learning, this video introduced extra "noise" in the process. Students became quite passive and did not engage in active meaning making of their own. We can therefore conclude that many multimedia environments may, in fact, induce more dispersed and superficial learning.

Possibly relying on modular elements, an ideal prototype might comprise characteristics of a "microworld" – a highly interactive learning environment that is geared to open-ended problem solving. The environment should be self-contained and provide enough opportunities for multiple views and knowledge representations. A variety of questions could be posed and possible solutions could be explored in constructive ways via activities that engage individual learners. A natural starting point would be a workstation with a large color screen and a Windows operating system that divides the screen into logical parts used for different purposes. The use of Windows in precisely this manner is typical of many computer users/ students. For example, while a browser window shows live video, another window can provides simultaneous accompanying text annotation. We foresee the need to base any future solutions on robust platforms that support several channels of communication, as well as links between the multiple documents.

Creating Digital Hyperscapes

The knowledge construction process that learners engage in typically follows a specific learning profile, and therefore should be supported by appropriate multi-channel tools based on effective hypermedia technology. Hypermedia spaces – or *hyperscapes* – may be conceptually identified with huge networks that extend from hypermedia "pages" to vast knowledge "spaces" housed on the Web, where the latter tends to grow to a "landscape" dimension. However, hyperscapes are also cognitive artifacts that offer expressive power to authors, and work to support active learners as they develop knowledge paths relevant to their own aims and needs. As people make sense of the fragmentary information that surrounds them, they create branched structures of knowledge that diverge from a single node; usually there is something that triggers new thoughts, perhaps as a question or a new point of view. A key-element in our approach is the explicit introduction of "mind mapping support" in the construction, visualization, and navigation of complex knowledge structures (Gaines, 1995). This feature is currently not found in learning content management software.

The construction of hyperscapes may be achieved through Mind Mapping®, a popular technique invented (and copyrighted) by Tony Buzan in the UK. According to Buzan (1995) the mind mapping technique was developed for representing knowledge in layers that constitute branches or networks of ideas. Departing from a central word or concept, one can aggregate images, graphics, and dynamic media elements (e.g., audio and video) to the representation. The difference between a concept map and a mind map is that a mind map departs from one main concept, while a concept map may deal with several. Hyperscapes can rely on both kinds of maps, depending on the objectives and strategies we define for a given learning environment.

Mapping techniques were developed to represent knowledge in graphs that constitute networks of concepts (Gaines, 1995). Networks consist of nodes (points/ vertices) and links (arcs/ edges), where nodes represent concepts and links represent the relations between concepts. Concepts (and sometimes links) are labeled, and may be categorized: they may be simply associative, specified, or divided in categories such as causal or temporal relations. The resulting patterns of association and branching create fractal-type structures. Like clouds or trees, they form physical structures that do not possess a defined form; we can always describe other levels or scales of its structure, where we may always find the same basic elements or patterns (self-similarity) in fractal structures.

Knowledge mapping is important in modern educational environments, because the ultimate goal is the development of reference models that are meaningful organizations of information in learners' minds. In addition, if we use significant sounds, pictures, and graphics to express ideas, learning processes are usually facilitated.

The cognition and learning related issues discussed previously, justify the need for a framework and a set of requirements to approach multimedia design for educational purposes, namely: 1) flexible access and structuring of knowledge and rich information; 2) flexible interaction with this knowledge and information; and 3) communication and interaction among participants in a learning experience. This framework could incorporate the following design ideas:

- To structure rich information and knowledge, we propose the integrated use of cognitive maps and hypermedia
- To support individual and collective interaction and manipulation of information and knowledge, we require the ability to navigate and change those structures
- To enable personal interaction and communication, we require sharing and co-construction of both information and knowledge structures

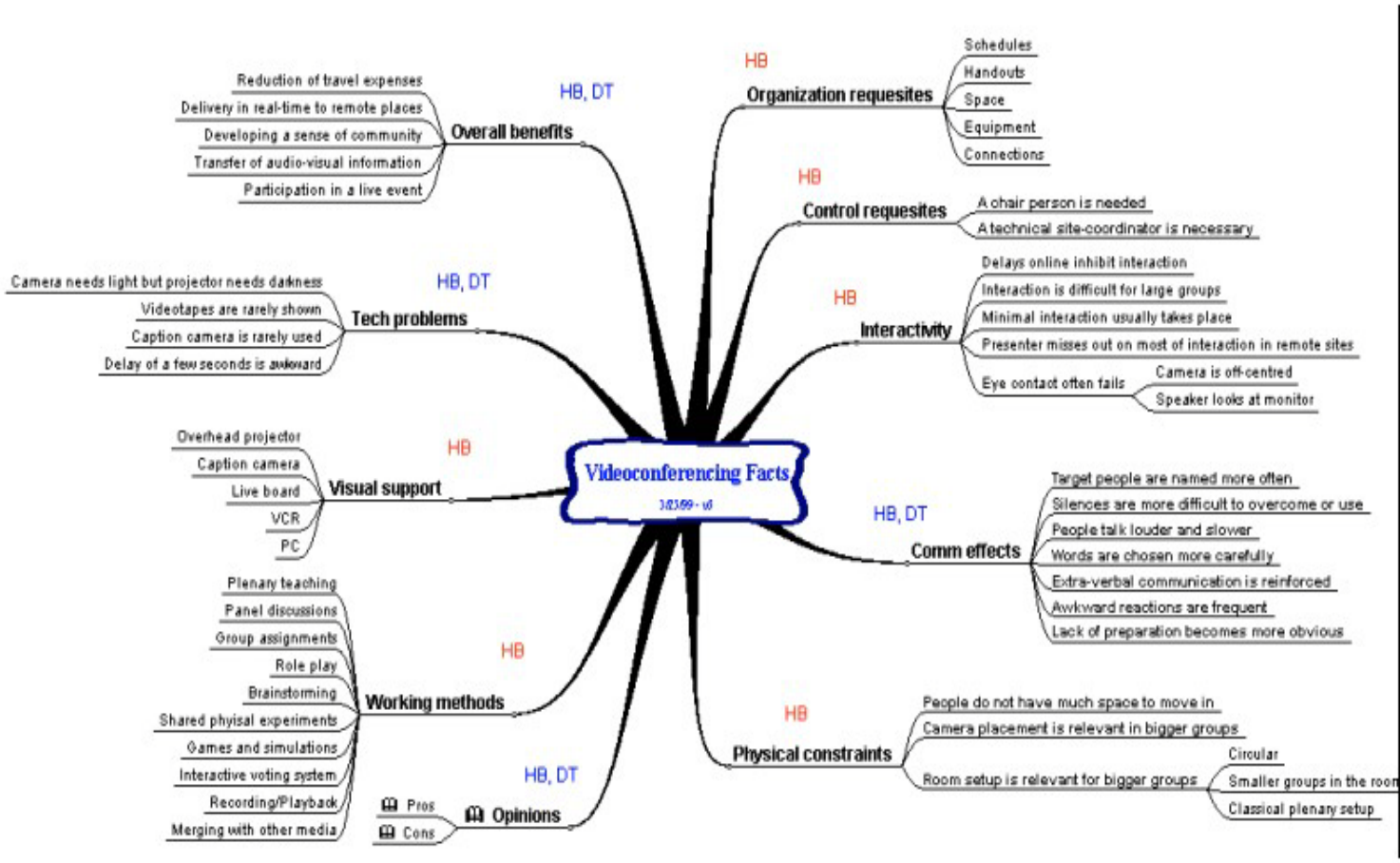
To support interaction and communication, one must first take into account the opportunities for synchronous and asynchronous, as well as remote or co-located interaction. In this context, the time-space matrix (Table 1) summarizes the role of the different components.

Table 1. Time Space Matrix

Interaction	*Same time*	Different time
Same space	Enhanced classroom	Shared offline facilities, knowledge and hypermedia structures
Different space	Videoconference and chat	Shared online facilities, knowledge and hypermedia structures

In the past, micro-worlds have been created to provide an entirely new framework for the learner to explore. However, today the Web can already provide numerous worlds in which one can interact. According to Cognitive Flexibility Theory (Spiro and Jengh, 1990), as learners chart their courses through the use of hypermedia material, they are able spontaneously to restructure their knowledge in many ways. For example, learners may construct knowledge artifacts initiated by the instructor, and further developed and shared in an organic, adaptive, and generative manner (Guimarães, Chambel, and Bidarra 2000). See Figure 2.

Figure 2. Structure of a knowledge map about "Videoconferencing Facts" developed with *MindManager* ©



Technologies that may be used to create learning hyperscapes currently take various forms and tend to have familiar labels – for example: *E-learning* for Internet-based learning; *T-learning* for television-based learning; and *M-learning* for Mobile-based learning. Perhaps these technologies will have a great impact in the near future, and will change the way we conceive open and distance learning.

In an experiment conducted by Guimarães, Chambel, and Bidarra (2000) a group of students attending a Master's program on Educational Multimedia was given the task of creating fractal hyperscapes; in this case, mapping and developing of layered Web structures that reflected their interaction with knowledge with instructors and other students. The aim of this experiment was to find out how the learning process evolved as students worked together as architects of conceptual hyperspaces. Emphasis was placed at the level of students' engagement and motivation, and the final quality of the hyperscapes material. Students were given a conceptual map with the course's main themes, which they had to explore and develop further both off and online. They were encouraged to proceed from linear thinking to non-linear authoring of hyperscapes in a process comprising of four phases: 1) preparation; 2) construction; 3) interaction; and 4) presentation.

Final assessment was based on project work following standard academic procedures. Results turned out to be promising, but required tremendous effort on the part of faculty in terms of authoring content and tutoring.

Learning Management Systems

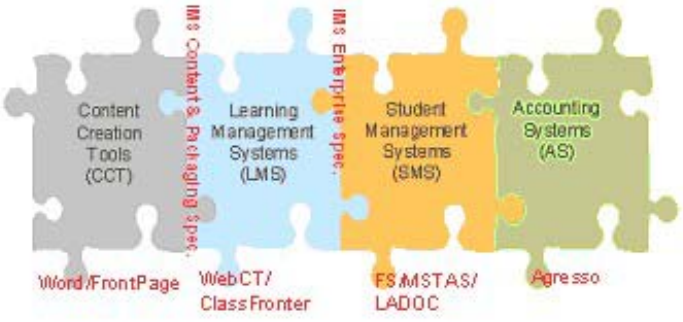
Many corporate learning Websites are organized around tightly focused topics, containing specific technologies (ranging from chat rooms to groupware) that enable users to submit and retrieve information in a mechanical manner. In these environments we find reusable "objects," media-independent collections of information used as modular building blocks for e-Learning content. These combinations of technologies and learning methodologies usually take the form of software and/ or hardware products that suppliers tout as answers to businesses' training needs. In general, these emergent technologies do not provide the tools we need to create learning hyperscapes – at least not in the sense we have discussed so far. However, these technologies are used to attempt to solve some interesting "engineering" problems.

Current e-Learning systems tend to be based on a group of innovative software solutions, which include the learning management systems (LMSs).

Paulsen (2002) describes four main categories of systems:

- Content creation tools (CCT)
- Learning management system (LMS)
- Student management system (SMS)
- Accounting system (AS)

Figure 3. Learning Management Systems (Paulsen, 2002, p. 23 – 24)



Learning management systems are intended to address a range of pedagogical and technical issues such as learning and design theory, hardware and software purchase, student support services, student assessment, student interaction, instructional strategies, security and firewalls, and staffing. The goal of this type of platform is to enable an information system that can handle effectively students, teachers, courses, and course material in an online environment.

Paulsen (2002) explained that an online college may have to handle thousands of students, hundreds of teachers, and a large number of courses with password restricted webpages, discussion forums, distribution lists, class rosters, and student presentations. It may also have to provide administrative systems for the timely dispatch of textbooks, handling of tuition and examination fees, and organization of local examinations. Institutions that plan to offer large scale and professional online education need such a Web-based administrative system integrated with the Internet. In this technological context, it becomes clear that the main issues that still to be addressed are associated with the instructional design enabled by the system, expectations and specific needs of learners, and the role of the teacher in this new environment.

Learning Objects

Today's tendency to develop large-scale e-Learning systems, which often include proprietary learning methods, creates the need to stabilize processes based on learning objects, specifications, requirements, and standards. The ideas of content portability, granularity, and interoperability often complete the notion of systems compliant with certain norms, thereby allowing users to migrate easily from one system or software to other similar systems or software.

It is striking that terms like "standards," "requirements," "specifications," and "learning objects" currently used in e-Learning are all terms derived from "engineering." The problem, however, is that these terms represent becomes part of an "engineering process" rather than of a "pedagogical process." Pedagogy theories appear to be positioned distantly in another domain of knowledge. Clearly, this dependency on technology and software development is driving e-Learning research into new areas, but with what effects?

An important aspect of e-Learning is that it depends upon digital technology for implementation. New and improved information technologies like databases, learning management systems (LMS), learning content management systems (LCMS), search engines, etc., are giving rise to new possibilities for storing, retrieving, and reusing information objects across systems, time, and geography (space). In his White Paper "Demystifying eLearning Standards," Singh (2001, p.4) explains these as:

Content Portability: When content has been separated from proprietary delivery systems, the organization can consolidate, organize and track their eLearning initiatives in the LMS of their choice. Because this is true for both third-party custom-content, corporations will have greater flexibility and lower switching costs.
Granularity: New specifications support learning object methodology, allowing for smaller and timelier units of information. Learning objects add "just enough" to "just-in-time" learning.
Interoperability: Application interoperability starts where different e-Learning applications can share content and tracking data. But even more exciting, these specifications open up the possibility for different types of applications to swap and access content."
Learning objects are seen as units of information that one can manipulate. Learning objects may be organized according to a structured framework in such a way that each "information piece" operates as an independent unit, which can be defined by metadata. This idea enlarges

possibilities for reusing, assembling and manipulating learning units, and (re)organizes them according to specific needs.

According to Olsen (2002), the fundamental idea behind this object oriented design model is that content can be split-up and put back together in new learning tracks/ courses in the same way one plays with blocks of LEGOÂ®. In recent research aimed at building a semantic notation for complete units of study in e-Learning, Koper (2001) showed that a unit of study (learning object) may not be broken down to its constituent parts without losing semantic and pragmatic meaning and thus failing to attain the intended learning objectives. Such units of study may take the set form of a course, study program, workshop, tutorial, or any kind of lesson.

Unfortunately, these models always focus on learning with bits and pieces of information (i.e., objects), and overlook the didactic or pedagogical model behind it. Learning perspectives that take into consideration cognitive variables – e.g., the learners' sphere of interests – must be taken into account.

Conclusion

Within a context of widespread multimedia content, following the emergence of massive information resources, there is a need for need for more powerful and effective learner-centered tools, capable of handling all kinds of design configurations and learning objects. Therefore we must ask: How do we address the cognitive needs of learners using new information technologies like databases, Learning Management Systems, and Learning Content Management Systems?

A first recommendation is to consider a model sustaining the acceptance of information technology by the learner, namely, to find out:

- What do users want an e-Learning system to look like? And what functionality should be included? (Can we proactively address their different learning styles?)
- To what degree do individuals believe that using a particular e-Learning system will enhance their global performance? (Can we show the benefits outweigh the costs?)
- What amount of mental or physical effort do individuals need to make in order to derive tangible benefits from the e-Learning system? (Can we inform learners through straightforward tutorials?)

Secondly, knowledge construction that accompanies an evolutionary process of self-development often yields unpredictable outcomes. Implicit suggestions therefore are to adopt pro-active learning strategies; foster collaboration with peers and other students; and adopt a bold perspective concerning the problems to solve. For instance, "chaotic" elements that enter the processes in creative activities (e.g., generation of new ideas) must be managed according to each learner's path and progression in order to arrive at meaningful results.

Greater flexibility does not necessarily call for application of less professional approaches. In fact, the exercise of more "authority," which is usually attributed to the teacher or organization, is

no longer desirable. Nevertheless, looking at the latest learning platforms, we find that these cognitive variables and pedagogical processes are rarely taken into consideration, and sometimes they are confused with the mere use of "diversified" hypermedia resources by learners. What remains is the idea that pedagogy vs. technology is a problematic contest that needs to be clarified by further research. We do not know for sure how learning takes place in the realm of today's Web hyperscapes and digital technologies, but we do know a great deal about human cognition.

In conclusion, by covering both old and new conceptual spaces we have examined some emerging issues in e-Learning. We have described the need for a bridge between cognitive issues and digital technology solutions, and new ways for instructional designers to create materials. We have also suggested ways to engage learners in reflective practice and critical thinking with mind mapping. Clearly, much more work and research needs to be done, but perhaps Salomon (2000) pointed the way forward when he said: "Let technology show us what *can* be done, and let educational considerations determine what *will* be done in actuality."

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Reviewer Commentary

From Cognitive Landscapes to Digital Hyperscapes

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Editor's Note: *All correspondence between the authors and reviewers, until date of publication, has been blind.*

The author takes readers on a surprising mental journey from cognitive landscapes to digital hyperscapes. Attempting to escape from the limited boundaries of already explored trails, the author(s) takes us along the beautiful, futuristic scenery of a diversified learning space in more dimensions. We can follow the author(s) in this exercise, sense the experience and appreciate their attention for our own cognitive profiles or learning styles. The concept of mind mapping techniques as a base for the creation of digital hyperscapes is an interesting idea, and invites further research and development, both by educationalists and technologists.

As an engineer myself, I appreciate the reference to "playing with blocks of LEGO" as a paradigm for the use of learning objects in a L(C)MS as (part of) the implementation of a digital hyperscape. However, I wonder why the author in this context fails to mention the theory of constructivism, and more specifically of socio-constructivism (inspired by the work of Vygotsky, a Russian psychologist). Nowadays, this is a well-accepted pedagogical concept that learners take responsibility for their own learning process by building new knowledge on what they have already mastered while interacting with their peers and experts. I believe it an interesting exercise to explore how this socio-constructivism could enforce and enhance the creation of digital hyperscapes as intended by the author(s).

Finally, I have a more philosophical comment: Why should digital hyperscapes as a learning environment be superior to than traditional delivery methods? Has someone ever doubted about the usability of paper as a learning tool? We just assume that since Gutenberg invented the art of publishing, books are the best way to share knowledge with others. Children nowadays grow up in a diversified multimedia and highly technological world; they probably wonder why their learning is not taking place in a similar way as their favourite games. I simply think we *should* develop rich and diversified digital hyperscapes, without asking the question if they could be better than existing learning environments. By taking into account the feelings and expectations of new learners in a sophisticated world, we will better address their learning needs.

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Authors' Response

To Wim Van Petegem by José Bidarra and Ana Dias

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Editor's Note: *This is José Biddara and Ana Dias' response to the review by Wim van Petegem, Katholieke Universiteit Leuven, Belgium. All correspondence between the authors and reviewers, until date of publication, has been blind.*

It seems to be now established that by adopting non-sequential (hypertext) architecture in texts and introducing therein components of sound, fixed images, and video clips (hypermedia), we have the means of creating new degrees of freedom in the way learning content is approached and studied. Furthermore, we have the potential for including a constructionist or "play" component that may increase its appeal, and facilitate learning, for different learner audiences. We also determine that "mind mapping" is a proven way to elicit knowledge structures in any constructivist learning process. This approach may be connected to different constructivist learning models, for instance, those based on multimedia materials (e.g., Papert's LOGO).

We agree with the first reviewer that Computer Mediated Communication (CMC) has permitted the possibility of assuring student-student interaction through the constitution of discussion and collaborative-learning groups, thus breaking the traditional and awkward isolation of the distance learning student. Online educators have realised that they can generate effective (small) group discussions, if they can provide learners with specific tasks to accomplish. Important aspects are resource quality, scheduling with precise deadlines, and consistent online support. In this regard, the creation of hyperscapes by learners working in virtual groups with access to expert guidance is a good example of socio-constructivism (proposed by Vygotsky for younger learners). Perhaps we did not explain the thought in so many words in the article, but surely, the idea of constructivism is noticeable throughout the text.

We do not think the question to be asked is: "Why should hyperscapes be better than traditional methods?" But rather, we feel we must approach hypermedia as actuality and ask: "How can hyperscapes be integrated with other learning modes (while coping with cognitive variables, pedagogical concerns and multimedia capabilities)" to ensure they address the diversified needs of learners in our sophisticated world? We must bear in mind that in addition to materials specially conceived and produced for use in a given distance learning situation, the Internet now allows students access to a huge amount of supplementary information based on many different

alternative sources. The challenge remains one of making sure that the information retrieved is positively related to the study subject, and that its source is credible, useful, and relevant for each learner. Surely, this will be the role of the teacher or professor in the years to come.

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Reviewer Commentary: From cognitive landscapes to digital hyperscapes

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Editor's Note: *All correspondence between the authors and reviewers, until date of publication, has been blind.*

This contribution from the world of corporate education reveals the gap that separates non-academic learning (most frequently, training for specific tasks) from academic learning (preparing the higher-order-thinking skills of future professionals) is narrowing. However, the sweeping generalizations offered in the article should give us pause, as should the "straw man" the authors have set up: nobody today is concerned with pedagogy, only with engineering and technology. The authors' abrupt and wholesale dismissal of course management systems, of the standards presently under development to facilitate portability and interoperability, and of attempts to find instructional designs adequate to the "styles" of present-day learners, is superficial, imprecise, and unfair. Although the authors confess that due to the complexity of the variables, no single learner-centered system can be totally effective, they propose one (*hyperspaces*: microworld-based, modular, with open-ended problem-solving, mind-mapping), without citing any examples or persuasive analysis of how it works. Likewise, merely listing the characteristics of learning styles identified by earlier investigators may bring us *closer* to finding practical solutions for creating effective learner-centered works, but in and of itself, it is neither original nor immediately useful.

The authors' summary treatment of Koper's investigations and subsequent studies in the area of educational modeling language (EML) ignores those serious attempts at integrating pedagogical models, learning and course environments. My University of Sao Paulo colleague, Cesar A. A. Nunes, has shown in his studies with learning objects that the diffusion of EML amongst projects around the world concerned with standardization and reusability, such as IMS, indicate a growing interest with pedagogical aspects, a phenomenon not acknowledged by the author.

As we move from being a community of professionals accustomed to "delivering" knowledge to just a few levels of learners, towards that of trying to create "learning opportunities" for many more levels and types of learners, it behooves us to be generous and encouraging to all those engaged in the process. Never before have so many individuals and institutions around the world been committed to the task of finding effective strategies for new forms of learning. Though surely some are closer to the goal than others are, all deserve a fair hearing and constructive criticism.

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Authors' Response to Fredic Litto by José Bidarra and Ana Dias

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Editor's Note: *This is José Biddara and Ana Dias' response to the review by Fredric Michael Litto, The University of São Paulo, Brazil. All correspondence between the authors and reviewers, until date of publication, has been blind.*

Our article starts with the sentence "Learner variables are often neglected in the development of educational products and systems." We do not affirm bluntly that: "nobody is concerned with pedagogy." Instead, we say that the hype today is digital technology, and this has pushed aside other important considerations such as pedagogy related to learners' cognitive profiles. Nevertheless, most Web delivery platforms use pedagogy as a strong selling point (this, of course, has to be verified for each specific case). We believe that it is not a waste of time to think about some "old stuff," especially when the way we teach and learn in schools has been around for some thousands of years.

New standards are usually an effective way of assuring that commercial products are compatible with each other and can be distributed widely with fewer problems. This works fine at the level of engineering and deployment of technology, but encounters problems when we focus on the level of individual learners, specifically their cognition variables that entail added levels of complexity. Recent studies concerning learning object languages point us in the right direction, and the educational modeling language (EML) is definitely a serious attempt. Although this was not the object of the article, it is worth mentioning here the work of The Valkenburg Group, set up in March 2002 around a three-day conference in Valkenburg, the Netherlands, on the topic of "Developing an EML authoring and content management environment." Participants included representatives from research and development institutions in the field of e-Learning technologies, users and private sector parties from various countries in Europe, the USA, Canada, and South Africa. The focus on design-time tooling for EML was broadened to e-Learning technologies in general, but still with a focus on the application of EML to model and implement learning opportunities.

The tremendous work done by many of the e-Learning Standard Committees is important and most appreciated by the authors of the article. Nevertheless, we understand that more efforts should be directed towards integration of pedagogical and cognition variables into standardization processes. From our point of view, all technologies should be considered just as tools used for distance learning, rather than seemingly essential factors involved in the learning process. The development of pedagogically sound materials implies much more than just using intensively a given technology or communication facility: it comprises all the (creative) human factors and

qualified work involved in conceiving appropriate learning materials, devising a sound pedagogical strategy, providing individual students with efficient support mechanisms, assessing their progress, and certifying their results. Eventually, standards like EML will help us realize these objectives. We conclude with some food for thought. How do we design standards for solving computer games, especially when individual strategies may come out of the blue? How do we reach a solution in a case study, one that often involves complex human factors?

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On the Concepts of Usability and Reusability of Learning Objects

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Abstract

"Reusable learning objects" oriented towards increasing their potential reusability are required to satisfy concerns about their granularity and their independence of concrete contexts of use. Such requirements also entail that the definition of learning object "usability," and the techniques required to carry out their "usability evaluation" must be substantially different from those commonly used to characterize and evaluate the usability of conventional educational applications. In this article, a specific characterization of the concept of learning object usability is discussed, which places emphasis on "reusability," the key property of learning objects residing in repositories. The concept of learning object reusability is described as the possibility and adequacy for the object to be usable in prospective educational settings, so that usability and reusability are considered two interrelated – and in many cases conflicting – properties of learning objects. Following the proposed characterization of two characteristics or properties of learning objects, a method to evaluate usability of specific learning objects will be presented.

Keywords: Learning objects; reusability; usability evaluation; learning technology standards

Introduction

Growing interest in Web-based learning has accelerated steps towards the standardization of electronic learning contents (Anido et al., 2002). Work on defining reference models for learning objects is currently underway, with the ultimate aim of facilitating their inter-changeability, composition, and even their use in highly personalized learning contexts (Martinez, 2001). Diverse organizations supporting standardization are converging towards the Sharable Content Object Reference Model (SCORM) (ADL, 2001a). The most current version of SCORM (1.2) comprises both a model for the description and aggregation of contents (ADL, 2001b), and a specification for run-time interaction between client applications and Learning Management Systems (ADL, 2001c). While the SCORM, the Institute for Mathematical Statistics (IMS), and others conform to the Learning Objects Metadata (LOM) standard, (IEEE, 2002), the IMS Global Consortium (*http://www.imsglobal.org/*) provides an even more comprehensive collection of specifications. The concept of reusable learning objects (Wiley, 2001) is a key feature currently driving efforts oriented towards standardization and specification of Web-based educational content. This industry is growing, and it is growing fast.

Both the concept of learning object and its realization in the SCORM model are not free of controversy (Polsani, 2003; Bohl et al., 2002). As a consequence, studies regarding learning objects are first forced to commit to a concrete definition of the term. According to Williams (2000), clarification is of central importance when approaching evaluation – as we are attempting here – since such criteria must be formulated according to some previous definitions of the desirable characteristics of learning objects. As pointed out by Sosteric and Hesemeier (2002), definitions found in specification documents are too loose or vague to serve as a source for the determination of the key characteristics of learning objects. For example, the IEEE LOM standard definition states that a learning object is "any entity – digital or non-digital – that may be used for learning, education or training" (IEEE, 2002), a vague definition which leaves unspecified any specific property beyond the mere fact of usage in educational contexts. These vague definitions may paradoxically result in learning objects that are not designed for reusability, simply because the "everything goes" principle neglects the fact that learning object design requires following specific guidelines, such as those described in (Boyle, 2003), which allow them to be used in diverse educational contexts.

Our focus here is on the development of learning objects intended for reuse that would typically be published in "learning object repositories" (Richards et al., 2002). Thus, more precise definitions that explicitly consider reusability are required. As a starting point, we shall use the critical definition given by Polsani (2003) "A Learning Object is an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts." This definition is consistent with those given by Sosteric and Hesemeier (2002) and Hamel and Ryan-Jones (2002). However, we shall add to this definition two additional constraints: first, learning objects are "digital entities" (i.e., digital files or streams); and second, they possess a related "metadata record" which describes the potential contexts in which they may be used. These metadata records contain descriptions about authorship and technical and educational properties of the learning object (among others), according to the information elements described in the above-mentioned specifications.

The characteristic of "predisposition to reuse" must be further analyzed to derive properties that are more concrete. Learning object specifications often refer to: 1) durability; 2) interoperability; 3) accessibility; and 4) reusability. The first three characteristics are essentially of a technical nature. "Durability" and "interoperability" are characteristics related to software and hardware platform independence, which can be obtained by adhering to public Web languages and conventions. The third characteristic, "accessibility," is understood in this context as the capability of being searched for and located, which is achieved by the presence of an appropriate searchable metadata record.

Consequently, the fourth characteristic, "reusability" remains the most difficult to define, since it is related mainly to instructional design, and not to digital formats or content structure that are the main concern of interoperability and accessibility. Additionally, the desirable "granularity" of a learning object is determined by the imposed reusability requirements; therefore, objects must be decoupled from each other (Boyle, 2003) to achieve both educational context independence and technical independence (i.e., not being linked to other digital contents). Several authors point out that, in consequence, granularity must be limited to describing a concept or a small number of related concepts (Polsani, 2003), or to a single educational objective (Hamel and Ryan-Jones, 2002). This is also consistent with the position argued by Wiley, Gibbons, and Recker (2002), who regard coarser granularity learning objects as more challenging to combine due to the multiple layers of elements that are integrated in the design of the object (e.g., instructional approach or learning design).

Reusability, therefore, is an essential and arguably the most important characteristic of learning objects. However, since reusability refers to prospective and future usage scenarios, it is difficult to measure. This entails that the specification of possible usage contexts determines the degree of reusability of the learning object, and that overall reusability may be measured as the aggregated degree of adequacy for each of the possible contexts specified. Unfortunately, both the estimation of that degree of adequacy and the determination of possible contexts are challenging tasks. Our research departs from Feldstein's view (2002) in which the "usability" of a learning object is defined as a context-dependant measure of "goodness," giving rise to the problem that a given learning object is likely to be fairly usable in a context or a set of contexts, but less usable or simply not appropriate in different contexts. This leads us to consider usability and reusability as two, somewhat conflicting properties that must be balanced when designing learning objects.

Based on preliminary results described by Sicilia, García, and Aedo (2003), we will determine measures of the quality of learning objects focusing on reusability and usability. To do so, our article is structured as follows. First, as the point of departure in the search for measures of quality of learning objects, the relationship between usability and reusability of learning objects is discussed. Then, in the light of that relationship, a concrete "discount" evaluation method for learning objects is sketched. Finally, conclusions and future research directions are described.

Usability and Reusability in Learning Objects

According to Feldstein (2002) "Usability in e-Learning is defined by the ability of a learning object to support or enable [. . .] a very particular concrete cognitive goal." The specific sense of the term "usability" suggests that "very particular goals" become the center of the evaluation, and in consequence, the context of the evaluation, including the pedagogical or instructional intention, must be to some extent pre-determined. Theoretically, a (finite) set *C* of possible contexts of use may be identified from the specifications of an appropriately defined metadata record. Each element *ci* - *C* is then a "possible context of use." For the evaluation to be feasible, at least the cognitive goal and some kind of user characterization must be described through metadata for each of those possible contexts. Then, some kind of usability evaluation must be carried out for each context. It is possible that the usability of a given learning object is appropriate in a concrete context, but inappropriate in others. For example, a learning object about the inheritance mechanism in Java may be highly appropriate for the objective of a first course of programming if it provides only the essential information, and if it is written in such a way as to take into consideration that prospective users are novices. Obviously, however, that learning object would not be appropriate for the goal of preparing senior engineers for an official Java certification test.

For simplicity sake, suppose that the usability evaluation procedure results in a value in the interval [-1, 1], with negative numbers meaning significant usability problems. This way, for a given context *ci* we have an associated evaluation outcome denoted by *Usability(ci)*. Since these usability evaluation outcomes are typically determined prior to any actual use of the learning object in an educational application, such outcomes are only estimations that would be subject to subsequent refinement, as will be discussed later. Nonetheless, they serve the purpose of constituting a valuable pre-assessment.

In abstract and idealized terms, the above relationship between usability and reusability may be described mathematically as:

$$\text{Reusability} = \text{SC Usability(ci)} \; |C| \quad (1)$$

The expression (1) describes reusability as the aggregation of the adequacy of the learning object to each of its possible contexts of use, multiplied by the number of those contexts. It should be noted that possible values for reusability thus depend on that cardinality of possible contexts and, in consequence, it ultimately depends on the scope of the object as specified in the metadata record. Of course, we do not pretend that this formula is the magic key to learning object evaluation, but it does provide descriptive properties that are useful in reasoning about methods of evaluation that make an explicit consideration of reusability.

Let us consider now the following two illustrative situations:

1. Learning object A is provided with a narrow metadata record that limits its possible contexts of use to only one. Accordingly, its reusability index according to the above formula lies in the [-1, 1] interval.

2. Learning object B specifies a broader range of possible uses in its metadata record, enabling ten different contexts. In this case, its reusability index lies in the [-10, 10] interval.

Learning object A represents a case of minimal reusability; it is intended for a single particular situation, and other usage contexts are simply not evaluated. Of course, experts inspecting the learning object may eventually decide that it is also appropriate for non-declared contexts, but they do so at their discretion. In contrast, software modules searching for learning objects to use in concrete situations are restricted to consider only the contexts declared explicitly. Learning object B is potentially "ten times more reusable" than learning object A, but this is only true if its degree of usability is high for every of its ten specified possible contexts of use. It should be noted that simply broadening the scope of the object in the metadata record is not enough for the object to be considered more reusable; some form of usability evaluation is required for each of those contexts. In an extreme case, the overall reusability grade of learning object B may fall below the one of learning object A. This indicates that metadata specifications should become as precise and narrow as possible, so that only contexts in which the object is really usable must be considered in metadata records. It should be noted that our use of the term "preciseness" in this article refers to any context declared in the metadata record as a context in which the learning object can be reasonably expected to be usable. A different problem is that of how to determine all the possible contexts of use for a learning object, prior to the creation of its metadata. In many cases, this would probably be a difficult task, but it does not affect the concepts of reusability and usability discussed here, since they are connected only to the contexts "explicitly declared" in the metadata record (that may be extended or restricted along the usage history of the learning object). For example, a learning object concerning introductory material on "Hoare triples" (a formal program verification method) created for the context of higher education in mathematics, can be extended to the context of a training module for senior programmers regarding "Design by Contract," since the latter subject borrows some terminology from the former. If the learning object on Hoare triples is simple and clear enough to be useful for the second context, the overall reusability of the learning object increases with the specification of that new context in the metadata, and it becomes searchable and accessible to tools looking for material regarding the second context.

Even if we consider that obtaining an expression like (1) is unrealistic or unpractical, usability and reusability are clearly two intimately connected properties, and the metadata record thus becomes the central element in the early stage of the learning object life cycle.

Some exceptions may be added to the evaluation procedure suggested in expression (1). Concretely, a number of prerequisites can be evaluated independently of any specific context. These prerequisites include both definitional characteristics and elemental usability aspects.

1. Definitional characteristics are those directly derived from the adopted definition of learning object. For example, the presence of a metadata record can be considered a *conditio sine qua non* for a digital entity to be considered a learning object. Additionally, as mentioned by Longmire (2000), the separation of content and presentation can be also considered unavoidable in many cases.

2. Elemental usability aspects may include compliance with standards (e.g., the validity of the HTML code), conformance with guidelines (e.g., W3C accessibility guidelines or IMS packaging or learning design), and other simple aspects such as labeling that affect usability that can be found in checklists and other resources like Smulders (2001).

The specification of possible contexts through metadata bears some resemblance to the technique of "design by contract" introduced by Bertrand Meyer in the field of object-oriented development (Meyer, 1997). According to this technique, the contract of an object specifies what that object expects of its clients and what clients can expect of it. The metadata record can then be considered as the contract of the learning object, which sanctions permissible usage contexts for automated tools. Just as software code is required to be tested against the requirements implicit in its contract, a learning object must be evaluated against its possible contexts of use. In this respect, it is important that an educator may use a learning object for a context that is not declared in the metadata record, but even so, software tools cannot proceed in such imaginative ways, so that they are restricted to what is provided in the metadata.

An important research problem, associated with the evaluation described immediately above, is that of the appropriateness of existing metadata schemas for the task of specifying the domain of possible contexts of use for a given learning object. In other words, are current metadata specifications precise enough to determine set *C* for a given object? Although this controversial issue is beyond the scope of this article, some initial reflections are provided here in an attempt to set the stage for future studies.

In our view, such an analysis must be approached from the viewpoint of software construction – i.e., a metadata record must be machine-understandable in a manner that enables a piece of software (or agent) to decide if it fits a concrete educational setting. In consequence, educational-oriented metadata items should not be considered as "optional" in metadata records. This raises the need for a concept of "completeness" of metadata records, intended as a quality indicator of the extent to which the required machine-readable metadata is available for a learning object. For example, the "educational objective" LOM value, that can be put into the "Purpose" sub-element of a "classification" instance, provides room for the definition of expected learning outcomes, and the "prerequisite" value can be used (in the same element) to specify a given target learner profile. Nonetheless, these descriptors are optional, and without common consensual or standardized practices for their specification, it would be difficult to characterize unambiguous intended usage contexts.

In addition, the basic collection given in IEEE LOM (IEEE LTSC, 2002) should be supplemented with richer item collections as the one described in the Educational Modeling Language (Koper, 2001), and now further specified as IMS Learning Design (IMS, 2003) to make explicit the educational process and roles involved in educational contexts. An analysis of the space of possibilities and the consensual nature of those schemas may be subject of future studies,

including its integration in logic-based frameworks providing more complex mechanisms for stating assertions about learning objects (Sicilia and García, 2003).

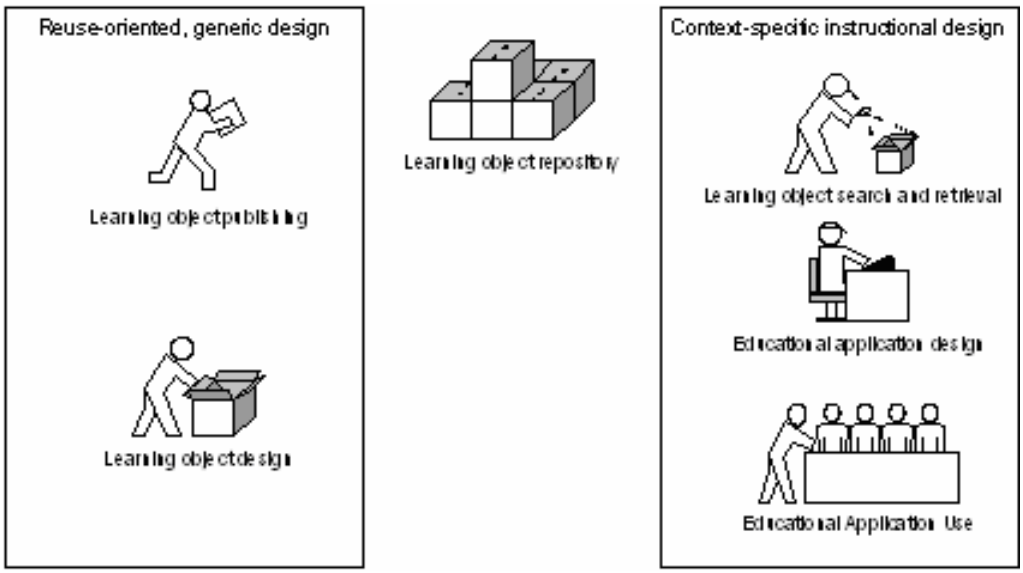
Additionally, current metadata annotation practices put a metadata record for each single content object. Perhaps more sophisticated encapsulation techniques may provide more information regarding contexts of use. For example, an instructional designer may elaborate three different learning components with the same overall cognitive objective, but providing different levels of depth or narrative structure targeted at different levels of student expertise. These three alternative learning components may be considered a single learning object with a metadata record indicating which one of the alternatives is appropriate for the each situation – in fact, this could be specified using the level C of the IMS Learning Design specification (IMS, 2003). Obviously, this process is more expensive in terms of resources than trying to provide a single content for different users, but this may be considered an option in situations in which different target communities of users require substantially different narrative or expositional characteristics, such as typically occurs when considering learning in multiple environments such as academia and the workplace.

Towards a Framework for (Re-)Usability Evaluation of Learning Objects

Several evaluation methods for learning objects have been proposed, as summarized by Williams (2000). Nonetheless, many of these approaches are intended for evaluation in a given context of use, while in the case of evaluation of reusable learning objects, those contexts of use may not be precisely determined . *priori*, and it may be difficult to find users and other stakeholders at the stage of learning object design. In consequence, we provide a simpler, more straightforward evaluation alternative, inspired by the philosophy of “discount techniques” that has emerged in recent years in the field of human-computer interaction evaluation (Nielsen, 1989). According to the discount philosophy, simpler evaluation methods stand a much better chance of actually being used in practical design situations, so that they, in turn, provide a practical, cost-effective alternative to more comprehensive and expensive approaches. For example, Nielsen’s “simplified” thinking aloud has demonstrated similar effectiveness to the thinking aloud protocol while lowering costs significantly (Nielsen, 1992).

The first step in sketching an evaluation method for learning objects is that of contextualizing design in reuse-oriented situations. Figure 1 shows the overall configuration of such a situation.

Figure 1. Learning object and educational application design as two differentiated processes



The left rectangle in Figure 1 shows learning object design and its subsequent publishing in repositories as a process independent of the design of concrete educational applications using them (depicted in the right rectangle). Even if the two forms of design are carried out simultaneously, learning object design can be considered a separate process (or sub-process), since it focuses on reusability (rather than in a concrete setting), and requires some explicit guidelines that are not a concern for the design of an educational application not intended for reuse. Thus, here we are concerned only with evaluation at the stage of learning object design and the evaluation of actual educational applications may follow existing commonly used techniques.

Departing from the concepts described above, we have sketched the following evaluation procedure consisting in four steps:

1. Pre-Evaluation
2. Generic Evaluation
3. Prospective Context Evaluation
4. Continuous Evaluation Data Gathering

Pre-Evaluation follows the objective of deciding whether or not a given digital element can be considered a learning object. This decision can be informed by inspecting the digital format of the entity (i.e., checking standard compliancy and other essential granularity and structure requirements, as those mentioned above). A possible good reference for this check is found in Hamel and Ryan-Jones's (2002) article regarding principles of learning object design.

Generic Evaluation is oriented towards checking any usability aspect that is independent of the context. This may include stylistic considerations in writing (to the extent that they are context independent, for example, clarity and correctness of expression can be checked irrespective of the possible use of the learning object and other simple checks as those mentioned above.

Once the object has passed the two previous filters, Pre-Evaluation and Generic Evaluation, prospective contexts of use may be analyzed. The Prospective Context Evaluation filter may result in finding the need to improve or complete the existing metadata record of the object, to come up with a more precise definition of its possible context of use. After that, we may proceed to carry out the usability evaluation for each of the identified prospective contexts of use. Since these possible contexts are still not actual ones, usability evaluation methods must be carefully selected to achieve a trade-off between cost and reliability. Our first proposal for that selection is using one or both of the following techniques:

1. Heuristic or expert evaluations (Nielsen, 1994) adapted to educational settings by using lists of items specific to instructional design. Indeed, this is actually common practice in existing object repositories. For example, "peer-reviews" in Merlot (Hanley and Zweier, 2001) are a form of expert evaluation.

2. In the case that a sample of possible users matching the characteristics specified in metadata is available, a streamlined version of user testing can be carried out. According to discount usability (Nielsen, 1989), three to five users provide the best cost-benefit ratio, and simply using a "thinking aloud" protocol with them for a number of typical task may be enough at this stage.

Once steps one to three of the proposed method have been carried out, an initial reusability index may be obtained for the object, and several iterations may follow if serious flaws are found, resulting in narrowing the scope of the learning object, or alternatively enhancing it to fit better to some contexts. At this stage of Continuous Evaluation Data Gathering, a continuous evaluation can take place. In this process, actual uses of the learning object in concrete applications would result in a historical record of evaluation data. In this manner, the practice of reuse gives feedback to the evaluation of the object, a process that ideally may result in more precise estimations of reusability and usability. For this last phase to become a reality, however, learning object repositories should provide support to forms of feedback, and standardization organizations should provide common evaluation data formats and transfer mechanisms. In addition, policies and procedures that support and recognize a collaborative culture in the design of learning contents, such as those described by McNaught et al. (2003), play a crucial role in these kind of collaborative assessment practices.

Conclusions and Future Research Directions

Once a learning object has been defined, measuring its "goodness" must take into account its essential properties. However, if we want learning objects to become the central component of a more efficient industry of educational content, existing definitions that focus on reusability must become the key property of learning objects. Therefore, assessment techniques for learning objects must approach the concept of reusability in their evaluation criteria.

In this article, we have analyzed the relationship between reusability and context-specific usability in learning objects, giving rise to a novel approach to formulate evaluation criteria for learning objects. In addition, we have sketched a tentative evaluation procedure that we have borrowed from the field of human-computer interaction, as well as from our own experiences.

Our ultimate aim has been to invite development of novel devices for the measurement of the quality of learning objects that go beyond expert rating-based approaches used so far. Two main research directions must follow the initial inquiry described in this article. First, the appropriateness of existing metadata schemas and metadata annotation practices must be

considered in the light of assessment and automated selection of learning objects. Second, measurement to determine learning object reusability must be subjected to more ambitious procedures that go beyond mere compliance with to specifications regarding format and structure of contents, and that dig deeper into the difficult issues of compatibility regarding learning objectives.

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Conceptual Integration in Online Interdisciplinary Study: Current perspective, theories, and implications for future research

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Abstract

The University of Oklahoma's College of Liberal Studies was established as an academic unit in 1960, and provides interdisciplinary education to non-traditional students with programs for Bachelor's and Master's degrees in Liberal Studies. In the Fall of 2003, the College offered both degrees in a fully online format, with no student residency requirements. Learners engaged in interdisciplinary studies online are faced with the difficult task of integrating chaotic pieces of information, various ways of knowing, and dissimilar concepts from various disciplines into a coherent and integrated body of knowledge. The purpose of this paper is to discuss the phenomenon of conceptual integration, and the unique challenges and opportunities of providing interdisciplinary study online in the context of conceptual integration.

Current Perspective, Theories, and Implications for Future Research

The intention is to survey the relevant literature, analyze, and synthesize the theoretical and experimental work done across the various areas and disciplines concerning conceptual integration and interdisciplinary online education. Based on current literature, this article provides a theoretical framework for understanding the phenomenon of conceptual integration, and then explores the possibility of enhancing the conceptual integration possibilities in the context of new ways of thinking and learning in the interdisciplinary online education environment. The literature reviewed includes literature that addresses conceptual integration, interdisciplinary education, and online learning. Literature that seems relevant, significant, and provided explanation of definitions is included. The intent is to initiate a discussion of the phenomenon as well as to provide an overview of the research on the subject.

Conceptual Integration as a Phenomenon

Conceptual integration can be viewed as a cognitive process or as an outcome of the learning process. As a cognitive process, conceptual integration is a background, perhaps even sub-conscious mental process, which enables one to make meaning from differing concepts that, on the surface, have no readily apparent connection or commonality. Two concepts are integrated into a third concept that contains some properties of both original concepts, but not all of the properties of the two original concepts. Commonalities of the two original concepts provide the

basis for an emerging concept that is different from either of the two original concepts. The literature refers to the concepts as mental spaces, and the conceptual integration as the blending of the spaces. The writings of Lakoff (1987), Fauconnier (1994), and Turner (2001) are described below to illustrate the evolution of the concept of conceptual integration as a potential lens through which to frame questions about interdisciplinary online learning.

Lakoff (1987) was convinced that "concepts that are spontaneous, automatic, and unconscious are simply going to have a greater (though less obvious) impact on how we understand everyday life than concepts that we merely ponder (p. 335)." If true, then the online course design that provides interaction with the mental aspects of the student, and elicits spontaneity of thinking, is more powerful than course design that simply presents material that requires reflection.

Lakoff (1987) believed "the idea that people are born with a conceptualizing capacity, seems to be the only plausible way to begin to provide answers for all these questions (p. 335)," concerning conceptualization and the ability of humans to learn new concepts. Lakoff believes humans have an innate ability to blend concepts and this allows them to engage in meaning making. Lakoff also posited that concepts that have been reinforced through experience, especially "perceptual-motor experience," are strong enough to shape our imaginative meaning making and become metaphors by which we understand and view reality.

The early theoretical work of Fauconnier dates from the late 1980s. His work seemed to be concurrent with Lakoff's and Johnson's (1981) development of conceptual metaphor theory, which develops the idea that our "conceptual systems are largely metaphorical (p. 3)." In contrast, Fauconnier, a linguist, explains conceptual integration as a function of language and how we use language to map our mental spaces. Fauconnier (1994) suggests we use descriptions of elements and names to introduce concepts, and linguistic devices such as tense and mood as clues to indicate which mental spaces are the subject of focus (p. xxiii)." The use of the nickname Iron Lady to refer to Margaret Thatcher represents a conceptual integration of; the concept of "iron" as a metal used in construction requiring strength, with the concept of "lady" as a woman who holds political rank. Proper nouns help us by describing two separate mental spaces, yet we understand that Margaret Thatcher is not a woman constructed of steel, but one of strong constitution in the blend of mental spaces. For Fauconnier (1994) it is the:

> *Lexical information that connects the mental space elements to frames and cognitive models from background knowledge; this information structures the spaces internally by taking advantage of available pre-structured background schemas. Such pre-structured schemas can, however, be altered or elaborated within the constructions under way* (p. xxiii).

Fauconnier (1994) used the idea of mental mapping in order to illustrate the cross-domain function of thinking. He describes cross-domain in this way: When we engage in thought mediated with language, we construct mental spaces that are structured, linked, and sometimes projected into other mental spaces. The key aspects of these spaces become visible by means of language. Fauconnier (1997) describes the process of conceptual integration as "integrating partial structures from two separate domains into a single structure with emergent properties within a third domain" (p. 22). In other words, he argues that parts of two separate concepts are blended into a third concept with new attributes contained in the third concept. In interdisciplinary studies, we take portions of two perspectives from different disciplines and create a blended third perspective to solve a problem or understand certain dynamics at work in

events or societies. We retain portions of the whole, but not all, and both previous perspectives must have commonalities that allow us to blend them.

Fauconnier also began to establish some principles that would enable the examination of cognitive products for conceptual integration.

> "*Blending is in principle a simple operation, but in practice gives rise to myriad possibilities. It operates on two input mental spaces to yield a third, the blend. The blend inherits partial structure from the input spaces and has emergent structure of its own*" (p. 149).

For Fauconnier, partial structure refers to the individual elements of the mental spaces that may or may not be common to the two spaces. In the conceptual integration of Margaret Thatcher as the Iron Lady, the properties of iron are a partial structure of that mental space relating to iron. The properties of English political rank are the partial structures the mental space regarding lady. The property of oxidation is not germane to our blend, yet it is a partial structure of the mental space. The emergent structure of our blend is Margaret Thatcher taking on the property of strength from the iron mental space, along with rank from the mental space of lady.

These principles help us understand the importance of the concept of conceptual integration to the understanding of an interdisciplinary learning environment. Turner's (2001) work serves as an illustration of conceptual integration from the perspective of the social sciences. His view blends the cognitive linguistic perspective of conceptual integration with the anthropologist's perspective of social events and actions. This interdisciplinary view is based on the argument that one cannot examine a concept or an event in isolation from the culture, history, and identity of the persons and society associated with the underlying cognitive operations. Turner (2002) draws on Fauconnier's principles as a foundation. As an illustration, Turner describes how Gertz in his book *Deep Play: Notes on the Balinese Cockfight,* explicated the social phenomenon of Balinese cockfighting by demonstrating the conceptual blending of event, culture, history, and identity in the underlying cognitive operations (pp. 13-17).

Turner (2002) offers this definition of conceptual integration:

> *. . . the essence of conceptual integration is its creation of a new mental assembly, a blend, that is identical to neither of its influences and not merely a correspondence between them and usually not even an additive combination of some of their features, but instead a third conceptual space, a child space, a blended space, with new meaning. This new meaning is "emergent" meaning, in the sense that it is not available in either of the influencing spaces, but instead emerges in the blended space by means of blending those influencing spaces* (p. 17).

Here, Turner focuses upon the new meaning that emerges through blended spaces, illustrated by describing the cognitive features of the Balinese cockfight that allow human participants to engage in fighting without personal physical consequences. Turner suggests that cockfighting allows participants to blend their humanity with the beast, their ego with the victorious cock, their social status rising and falling based on the outcome of the fight. Turner expands the ideas of Fauconnier to include mental functions that are a result of "social, cultural, and intentional environments" (p. 46). He extends conceptual integration to include the function of distributed

cognition over a period of history through the engagement of "functionally interacting agents and instruments" (p. 46). Conceptual integration, then, encompasses a single individual engaged in blending ideas and mental spaces, or a series of individuals, cultures, and societies engaged in a continuous sequence of blending of concepts and ideas. In fact, powerful blends and metaphors that result may become entangled and embedded in the culture of those groups sharing these mental representations.

Conceptual Integration and Interdisciplinary Study

Interdisciplinary education provides a rich context for the study of conceptual integration. Complexity, ambiguity, dispersion, and disconnects are adjectives used when discussing interdisciplinary study. Concepts must be analyzed in the context and theoretical framework of the discipline from which they come. Definitions vary according to the literature base and multiple perspectives are embedded in the discipline's community of learners.

Inquiry, approaches to research, and ideas of practice differ among disciplines. Disciplinary work is often considered on a vertical axis measuring the depth of study, and interdisciplinary work may be considered on the horizontal axis for signifying the breadth of study. These two dimensions alone though miss the vital integration of breadth and depth. Synthesis, the integration of concepts, supplies the missing dimension. Synthesis of the deep disciplinary knowledge with the boundary crossing breadth of interdisciplinary study provides the third dimension (Klein, 1996, p. 212).

Conceptual integration is a phenomenon discussed in other disciplines. What follows are descriptions from the fields of Theology, Business, and Educational Psychology. These descriptions help us gain an understanding of the role conceptual integration plays in interdisciplinary study. The significance of conceptual integration as a phenomenon in interdisciplinary study is explained in Moreland's (1999) writing regarding the manner in which theology interacts with other disciplines. Moreland suggests there are a number of ways in which theology and other disciplines interact:

1. **The two realms view.** Propositions, theories, or methodologies in theology and another discipline may involve two distinct, overlapping areas of investigation.

2. **The complementary view.** Propositions, theories, or methodologies in theology and another discipline may involve two different complementary, non-interacting approaches to the same reality.

3. **The direct interaction view.** Propositions, theories, or methodologies in theology and another discipline may directly interact in such a way that either one area of study offers rational support for the other or one area of study raises rational difficulties for the other.

4. **The presuppositions view.** Theology tends to support the presuppositions of another discipline and vice versa.

5. **The practical application view.** Theology fills out and adds details to the general principles in another discipline and vice versa, and theology helps one practically apply principles in another discipline and vice versa (p. 8-9).

These views of interaction help explain why it is critical to find methods that enhance learners' conceptual integration in interdisciplinary courses. They also offer some insights into what activities might be of value in providing an enriched environment. For instance, the use of concepts maps to enhance visualization of connections and relationships, providing access to multiple disciplinary viewpoints and perspectives in course readings. Technology is excellent at providing links to multiple sources of data and information that allow learners access to disciplinary viewpoints. Databases of sociological abstracts and journals provide ready sources of information that may be helpful to a theologian looking at the phenomenon of Church growth, or the organizational aspects of a particular religious institution.

Moreland (1999) also suggests lines of demarcation between disciplines, while strongly defended, are largely philosophical matters (p. 10). If we are to tap in to the exemplary concepts of another discipline, we need those lines to become fuzzy. Conceptual integration provides a vehicle to cross these boundaries.

The field of business provides an example of the application of conceptual integration. Kenney and Leggiere (2003) suggest that building of teams depends heavily on the team having a core story, a story that is "compressed in time and space and that expresses shared values (p. 1)." They further suggest that once the story is developed and stable, the process of conceptual integration can be used to strengthen that story:

> *When the core story is stable, conceptual blending can help the team derive new, related sub-stories to tackle various business and technical questions, such as the business case or process flow . . . through trial and error, the team then maps the elements of one input space to the other. Pairs of connected elements go into the "blended frame." The blended frame is a new story that combines parts of the core story and parts of the standard business case* (p.2).

The core story of the team is a conceptual integration of the team member's personal experience and serves to unite the team around an emergent common experience. Ideally, individual stories from the field are continuously merged and internalized as integrated team experience.

Zimmer (1998) explored the use of conceptual integration as a tool of interdisciplinary inquiry. Zimmer posits that evolutionary psychology is a conceptual integration of psychology and evolutionary biology "by tying together psychological phenomena and theories of adaptive function (p.1)". He further suggests that "conceptual integration has been one distinguishing feature of the natural sciences," and therefore argues that this places evolutionary psychology "on the natural science side of human studies" (p.1). The impact of conceptual integration for Zimmer has "mind-boggling implications," (p. 8) and he believes we have:

> *. . . achieved a perspective where the essence of the biblical creation of humans in the image of God is unexpectedly imaged by a proposal in evolutionary psychology on the adaptive function of human awareness of something beyond nature. In achieving this perspective, we recognize a "mythic" or "supernatural" implication to evolutionary science that complements Judeo-Christian tradition* (p. 8).

Whether you understand or agree with Zimmer, it is apparent that conceptual integration has provided a significant shift in the author's thinking, and that conceptual integration has become a

powerful tool of interdisciplinary reflection. Conceptual integration has enabled a reconciliation of the dichotomy of religious belief with science for this author.

While hyper-media may engage us in a new way of learning, Hamilton (2001) suggested that the cognitive architecture of poetry is worthy of investigation because "its language makes us see things in our world with new eyes (p.27)." Metaphor returns us to interdisciplinary study and the significance of conceptual integration in that study. Lakoff (1987) argued that the use of metaphor helps us develop conceptual structure where none existed before. According to Lakoff, "Metaphor provides us with the means for comprehending domains of experience that do not have a pre-conceptual structure of their own in our experience. Comprehending experience via metaphor is one of the great imaginative triumphs of the mind (p.302)." However, Grady, Oakley, and Coulson (1997), concluded that there is a difference between conceptual metaphor theory, "a stable knowledge structure represented in long-term memory" and blending which "seeks to model the dynamic of speakers' on-line representation (p. 120)." This suggest that blending is a cognitive process that is more dynamic and perhaps less stable until rooted in the individuals perspective of reality through metaphor.

Conceptual Integration in the Online Environment

The online environment should be conducive to conceptual integration and, indeed, requires a high level of conceptual integration to accomplish interdisciplinarity. The online environment supports:

- Through multi-media expanded opportunities for visual and audio reinforcement of ideas and trigger mechanism for reflection
- Non-linear thinking and enables associative reflection
- Adequate opportunity for dialogue using text and language for collaborative activities
- The making of connections and the sustaining of emergent meaning

The Web as a Visual Tool

The power of visualization is a strength of both technology and the Web. The theoretical framework of conceptual integration provides a powerful argument for the role visual language can play in enhancing conceptual integration. Horn (2001) suggests visual language "has the potential for increasing human bandwidth, the capacity to take in, comprehend, and more efficiently synthesize large amounts of new information (p.1)." Visual language is like having a valve on a fire hose that decreases the flow of water so you can take a drink from that fire hose. Pictures, icons, graphics depicting movement and direction of flow, serve as valves restricting the textual data flow so the human mind can cope with the prodigious amount of data engorging the senses. The constriction through compression actually enhances the human ability to integrate dissimilar concepts and achieve coherence of interdisciplinary knowledge through compression of ideas and thoughts into a visual language.

Muirhead (2002) warns against the proclivity of teachers to focus on content knowledge rather than on the creation of an environment that fosters the use of transferable reflective skills (p.2). For example, Muirhead describes the use of "pictures, cartoons, simulations, or graphics instead of questions" (p.3) as an alternative to the questioning approach as a methodology to enhance

dialogue and critical thinking. According to Muirhead, using visual triggers enhances dialogue and reflective thinking, which in turn supports greater integration of the concepts presented in the material. In addition, the use of multi-media as visual language increases the human capacity to process information thus allowing learners to learn more effectively and efficiently. Muirhead focuses on teaching strategies, such as dialogue, as the critical issue in encouraging critical thinking in an online course. Discussion among learners, according to Muirhead, thus becomes the strategy that most promotes "internalization of critical thinking skills and knowledge (p. 6)." Use of visual language and visual triggers incorporated in multi-media enhances both internal and external dialogue. Enhanced dialogue with content or a person leads to a deeper understanding and more thorough integration of concepts. When considering the attributes of technology, it appears this visual language becomes a strength in online courses.

Muirhead (2002) concludes that language is a significant aspect of today's online classes for these classes, "rely heavily on printed materials and teacher created lectures and handouts. Therefore the use of language becomes a focal point for teachers and students because the entire communications process is linked to them" (p.6). Muirhead views conceptual integration from its background in linguistics and the importance of having text. Alfred Bork (2003) also supports the point that "languages are the most powerful learning tools we have," and one of the weaknesses he sees in technology is the "mouse as a computer device (p. 1)." Language may be the most powerful tool we have for learning, but the triggering mechanism of thought and resultant understanding and integration of concepts may be equally important. The visual multi-media aspect of the online environment may serve as the triggering function. Visual language may, through the use of graphics, also enable one to handle more information and increase the value of the concepts integrated.

Cifuentes and Dylak (2003) also speak of the value of "trigger visuals" used to create an emotional response in an attempt to stimulate online discussions. These "trigger visuals" are an important feature of the online environment, and can be incorporated in student prepared multi-media materials in online courses. According to Cifuentes and Dylak, online discussions using these multi-media offerings created by students fostered a constructivist learning environment that included generativity, collaboration, and active engagement. These results of the multi-media learning environment are crucial to the making of meaning for humans, and are interwoven with the following elements of conceptual integration. Fauconnier and Turner (2002) consider the operations of identity, integration, and imagination to be crucial elements "at the heart of even the simplest possible meaning" (p. 6). Based upon this reasoning, it can be argued that conceptual integration should also benefit from the use of "visual triggers" incorporated into the material presented to learners.

Making Connections on the Web Through Hyper-Linking

Engaged and meaningful learning that seeks out connections and relationships between concepts defines the term deep learning. Rosie (2000) suggests that the attributes of online technology can provide approaches that encourage "deep learning" (p.1). Rosie posits that the Web provides connection opportunities through linking to online learners, providing them the opportunity to seek out and grasp relationships and interconnections between concepts and data. Deep learning involves the bringing together of thesis, antithesis, and synthesis. "What is important is that the synthesis shows not simply progression but a reconceptualisation of the inquiry" (p. 110). Reconceptualisation is key to describing blending in the context of online pedagogies. It appears

that the phenomenon of conceptual integration, as a background cognitive process, underlies and supports the interconnection of material and the logical organization of material presented.

One can readily see how online study might breakdown into a transmittal of bits of fragmented and meaningless data void of any knowledge building capacity. Fauconnier and Turner (2002) suggest: "The illusion that meaning is transmitted when we send the digitized picture over the Internet is possible, only because there is a brain on each end to handle the construction of meaning" (p.5). This suggests that streams of data and the value of transmitting that information to the online learner lies in the "complex emergent dynamics" that the data or information "triggers in the imaginative mind" (p.6). Content that requires no reflection or activation of the imaginative mind is of no value. The triggering of conceptual integration is of utmost importance to quality synthesis of concepts in online interdisciplinary education. Turner (2001) states:

> *The theory of conceptual integration is an attempt to provide substance to the intuition that meaning – in individual lives and in cultures – descends through elaborate, perpetual, and distributed processes of modification, inheritance, and selection, to develop all the great richness, diversity, and nuance that characterize cognitively modern human beings and the complex societies they make* (p. 151).

It is not enough to transmit information and content, if the goal is synthesis of ideas and concepts and meaning making. Fauconnier and Turner (2002) stress that conceptual integration provides the process by which humans synthesize ideas to make meaning and create knowledge.

The weakness Bork (2003) sees in the technology of online environment is that people begin to think they can deal with the world by pointing and clicking, rather than by thinking. Pointing and clicking seems to have replaced reflection and engagement. It is the cognitive process of conceptual integration that is perhaps the critical component of learning. The mental processes that are required in learning are more than pointing and clicking to navigate through pages.

Integration of information, constructs, and concepts enable one to make sense of and create meaning from divergent streams of data and non-liner links to ideas. Conceptual integration enables one to understand and synthesize ideas drawn from various disciplines and dissimilar bodies of knowledge. A key attribute of online learning is the use of hyper-linking for the construction of knowledge, thus moving from simply gathering data and information to the creation of meaning.

Online Support of Interaction

In recognition of the need for supporting critical thinking in the online course environment, Muirhead (2002) suggests developing a course structure and teaching style that encourages the engagement of students in higher order thinking skills. Exercising skills such as analysis and synthesis should prove conducive to the underlying mental process of conceptual integration for the learner (p.2). Critical thinking skills that enable thinking in a purposeful, reasoned, goal oriented manner must be applied to concepts and those concepts evaluated in a careful and deliberate manner to reach a conceptual integration outcome that is useful and relevant.

Bullen's (1998) research suggests that, "technology may have attributes that have the potential to facilitate a dynamic and interactive educational experience, making this happen depends on much

more than the technology" (p. 17). In fact, Bullen found that factors such as the learners, "previous experience with distance education, cognitive maturity, and experience with interactive learning environments seem to be necessary preconditions for the successful implementation of computer conferencing" (p.17). The use of interactive learning environments seems a strength of online learning, yet Bullen found other non-technological characteristics of learners to be perhaps more important, suggesting that the design of environments may not be the total answer to enhancement of conceptual integration.

Asynchronous Online Environments

The nature of the online environment is such that communication loses immediacy if asynchronous methods are employed. Asynchronous methods may impede the immediacy because of the time elapsed between communications. Web communications are further hampered by lack of verbal and visual cues. The Web environment enables the user to seek out help from an extraordinary repository of resources, in addition to the immediacy of these resources, time and place independence provide the user with flexibility in their learning schedules and learning spaces. The potential distraction of extraneous material can impede conceptual integration when so many links and resources are available. In addition, the availability of hyperlinks and pop-up screens and messages may interrupt concentration. The sheer magnitude of information may create cognitive overload. Processing of bits of information and incomplete data may hinder the integration of concepts and make it difficult to make meaningful connections between ideas.

Finally, Levine and Sun (2002) suggest, "the Internet is a highly interactive, highly individualized medium," yet distance learning faces several barriers. The most significant barrier is that "academe lacks a pedagogy for using the Internet" (p. 5). Perhaps a good beginning for this new pedagogy is the understanding of the cognitive process of conceptual integration, and the application of the attributes most supportive of enhancing and fostering the blending of a learner's experience and understanding with new information.

Pros and Cons of Online Learning

As we explore these constructs, we begin to understand the difficulties for the learner engaged in interdisciplinary study delivered in an online format. The speed at which information is transmitted, the myriad connections and jumps across knowledge domains, the non-linear linkages, and time leaps and time compressions that are possible as a learner engages with the interdisciplinary content, provide a fertile learning environment. The speed, the myriad connections and non-linear linkages, can also become overwhelming. The audio-visual presentation can illustrate difficult elements of the concept. Yet, if that presentation is fragmented or exceedingly complex, learners become distracted. The lack of social presence and context may also inhibit understanding or construction of knowledge because there is no dialogue. Online instruction designed by, and for one culture, may result in discontinuity of meaning for another culture.

The reality of the online environment is that interdisciplinary course content and material runs the risk of being fragmented and superficial, making analysis and synthesis difficult for learners. Online education provides a rich environment for the study of the phenomenon of conceptual integration as a cognitive process, and as a desirable outcome of interdisciplinary study. The well

designed online learning environment that is conducive to conceptual integration and requires a high level of analysis and synthesis, will pay dividends in the quality of student learning.

Design Considerations for Online Learning

Design parameters for online interdisciplinary education should include opportunities for learners to engage in the manipulation of language, visual and textual. The environment should provide multi-media presentation to support the presentation of content, visually and aurally as in music, art, and demonstration of skills. However, it is also an important tool for activating reflective engagement, as when new concepts and new perspectives are introduced. Tools, such as Axon2003, enable concept mapping, visual space constructions, and the visual representations of connections, which are crucial to the development and integration of concepts. In addition, the communication capability of the online environment should be exploited to foster dialogue and encourage learners' thinking to be imaginative, generative, and collaborative. The online environment should require students to engage in the crossing of boundaries. This can be done through the use of hyperlinks that lure students into the exploration of multiple perspectives. The online environment can also assist learners in crossing cultural boundaries, by providing for communication with people of diverse cultures, and by bringing new perspectives for the learner's consideration.

Conceptual Integration and Research

The Cognitive Linguistics literature does not include a large body of data based research. The literature does provide criteria for identifying conceptual integration. Fauconnier's and Turner's present criteria for identifying and analyzing conceptual integration as:

Conditions that are satisfied when two input spaces are blended:

- **Cross Space:** There is partial mapping of counterparts between the input spaces
- **Generic Space:** There is a generic space that maps onto each of the inputs. This generic space reflects some common, usually more abstract, structure and organization shared by the inputs and defines the core cross-space mapping between them
- **Blend:** Inputs are partially projected onto a fourth space, the blend
- **Emergent Structure:** The blend has emergent structure not provided by the inputs. This happens in three (interrelated) ways
- **Composition:** Taken together, the projections from the inputs make new relations available that did not exist in the separate inputs
- **Completion:** Knowledge of background frames, cognitive, and cultural models, allows the composite structure projected into the blend from the inputs to be viewed as part of a larger self-contained structure in the blend. The pattern in the blend triggered by the inherited structures is "completed" into the larger, emergent structure
- **Elaboration:** The structure in the blend can then be elaborated. This is "running the blend," and consists of cognitive work performed within the blend, according to its own emergent logic

> *The central features of blending exemplified by the above criteria are: cross-space mapping, partial projections from inputs, generic space, integration of events, and emergent structure through composition, completion and elaboration* (Fauconnier, 1997, p. 151-159).

Several educational researchers have touched on the phenomenon of conceptual integration in their studies of concept development and knowledge construction in online learning. These studies present alternative methods of data based research and measurement of the phenomenon of conceptual integration.

Concept development is a necessary precursor to conceptual integration. McWhirter's (1998) study of conceptual development within the learning cycle provides the methodology to identify and measure conceptual development, and perhaps conceptual integration. Her dissertation "examined concept development and retention within the learning cycle," and investigated "students" concept development mediated by classroom discussions and small cooperative learning groups (p. x). Concept maps were used as the quantitative assessment tools in her study. Students produced the maps and scored using a comparison of their components. A science expert assessed teacher created criterion maps for content. The teacher's map was then used to produce a scoring system template. Multiple coders were used to determine the extent of concept development and retention. Video and audiotapes of the focal group were used to analyze the interaction as a means of triangulation. Concept development was defined as, "important repeatable pattern of two or more distinguished objects, events or situations" (p.39).

McWhirter (1998) used a covariant design for her quantitative analysis, because she discovered that, "reading levels had an effect on students' pre-test scores in both concept mapping and multiple-choice assessment" (p. x). Her research indicated that all three phases of the learning cycle were necessary for conceptual development; however, "individual students showed evidence of concept development and integration at each phase" (p. xi). McWhirter concluded that concept development is individualized, and not all students required each of the three phases of the educational cycle to develop concepts. She also discovered that students who engaged in a high level of dialogue with the instructor, mediated ideas within their small group discussions (p. xi). High levels of dialogue were found to enhance conceptual integration. Concept mapping not only provided a measurement tool, but also appeared to enhance dialogue and understanding of concepts.

Chen (1999) investigated knowledge construction among high school students involved in hyper-media design projects. She determined that evidence of learning could be established by assessing the relationships between concepts the student created, and the organizations of concepts demonstrated by the hypermedia design projects. Chen suggested that the student's struggles with hypermedia design projects engaged them in a new habit of thinking. The four features she describes in terms of this new way of thinking were: typology, associativity, nonlinearity, and abstraction. Chen's observations seem to fit the attributes of the online environment of metaphors indicating conceptual integration to the linguist. Chen also suggests that construction of, and communication of, cognitive products or artifacts actually served to "challenge the learner to engage in higher order thinking" (p. 1). The new way of learning was evaluated by measuring the amount of organization the student exhibited, the depth of the knowledge structures in the concept mapping exercises, and the directionality of the concepts.

This research helps us understand the relationship of conceptual integration in the classroom. We see how concept maps helps students recognize relationships, and helps teachers assess the

progression of students' capabilities of developing concepts and engage in higher order thinking. We also see that dialogue has a positive effect on the development of concepts and, by implication, on conceptual integration.

Conceptual Integration and Technology Assisted Deep Learning

Kanselaar, de John, Andriessen, and Goodyear (2000) suggested that the attributes of the new technology contribute to deep learning and consist of:

1. **Multiple Representations:** Digital video and animations, graphical representations in distance-time and speed-time graphs - text, speech, and video

2. **Technological Mediation:** Learning activities that are possible due to the interactive way domain knowledge can be used, computer simulations and discovery learning

3. **Computer Mediated Communication:** Integrating social and technological mediation in CMC (p. 56)

Kanselaar and colleagues further posited that technology not only has the capability of changing the manner in which people process information, but also the manner in which they represent that information – i.e., through the use of visual language and graphing capabilities of spreadsheet software. They suggested that technology also provides methods by which people can represent information in multiple ways, numbers, and transformation of numbers into graphical representation. In addition, technology has enabled simulation of models and processes. The authors concluded that technology supports collaborative learning through the, "presentation of a task environment to foster student cooperation – joint problem space, ease of data access, intelligent coaching; providing "cooperative tools" – i.e., software that helps one write or a reasoning software tool; by providing a communication facilitator and interface allowing email conferencing or groupware organizational tools; and finally through the use of computer simulation of partner dialogue and problem solving" (p. 67).

Implications and Questions for Future Research

Young et al. (2000) suggest that from an ecological psychology perspective, the manner in which people learn is explained in terms of the learner's interaction with the properties of their learning environment (p. 148). The online environment has the potential to provide opportunities for interaction and active learning, multi-modal presentation of content, immediacy of communication through email, and group interaction through shareware. Course or environment design, however, must take advantage of these capabilities. Technology also contains inherent barriers, such as including the difficulty of creating a community of learners, lack of expertise on the part of students to fully exploit the hardware, and the dramatic numbers of paths available in navigation, software, or communications portals that may distract learners.

The attributes of technology provide many opportunities to enhance the richness of the information and course content. The visual and audio capabilities of multi-media to provide context and trigger reflection, the non-linear linkage possibilities that produce associative rather than linear thinking, and the capacity to explore issues from a variety of disciplinary resources, all serve to increase the potential for quality learning.

Future research might investigate questions such as:

1. Can conceptual integration be identified and measured relative to a set of criteria in a quantifiable manner or must we address the issues purely with qualitative methodology?

2. Can conceptual integration be measured in such a way as to determine the extent of its presence and the level of excellence exhibited by the learner in their visual and textual products?

3. Can conceptual integration be enhanced through pedagogical or instructional strategies?

Online interdisciplinary education holds great promise for the learner to reach what Klein (1990) refers to as "the fourth and highest level" (p. 56), or the epitome of interdisciplinary study. At this level, learners have achieved a "conscious attempt to integrate material from various fields of knowledge into a new, single, intellectually coherent entity" (p.56). The understanding of conceptual integration, and the manner in which it is influenced by pedagogical and instructional strategies, is key to enabling students to reach this level of understanding.

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Differences Between Traditional and Distance Education Academic Performances: A meta-analytic approach

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Abstract

This meta-analysis research estimated and compared the differences between the academic performance of students enrolled in distance education courses relative to those enrolled in traditional settings, as demonstrated by their final course grades/ scores within the 1990-2002 period.

Eighty-six experimental and quasi-experimental studies met the established inclusion criteria for the meta-analysis (including data from over 15,000 participating students), and provided effect sizes, clearly demonstrating that: 1) in two thirds of the cases, students taking courses by distance education outperformed their student counterparts enrolled in traditionally instructed courses; 2) the overall effect size $d+$ was calculated as 0.37 standard deviation units ($0.33 < 95\%$ confidence interval < 0.40); and (3) this effect size of 0.37 indicates the mean percentile standing of the DE group is at the 65th percentile of the traditional group (mean defined as the 50th percentile).

Background

Introduction

The Telecommunications Revolution of the last two decades of the Twentieth Century has changed all aspects of life, public and personal. The Internet truly has cast a worldwide Web of almost instantaneously active, fiber optic strands that bind together the practical worlds of business and commerce, and facilitates the exchange of views in the various academic and non-academic disciplines. In response to this burgeoning exchange of ideas, education systems (mainly in the industrialized countries and at higher levels) have pursued new methods of delivering education.

Distance Education

From time immemorial, teacher-lecturing/ student-listening was the primary mode of traditional academic education. The delivery system for higher education has been a classroom setting with a professor giving a lecture and students listening and writing notes. Interaction between the professor and student has been viewed as an essential learning element within this arrangement (O'Malley and McCraw, 1999), often referred to as the "sage on the stage."

Technological improvements such as printing machines, postal services, telephone, radio, television, and more recently the Internet, have been a driving force yielding new delivery methods and platforms. These new learning methods used to deliver distance education (DE) are proliferating exponentially in various learning programs, and leading some experts to predict that the "residential based model," in the form of students attending classes at prearranged times and locations, will disappear in the near future (Blustain, Goldstein, and Lozier, 1999; Drucker, 1997, as cited in O'Malley, 1999). Although an expensive option today, video conferencing may create a virtual feeling that we are "back in the classroom." Some forms of DE has progressed in concept and practice from an "anywhere," to an "anytime," to an "any pace" delivery method.

Adjusting to Distance Education

Academic and training communities have been continuously examining, assessing, criticizing, hallowing, and demonizing these new delivery methods as they appear. Without doubt, DE is of the highest relevance and importance to educators, students, and all other stakeholders. It is changing the physical face (i.e., massive buildings) of academic establishments. Students can now learn from the comfort of their homes or offices with no need to commute to campuses. Cutting-edge data are easily accessible on compact discs (CDs), portable personal computers (PCs), and have taken the place of instantly obsolete books. Online classrooms and libraries are replacing traditional campus facilities. Rather than requiring students to travel to a specific physical classroom or library, the Internet has facilitated the delivery of (nearly) unlimited learning resources to students.

Another facet of this change is evident in the increased accessibility of DE curricula and expert training and educational staff available at convenient venues for businesses and professional organizations. The need to train and develop employees on all levels has coincided with advances in new educational options. Organizations are continuously weighing the merits of in-house training versus sending candidates off-site to observe and train at other facilities. With the guidance of outside academic institutions specializing in DE training and development programs, human resource managers are implementing in-house DE programs. Access to courses, coaching, rotational assignments, and professional programs such as the American Management Association seminars, and university-sponsored Executive MBA programs, are now commonplace (Mondy, Noe, and Premeaux, 1999; Dessler, 1997; Westwood, 2001).

The Problem, Question, and Purpose

Distance education has existed for more than a century, although it has yet to be universally accepted relative to current and well-practiced face-to-face (F2F) programs provided by traditional brick and mortar institutions.

Some of the most frequently asked questions regarding DE, pertain to the quality of instruction and learning as compared to that experienced and achieved by students enrolled in F2F programs. Questions include: the cost of attendance compared to F2F institution; the needs of the "characteristic or average" DE students (e.g., DE students are generally older, employed, pay their own tuition, and computer skilled), as compared to "characteristic or average" students studying in traditional F2F environments; and finally, a comparison of factors affecting instructional efficacy and student learning in both situations. Many studies have researched various factors pertaining to DE, but as yet there is no comprehensive answer to these questions. Indeed, educational research often produces contradictory results. Differences among studies in

treatments, settings, measurement instruments, and research methods, make research findings difficult to compare and may even obscure existing trends (Bangert-Drowns and Rudner, 1991).

The purpose of this study was to research and provide an answer to the question of "quality" of DE programs: "Is there a difference in the quality of learning outcomes of DE programs compared to traditional F2F programs?" In order to examine the issue in its totality, a meta-analytical approach was adopted to synthesize various research studies in this field, and to examine differences between the two methods of delivery.

Distance Education and Quality Assessment

Distance Education Background

Distance education's origins may be traced to nineteenth century in England and continental Europe when colleges used postal services for providing education by means of correspondence (Phipps and Merisotis, 1999; Ponzurick, Russo, and Logar, 2000; Sherry, 1996; Wernet, Olliges, and Delicath, 2000).

The term "distance education" has been used to describe the process of providing education where the instructor is distant (geographically separated) from the student (Gallagher and McCormick, 1999), or any instructional arrangement in which the teacher and learner are geographically separated to an extent that requires communication through media such as print or some other form of technology (Moore and Thompson, 1997, as cited in Spooner, Jordan, Algozzine, and Spooner, 1999; Perraton, 1988; Keegan, 1986; Garrison and Shale, 1987, as cited in Sherry, 1996).

Distance Education - Types and Technologies

Continued growth of DE has much to do with the advent of radio, television, and other media, which allowed for learning at a distance. This growth accelerated significantly during the 1990s with the use of computer-mediated learning technologies, e.g., two-way interactive video; two-way audio and Web-based asynchronous communication; and online or offline Internet Web-based instruction (Phipps and Merisotis, 1999; Ponzurick et al., 2000; Sherry, 1996; Wernet et al., 2000; Setaro, 2000). Advancements in increasingly flexible technology have enabled the Web's visual, interactive nature to transform the traditional campus classroom-instructor system into a variety of different and innovative forms of instructional dissemination and to decentralized locations (Hall, 2002; Ponzurick et al., 2000).

Distance Education – Research Studies

A substantial body of research on DE, conducted between 1952 and 1992, showed that DE outcomes were not that different from those achieved in traditional classrooms (DeSantis, 2002). In their review of DE programs, Phipps and Merisotis" (1999) reported:

> *With few exceptions, the bulk of these writings suggest that the learning outcomes of students using technology at a distance are similar to the learning outcomes of students who participate in conventional classroom instruction. The attitudes and satisfaction of students using distance education also are characterized as generally positive. Most of these studies conclude that,*

> *regardless of the technology used, distance education courses compare favorably with classroom-based instruction and enjoy high student satisfaction*.

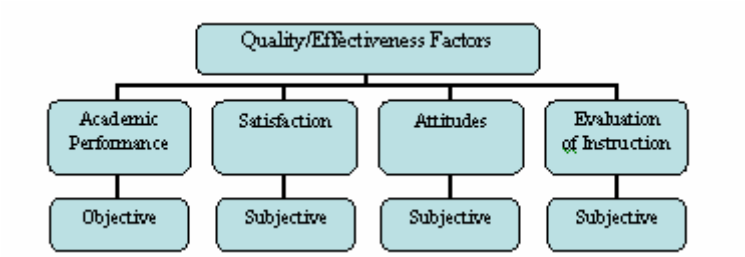
Russell (2002) also examined numerous studies and similarly reported further support of the "no significant difference" phenomenon.

On the other hand, numerous research studies have presented a different picture and therefore conflict with the conclusions cited above, creating a mixed and confusing situation (Dellana, Collins, and West, 2000).

Distance Education – Quality / Effectiveness Factors

A major concern about DE continues to be its quality compared to traditional classroom education. This concern has spurred extensive research into the factors that affect the quality of these programs. In many cases, "broad" measures of the effectiveness of DE have been examined (as shown in Figure 1).

Figure 1. Quality / Effectiveness Factors



Although student achievement is one common measure of a DE program's success, it is recommended that program evaluators collect and report additional data to give the most exhaustive description possible.

Additional models of DE effectiveness that have been suggested include the "Flashlight Project" and Aptitude-Treatment Interaction (ATI) studies (Holmberg, 1989; Keegan, 1996; Thorpe, 1988, as cited in Lockee, Burton, and Cross, 1999); and assessment of cognitive and motivational characteristics of learners enrolled in Web-based instruction (Newlin, Wang, and Kosarzycki, 1998, as cited in Lockee et al., 1999). Research on DE effectiveness has focused on four domains: 1) student attitude and satisfaction regarding delivery of coursework; 2) interactions of students and faculty during delivery of coursework; 3) student outcomes in DE coursework; and 4) faculty satisfaction with delivery and coursework (Gallagher and McCormick, 1999). Additionally, Spooner et al. (1999) have analyzed many studies based on such comparative factors as: 1) *cognitive factors*, namely amount of learning, academic performance, achievement, and examination and assignment grades; and 2) *other factors* namely, student satisfaction, comfort, convenience, and communication with instructor, interaction and collaboration between students, independence, and perceptions of effectiveness.

Recent meta-analysis studies have focused on specific characteristics in DE: student satisfaction (Allen, Bourhis, Burrell, and Mabry, 2002); instructional features affecting learner achievement (Machtmes and Asher, 2000); and education technologies in K-12 learning (Cavanaugh, 2001).

Objective vs. Subjective Measurements

Measurement of such factors may be divided into two methods:

1. **Objective Measurements** of the academic performance factors. Operationalization of these measurements is based on course grades, tests, and exams. Scores are presented in quantitative measurements: points, percents, or letter grades that can be transformed to numeric values by a common transformation table. (Although course grades may carry some assessor subjectivity, they may be regarded as "more objective" than other factors.)

2. **Subjective Measurements** of the attitudes, satisfaction, and evaluation of instruction factors. Most researchers operationalize these variables using surveys and administering questionnaires with Likert-type scales, making comparability of results across different studies problematic.

Research Question and Hypothesis

Research Question

The literature search findings on one hand, and this study's intent and purpose on the other, coincide in the direction of providing a comprehensive response to the following research question (RQ) focusing on the *objective dimension* of effectiveness pertaining to the quality of DE programs, in general, for the 1990-2002 period, and for the final academic performance dependant variable, in particular:

Is there a difference in the final academic performance of students enrolled in DE programs as compared to those enrolled in traditional F2F programs?

Hypothesis

The hypotheses was derived from all the aforementioned:

- H null: There is no difference in the final academic performance between students enrolled in DE programs and those enrolled in traditional F2F programs.

- H alt: The final academic performance grades of students enrolled in DE programs are *higher* than those enrolled in traditional F2F programs.

Methodology

The Meta-Analysis Concept

To synthesize the various studies, the statistical technique called "meta-analysis" has been implemented in this study. As there is more than one method of performing a meta-analysis and

calculating individual and aggregate effect-size, it is important to explain briefly the concept and rationale behind this technique in general, and how, in particular, it is implemented in this study.

- Comparison in terms of a standard effect-size can be conceptualized as a 'standardized difference." In the simplest form, effect-size, as denoted by the symbol "*d*," is the mean difference between groups in standard score form – i.e., the ratio of the difference between the means to the standard deviation (Yu, 2001).

- "A meta-analysis on a given research topic is directed toward the quantitative integration of findings from various studies. Each study serves as the unit of analysis; the findings between studies are compared by transforming the results to a common metric called an effect-size (ES)" (Lemura, Von Duvillard, and Mookerjee, 2000; Cook, Heath, and Thompson, 2000; Becker, 1998).

- The approach provides "a clearer, more parsimonious review than previous qualitative discussions. The results are quantitative so a researcher gets a sense of the possible impact of a procedure against all published studies, rather than an illustrative few selected by a reviewer" (Heberlein and Baumgartner, 1978, p. 448).

- Bangert-Drowns and Rudner (1991) explained: Meta-analysis is a collection of systematic techniques for resolving apparent contradictions in research findings. Meta analysts translate results from different studies to a common metric and statistically explore relations between study characteristics and finding. Glass et al. (1981) argued that literature review should be as systematic as primary research and should interpret the results of individual studies in the context of distributions of findings, partially determined by study characteristics and partially random.

Meta-Analytic Approaches

With respect to meta-analysis, there are different approaches to the procedures, computations, and interpretation of results. Three main approaches (Bangert-Drowns and Rudner, 1991) are explained as follows:

1. **Classic or Glassian Meta-analysis:** Glass' early meta-analyses set the pattern for conventional meta-analysis: define questions to be examined, collect studies, code study features and outcomes, and analyze relations between study features and outcomes. Additional features include: a) "classic" meta-analysis applies liberal inclusion criteria; b) The unit of analysis is the study finding. A single study can report many comparisons between groups and subgroups on different criteria, with effect sizes calculated for each comparison; c) Meta-analysts using this approach may average effects from different dependent variables, even when these measure different constructs. When submitted to critical re-analysis, Glassian meta-analysis has proven quite robust.

2. **Study Effect Meta-analysis:** This approach modifies the Glassian form in two ways: a) Inclusion rules are more selective. Studies with serious methodological flaws are excluded; b) Since the study is the unit of analysis, one effect size is computed for each study.

3. **Psychometric Meta-analysis:** Hunter and Schmidt's (1990) approach to meta-analysis combined some of the best features of other approaches. All studies related to a given topic are gathered, regardless of quality. The distribution of effect sizes is corrected for sampling error, measurement error, range restriction, and other systematic artifacts.

The Chosen Approach

The meta-analytic research type and approach chosen and implemented for this study was a combination of the 'Study-Effect" and "Psychometric" methods. The parameters for this study are as follows: 1) Inclusion rules were more selective. Studies with serious methodological flaws were excluded. 2) The study is the unit of analysis. One effect size was computed for each study. 3) Effect sizes are of separate and independent studies. 4) Hunter and Schmidt's (1990) corrections for sampling error, measurement error, range restriction, and other systematic artifacts were applied to the distribution of effect sizes. 5) Effect sizes were examined *within* each stratum and *across* all of the studies/ strata.

Procedures

Glass, McGraw, and Smith (1981) suggest procedures for conducting a meta-analysis that require a reviewer to complete the following steps: conduct a literature research to collect studies; code characteristics of studies; calculate effect sizes as common measures of study outcomes; and search for relationships between study features and study outcomes. These broad requirements and the methodological steps followed in this study are explained below.

1. **Defining the Domain of Research:** The "independent variable" is the method/ mode of delivery. In our case, we have the: 1), DE mode, and 2) the F2F mode. The "dependent variable of choice" is final academic performance (final grade of course studies).

2. **Criteria for Including Studies in the Review were as follows:**

    - **Criterion 1:** The time period covered in the review: 1990–2002.

    - **Criterion 2:** Published/ unpublished studies: Both types were included.

    - **Criterion 3:** The quality of a study. Only studies showing no severe methodological flaws were included. Because the materials gathered were from a wide scope of researchers and studies, a thorough 'sensitivity analysis' was consequently performed to assess the robustness of combined estimates to different assumptions and inclusion criteria.

    - **Criterion 4:** Control group – Each primary study had a control or comparison group.

    - **Criterion 5:** Sufficient quantitative data – The results in these studies all provided sufficient quantitative data (sample size, mean and standard deviation) from which effect sizes were calculated.

3. **Determining the Type of Effect Size to Use:** Different statistical methods exist for combining the data, but there is no single correct method (Egger, Smith, and Phillips, 1997). Two popular approaches are those of Glass (of which the basic formula for *d* is

"the Mean of control group minus the Mean of treatment group, divided by the Standard deviation of the control group" (Glass et al., 1981); and Hunter and Schmidt (1990) who suggested a "pooled within-group standard deviation" and correcting the effect size for measurement error. Based on the statistical methods described in Buchan (2000), the estimation of the effect size in this study was calculated by using:

1. "*g*" – Modified Glass statistic with pooled sample standard deviation, presented with an 'exact' 95 percent confidence interval as in the formula:

$$g = \frac{\mu_e - \mu_c}{\sigma_{pooled}}$$

4. "*d*" – The unbiased estimator (Hedges and Olkin, 1985), presented with an "approximate" 95 percent confidence interval (Where: sample size $N = . e + . c$, $J(m)$ is the correction factor).

$$d = g\left[J(N-2)\right]$$

5. By convention, if the subtraction of the means (*M*) of the two groups (experimental and control) yields a positive difference if it is in the direction of improvement or in the predicted direction, and a negative difference if in the direction of deterioration or opposite to the predicted direction.

6. Searching for Relevant Studies: The search for published and unpublished materials was carried out using several different approaches:

   - **Computer Search.** All searches were for studies published principally in English. Studies in French, Spanish, and Hebrew were translated only if they showed relevancy. The electronic search engines *Pro-Quest, Google, NorthernLight* and *WiseNut* were used to retrieve as many published articles as possible. The electronic library and inter-library data banks of Touro College and Tel Aviv University were consulted as well.

   - **Compilations, Reference Lists, and Authors.** Two robust compilations of published study materials: *"What's the Difference?"* A review of contemporary research on the effectiveness of distance education in higher education (Phipps and Merisotis, 1999), and *"The No Significant Difference Phenomenon"* (Russell, 2002), proved invaluable in addendum to the reference lists and bibliographies of the studies collected through the online searches. In most cases, data were incomplete or not clear, requiring a personal follow-up letter to the authors.

   - **Yield.** Over 1,600 papers were reviewed, but initial criteria for screening for study content and timeframe (criterions 1 and 2), reduced the number to 259.

7. **Selecting the Final Set of Studies:** Results from the studies were entered into a database using Microsoft Excel, and every study was assigned a unique identification number. From the 259 studies aggregated within the database: 86 (33 percent) qualified; 105 (41

percent) did not meet criteria 3, 4, and 5; and the search for the full text versions of 68 (26 percent) studies was not successful.

8. **Data Extraction and Coding:** All studies were reviewed for relevant information and noteworthy characteristics that might be related to the effect size pertinent to this study. Data on variables of interest were extracted, recorded, and appended to the database and coded for the following characteristics: factors in research design, list of sample characteristics, and type of dependent variable. In addition to effect sizes derived for the dependent variable of final academic performance, data extraction and analysis of qualifying studies produced effect sizes for five other variables: 1) academic performance – sub tests; 2) satisfaction; 3) gain; 4) instruction evaluation; and 5) other factors. The sample size for each aforementioned category was small ($n < 30$); therefore, it was not robust enough for inclusion in this statistical analysis.

9. **Determining The Mean and Confidence Intervals of Effect Sizes across Studies:**

    - **Individual Effect Sizes.** Individual results were expressed in a standardized format to allow for comparison between studies. A statistical computing software program, *Stats Direct LTD* (2002), was used to input and calculate individual and overall effect sizes. The statistical methods employed in this program were conservative and conformed to the current consensus in statistical literature.

    - **Overall Effect Size.** Once all effect sizes of the individual studies were recorded, the overall pooled mean effect size estimate "*d+*" was calculated using direct weights defined as the inverse of the variance of "*d*" for each study/ stratum. An approximate confidence interval for "*d+*" is given with a Chi Square statistic with the probability of this pooled effect size being equal to zero (Hedges and Olkin, 1985).

    - **The Fixed Effect Method.** Egger et al. (1997) argued that the results from small studies are subject more to the play of chance and should, therefore, be given less weight. The statistical techniques or models to do this (differing in the way the variability of the results between the studies is treated) are the "fixed effects" model and the "random effects" model. Neither model can be said to be correct; both are subject to continuing disagreement and debate among statisticians (Fleiss and Gross, 1991; Sahai and Kurshid, 1996; DerSimonian and Laird, 1986). This research was implemented following the more conservative fixed effects method (Buchan, 2000).

10. **Homogeneity and Bias Analysis:** Because diverse studies and data based on different methods of calculation were synthesized, each with its own method of calculation, for the results to be accepted it was necessary to examine the robustness of the findings in light of different assumptions using a Homogeneity and Bias analysis.

    - **Homogeneity.** Individual trial results will show chance variation, therefore, it was necessary to explore whether the differences were larger than those that were expected. One of the main concerns in conducting meta-analysis is that there would be a publication bias arising when trials with statistically significant results are more likely to be published and cited, and are therefore preferentially published in English language journals (Jüni, Holenstein, Sterne, Bartlett, and Egger, 2001). Consequently, the plots of the trials' variability or sample size

against effect size are usually skewed and asymmetrical in the presence of publication bias and other biases (Sterne and Egger, 2001), and are more likely to affect small trials. This leads to the use of plots of sample size against effect estimate. Bias is likely to cause asymmetry in such plots, making the examination of the left-right symmetry of the plot required to detect bias (StatsDirect, 2002; Buchan, 2000).

- **Fail Safe *N*.** Since only published studies were analyzed, there was a "file drawer problem." In other words, how many studies that did not find significant effects had not been published? If those studies in the file drawer had been published, then effect sizes for those treatments would be smaller. Therefore, the Fail Safe *N* is the number of non-significant studies (NFS) that would be necessary to reduce the effect size to a non-significant value. Based on Orwin's (1983) formula, and Lipsey's (1990) standards, an NFS was calculated for each meta-analysis iteration.

11. **Presenting the Results:** An effect size ($d+$) calculated from a very large sample is likely to be more accurate, than one calculated from a small sample. This margin for error can be quantified using the idea of a confidence interval, which provides the same information that is usually contained in a significance test (i.e., a 95 percent confidence interval is equivalent to a 5 percent significance level). Because meta-analysis results are better understood when displayed graphically, the effect sizes with their 95 percent confidence intervals (CI) are presented using a Forest Plot (Egger et al., 1997), or by presenting the results in a histogram of the "*g*" effect size distribution.

12. **Testing the Hypothesis:** An approximate confidence interval for the effect size ($d+$) is given with a Chi-square statistic including the probability that effect size is equal to zero. Following Hedges and Olkin (1985), the null hypothesis is rejected if the probability for $d+$ being equal to zero is smaller than 0.01.

13. **Qualitative Interpretation of Effect Size ($d+$):** Interpreting the results of a meta-analysis requires an understanding of the standards employed that allow for meaningful interpretation of effect sizes. Based on the findings of 102 selected mean effect size estimates from 186 meta-analyses of 6,700 studies involving 800,000 subjects, Lipsey (1990) categorized effect sizes into three groups. These groups and their range of effect sizes were: Small 0.00 to 0.32; Medium 0.33 to 0.55, and; Large 0.56 and higher. Lipsey's (1990) categorizations were used in this study.

Research Results

Of the 259 studies aggregated within the database, 86 met all relevant criteria and therefore were included in this study. The data extraction and analysis from these works produced 86 calculated effect sizes, which yielded the final academic performance factor. These 86 effect sizes were the "basis" for the meta-analysis iterations conducted to answer the study's research question:

Research Question

The central research question for this study was: "Is there a difference in the Final Academic Performance of students enrolled in DE programs compared to those enrolled in traditional F2F programs?"

Results

The Results of This Study Were as Follows:

1. **Sample:** Eighty-six effect sizes were calculated for final academic performance. There was a "clear distinction" between positive and negative results: 66 percent were positive (DE out-performed F2F). Aggregating all of the comparative studies provides for a large student subject body of over 15,300 students, divided almost equally between the two groups: DE (7,270) and F2F (8,076).

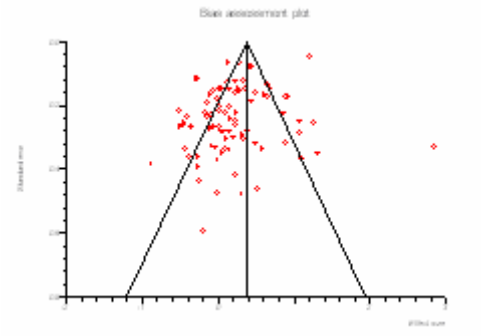
2. **Effect Sizes** *g* **and** *d.***:** The breakdown of all 86 effect sizes, in terms of *d*+ standards, negative and positive, provides roughly the following findings: a one-third negative, a one-third small, and a one-third medium and large result (see Table 1 for detailed distribution).

Table 1. Distribution of Effect Sizes by Magnitude

Standard	Overall N	Overall %
Large: d+ ≥ 0.56	16	19
Medium: 0.33 ≤ d+ ≥ 0.55	11	13
Small: d+ ≤ 0.32	30	35
Negative: d+ ≤ 0	29	33
Total	86	100

3. **Bias Indicators Numbers and Plot:** From regression of normalized effect vs. precision: Intercept (0 if unbiased) = -1.908 (approximate 95 percent); CI = -3.012 to -0.804; *P* = 0.0009. From Kendall's test on standardized effect vs. variance: tau = 0.056; *P* = 0.452. An examination of the left-right symmetry of the plot as depicted in Figure 2 denotes that there is, in fact, a small sample bias.

Figure 2. Bias Assessment Plot



4. **Fail Safe *N*:** Based on Orwin's (1983) formula for calculating the *N* fail safe number, when *dc* = 0.01 is selected as our criterion value, about 3,062 additional unreported studies averaging a "null" result are needed (existing somewhere), to "nullify" the average of 0.366. The Fail Safe *N* for the overall study is large. It was unlikely that there were that many well constructed studies sitting in file drawers.

5. **Pooled Estimate of Effect Size '*d+*':** Computation of the pooled estimate of effect size *d+* yielded the final result of 0.366, with a 95 percent confidence interval of 0.33 to 0.40. This finding corresponded with Lipsey's (1990) medium effect size definition. The Chi Square of 397 ($P < 0.0001$) is most significant. In Figure 3, the solid contour line is the control (F2F) group distribution; the dotted contour line is the experimental (DE) distribution; and SDx is the average effect size in standard deviation units. An effect size of 0.366 indicates that the mean of the treated group is at the 65th percentile of the untreated group (See Figure 3). Figure 4 depicts further detailed data relative to the distribution of the effect sizes (*g*) thought of as the average percentile standing of the average treated (or experimental) participant compared to the average untreated (or control) participant.

Figure 3. Percentile of F2F Group Distribution

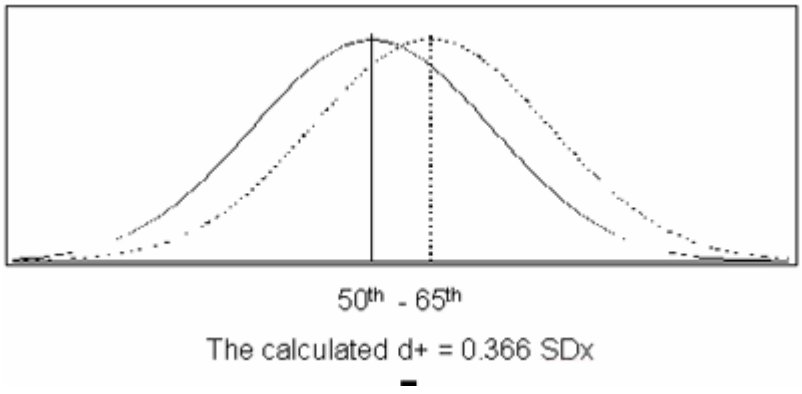
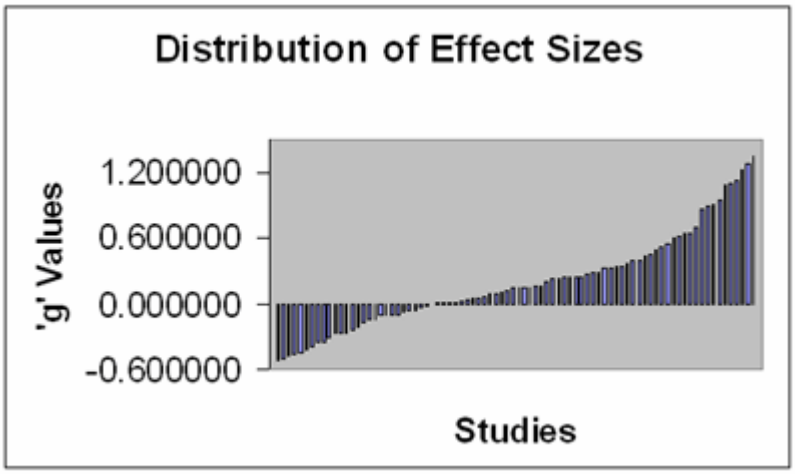


Figure 4. Distribution of Effect Sizes (*g*)



6. **Hypothesis:** Based on these findings, providing an overall effect size of 0.366 from 86 studies, with a significant Chi-square of 397.55, we are accepting the alternative hypothesis that: The Final Academic Performance grades of students enrolled in DE programs are higher than those enrolled in traditional F2F programs.

Discussion and Implications

Summary

To facilitate review and discussion, all previous findings for the research question were aggregated and consolidated within Table 2. Of the 86 qualifying studies, over two-thirds were positive, denoting that DE out-performed F2F. The overall effect size calculated was positive in direction, and, by Lipsey's (1990) standards, the overall effect size ($d+ = 0.366$) was of a medium magnitude.

The overall effect size of 0.366 calculated from 86 studies and testing for Chi Square of 397 brought us to the conclusion that our null hypothesis defined as: "there is no difference between DE and F2F instruction for the final academic performance factor," should be rejected in favor of our alternative hypothesis.

Table 2. Summary of Study Results

Literature / Study Search Results	Studies (II)	Studies(%)	Remarks
Total	259	100%	
Studies – that met criteria	86	33%	
Studies – That do not meet criteria	105	41%	
Studies – Full text not found	68	26%	

Discussion

Based on 86 studies and using learning outcome data from over 15,000 participating students, the results of the meta-analysis show a strong positive trend indicating that DE is an effective form of instruction. This analysis demonstrates that students engaged in DE academically outperform their F2F counterparts. We have been focusing all along on the question: "Is DE suitable for all students?" The results of this study may raise the inverse question: "Is F2F suitable for all students?" and may begin a paradigm shift in the way postsecondary education is pedagogically conceptualized.

Examining and reducing bias is of major concern to any researcher implementing meta-analysis procedures. Homogeneity and bias analysis have been the focus of many statistical discussions, and are worthy and deserving of specific attention in this discussion.

Homogeneity

Since all individual trials will show chance variation in their results, we need to explore whether the differences presenting in this study are larger than those caused by chance alone. If a series of independent studies provide a common (homogenous) estimate of the population effect size, then it is more likely that the various studies are testing the same hypothesis. If these estimates are heterogeneous, then the question of whether each study is testing the same hypothesis arises.

Heterogeneity provides a warning that it may not be appropriate to combine and synthesize all the study results in one meta-analysis (Wolf, 1986). Debate among statisticians continues as to how to minimize those studies affecting the homogeneity of the research. Hedges (1982) and Hunter, Schmidt, and Jackson (1982) suggest that it is inappropriate to include them in one meta-analysis. Harris and Rosenthal (1985) argue that heterogeneity is analogous to individual differences among subjects within single studies, and is common whenever many studies by different investigators using different methods are examined. Hedges (Becker and Hedges, 1984) admitted that: "It is not necessarily inadvisable to draw inferences from heterogeneous effects."

The bottom line is that the more refined the research, and the more acute the coding of the individual study's characteristics, and the less likely that heterogeneous studies will be accepted. This study has adopted and followed a conservative approach throughout all of the meta-analysis procedures. Therefore, even though the final results produce a significant *Q* (non-combinability) statistic, it is strongly contended that the well defined scope of the study and the narrow and acute extraction of specific data pertaining to a defined dependent variable, override the need for the reduction of supposedly suspicious, outlier studies.

Bias Detection and Analysis

Publication bias arises when trials with statistically significant results are more likely to be published and cited, and are preferentially published in English language journals (Jüni et al., 2001). In this study a systematic approach – the usage and presentation of Bias Plots (where lateral asymmetry indicates bias), and the calculation of Fail Safe *N* numbers, was taken to identify the possibility of publication bias.

Bias Plots

Examination of the bias indicators and plots for our research question shows that we have a small sample bias for the overall meta-analysis. Assessing this bias from the "half-full glass" perspective, had the studies that were analyzed been more robust in their student sample sizes, the bias would have been reduced and we would be even more confident in our current positive findings and results.

Fail Safe N (NFS)

The "file drawer problem" (Rosenthal, 1979) refers to the question: How many studies that did not find significant effects have not been published? In other words, if those studies in the file drawer had been published, then the effect sizes for those treatments would be smaller. Therefore, the Fail Safe *N* is the number of non-significant studies that would be necessary to reduce the effect size to a non-significant value.

In this study the NFS numbers were calculated based on Orwin's (1983) formula, providing large numbers for our research questions sample sizes. When *dc* = 0.01 was taken as our criterion value, it was found that about 3,062 additional unreported studies averaging a "null" result would be needed, to nullify our overall *d*+ average. It is unlikely that there were that many well constructed studies sitting in file drawers.

Distance education literature and research have revolved around three main issues: 1) differences in study formats; 2) variety of technologies; and 3) quality of instruction. Unfortunately, the plethora of information and the diversity of its presentation have obscured some significant findings. First, the differences among studies in terms of treatment, setting, measurement instruments, and research methods have made findings difficult to compare. These differences are so extensive that they obscure trends with an overwhelming amount of information (Bangert-Drowns and Rudner, 1991). Second, an emphasis on the technical aspects of overcoming the distance factor in DE has distracted the discussion from the efficacy of the education itself. The methods of overcoming the geographic distance, which separates instructor from student, vary widely (Gallagher and McCormick, 1999). Methods take the form of computer-mediated learning, two-way interactive video, Web-based asynchronous communication, and on and offline Internet Web-based instruction (Ponzurick et al., 2000; Phipps and Merisotis, 1999). Third, studies of individual DE courses generally conclude that the learning outcomes are not that different from those found in traditional F2F classroom formats (DeSantis, 2002; Phipps and Merisotis, 1999; Russell, 2002).

The meta-analysis approach, methodology, and findings of this study, specifically address these three issues. Since this study provided a positive result for the final academic performance dependent variable, we can deduce that DE not only is comparable to traditional instruction, but also, when subject to our criteria, can outperform traditional instruction. It is important to note that this deduction is further supported by the preliminary results of an ongoing meta-analytic study comparing DE to traditional classroom instruction (Bernard, Lou, Abrami, Wozney, and Borokhovski, et al., 2003). Also, this study did not differentiate between the educational delivery methods of time (synchronous and asynchronous) and place (same and different) dimensions, as categorized by O'Malley and McCraw (1999), or the various technological and tele-communication delivery systems, but rather remained with the general dichotomy of DE courses vs. traditional courses.

Most education researchers accept that if it could be shown that making a small and inexpensive change would raise academic achievement by an effect size of even as little as 0.1, then this could be a significant improvement (Coe, 2000). Even a 0.50 standard deviation improvement in achievement scores is considered to be a conventional measure of practical significance (Rossi and Wright, 1977). A one-third (0.33sd), but at times as small as one-fourth (0.25sd), standard deviation improvement will also be considered to be educationally significant (Tallmadge, 1977). Therefore, the overall effect size *d*+ = 0.366 found in this study, defined by Lipsey's (1990) standard as a sound "medium," denotes that average students in the DE group would find themselves in the 65th percentile of the traditional control group: an educational incremental achievement, at least.

Implications

The purpose of this work was to research and provide an answer to the "quality question" of distance-learning programs. Specifically: Is there a difference in the quality of DE programs relative to traditional F2F programs? Providing an answer to this question would serve the multi-faceted fields of education, teaching, training, and learning. Such information would be a

supporting construct to the decision makers in academic, business, and professional organizations contemplating the various options for training and development.

These findings provide a definite and positive answer to the DE versus F2F conundrum. This study serves a variety of functions: a) it may serve future researchers in this field, in that this meta-analysis synthesizes a wide body of academic comparative studies of DE vs. F2F; b) with respect to quality of DE programs, it provides concrete findings based on a robust compilation of research studies across various subjects of learning and across all levels of higher education as to the quality of DE Programs; and c) by adopting a meta-analytic approach, it provides a comprehensive answer.

If we argued that DE has yet to be compared to F2F programs provided by the traditional brick and mortar institutions, then the implication of this study's results should be to accept DE as a respectable and feasible option for education. The findings have implications for changes in each of the following entities:

Academic Institutions and Policy Makers: Educational institutions (mostly in the higher levels of academia) have adopted these new DE methods as the educational delivery systems of the future. We have seen the insertion of DE delivery methods into learning programs in a variety of formats: optional, complementary, interchangeable, or full and completely on-line programs. It is doubtful, however, that we will see materialization of some experts' predictions of the disappearance of the residential based model in the near future (Blustain et al., 1999; Drucker, 1997 as cited in O'Malley and McCraw, 1999). Rather, these institutions should be encouraged to invest in DE technology, implement DE learning programs, and transform some existing F2F courses to DE so that a wider range of students, regardless of age or geographic location, may enroll in quality learning programs. The realistic possibility of hybrid programs, providing the student with the best of both worlds, may likewise be enhanced.

Organizations: This study may encourage organizations to enhance their in-house professional and managerial training and development programs by combining the power of the Internet and other telecommunication options to create the "information society" characterized by the emergence of the "knowledge worker" (Drucker, 1989). The case for what Dessler (1997) and Mondy, Noe, and Premeaux (1999) refer to as in-house training and development programs that are provided by numerous colleges and universities, can be strengthened by the supporting evidence of this study.

Students: When offered the option of DE as a means of pursuing their academic quest, students can now choose solely on the merits and quality of the program offered, without fear that DE may hinder their academic performance outcomes. For those prepared to commit themselves to this form of study, need not wonder if the DE option of learning anywhere, anytime and at any-pace, is any good. This study may provide positive reassurance, subject to their serious assessment of their specific field of study.

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The Personalized System of Instruction: Review and applications to distance education

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Abstract

The present paper a) outlines the basic features of the Personalized System of Instruction (PSI); b) provides a brief history of PSI; and c) describes the application of PSI to distance education. Some common misconceptions about PSI are also addressed. PSI is presented as a helpful universally applicable set of instructional practices that are well suited to distance teaching and learning.

Keywords: Personalized System of Instruction; distance learning; computer-based instruction; mastery-learning; self-pacing; higher-order objectives; scholarship of teaching; proctors; tutoring

Cracolice and Roth (1996) wrote:

> *What would you do if you discovered an instructional strategy that raised the scores of your students from the 50th percentile to the 70th percentile? What if that strategy required more work on your part the first time you taught the course? Would it be worth the effort? Such a strategy has been known for more than 25 years, yet it is virtually ignored.*

What if students also liked this teaching method more than lectures? What if the strategy meshed well with computer-based learning, online learning, and distance education?

In this article, we outline the basic features of the strategy that Cracolice and Roth (1996) refer to: the Personalized System of Instruction (PSI), which is also known as the Keller Plan. PSI is a non-traditional method of teaching that thousands of instructors have used at colleges and universities since the 1960s. Although PSI is an effective and empirically validated method of instruction, many traditional and distance educators are unfamiliar with the system, mainly because dissemination of the method occurred during the 1970s, before an entire generation of instructors assumed their positions, and before distance learning came into prominence. The purpose of this paper is to present PSI and its history to potential users in the distance education community. In this paper, we describe the basic elements of PSI, provide a brief history of the system, discuss misconceptions about PSI, and discuss how it may be applied to distance learning.

Background: What is PSI?

PSI was originally designed as a classroom-based method of instruction with the intention of improving student achievement and, at the same time, replacing the long tradition of punishment in education with the use of positive consequences for learning. PSI has five defining features:

Stress on the Written Word

In a PSI course, the instructional content is presented in written form rather than via lectures. PSI teachers normally prepare a written study guide that is designed to assist students with learning. The study guide contains study objectives and questions that focus students' attention on important material to be learned, and provide a clear indication of what students are expected to do. The study guide may also include instructor comments used to elucidate difficult points, exercises and practice problems to prepare students for the unit quiz, thought questions to stimulate students' interest in the exploring the subject matter further, and a supplementary reading list. In addition to the study guide, PSI instructors also prepare a course policy statement or student manual (e.g., Grant, 2002a, 2002b) containing an overview of the course, policies for such matters as essay expectations, deadline dates for exams, and instructor tips for good performance. Keller and Sherman (1974) provide detailed information about the written components of a PSI course.

Unit Mastery Requirement

In a PSI course, content is separated into portions called units. To advance from one unit to the next, students must demonstrate that they have learned the unit's material. In many PSI courses, students demonstrates unit mastery by taking a quiz that requires a minimum score of, for example, 80 percent or 90 percent. Students who fail the first attempt at the quiz are typically given at least two additional attempts to pass the unit by taking a different form of the unit quiz. When the course objectives require some kind of evaluation, other than a paper-and-pencil quiz such as an essay (e.g., McFarland, 1976; Mills, 1978), or demonstration of a physical skill (Cregger and Metzler, 1992), students are also given multiple opportunities to demonstrate mastery. Providing remedial opportunities for students to learn substantially removes the stigma of failure. Remedial opportunities also transform the purpose of grades: grades are not used to rank students relative to each other, but are instead used as incentives to promote achievement.

Student Self-Pacing

A system of individualized student pacing follows from PSI's use of a unit mastery requirement. Because some students take more time to master individual units, students will thus progress through a PSI course at different rates. Some students finish a PSI course relatively quickly, while others require the total allotted time (e.g., a semester) to finish the course. As such, once a PSI course has begun, students enrolled n the same course, will work on different units of the same course depending on their rate of progress. Unlike the lock-step model of traditional instruction, a self-paced model recognizes and accounts for differences among students in the rate at which they learn the course material and avoids grade penalties for students who require more time to learn. Although PSI can be used within conventional academic time units like semesters, PSI works especially well when an entire institution functions on a self-paced basis (e.g., Athabasca University – Canada's Open University).

Use of Proctors

PSI courses make use of course staff called proctors or tutors to help students learn the material, administer unit quizzes, provide feedback regarding unit quiz performance, and conduct certain administrative tasks such as maintaining student records. PSI proctors can be external or internal proctors. External proctors are former students who receive academic credit for proctoring a course. Internal proctors are students enrolled in the course, who have passed early units in the course, and are now assisting students with the units they have already mastered. Some PSI courses also make use of professional tutors or proctors who are paid for their work. In an online environment, tutors can have homepages that provide contact information and autobiographical sketches for students (e.g., Psychology Tutor: Dr. Alan LeBoeuf, 2002; Psychology Tutor: Rebecca Heartt, 2002).

Lectures and Demonstrations as Motivational Devices

With PSI's emphasis on the written word, lectures tend to be de-emphasized. However, the founders of PSI also felt there was a place for lectures in order to stimulate the students' interest in the subject matter, so occasional lectures were initially included as a feature of a PSI course. Unlike the other components of PSI, lectures have not been demonstrated to be effective in boosting student academic performance (e.g., Brothen and Wambach, 1998; Johnson and Ruskin, 1977), and should be considered as an optional feature of the method, at best, that might be reserved for those rare spellbinding lecturers. Note that PSI is an evolving data-driven system, not an ideological model that asserts . *priori* definitions about what represents good instruction. The data dissuading teachers from lecturing illustrate that PSI is a model that is subject to alterations in accordance with new data.

A Brief History of PSI

Growth of PSI From 1968 to 1980

A useful starting point in the history of PSI is Dubin and Taveggia's (1968) book *The Teaching-Learning Paradox: A Comparative Analysis of College Teaching Methods* in which the authors analyzed the results of 74 empirical comparison studies of higher education teaching methods conducted from 1924 to 1965. The methods reviewed included face-to-face techniques as the lecture, group-discussion, tutorials, as well as independent study in which students take primary responsibility for their own learning. Dubin and Taveggia found no consistent differences in the results attained by any of the methods studied. They concluded: "These data demonstrate clearly and unequivocally that there is no measurable difference among truly distinctive methods of college instruction when evaluated by student performance on final examinations"(p. 35).

Dubin and Taveggia's milestone work had several important implications, one of which was empirical support for programs of independent study and distance education. The finding that students did equally well in an independent study format, in which they managed their own learning without a classroom instructor, gave considerable credence to alternative methods of instruction in which students work largely on their own, as in independent study and distance education courses. If teaching methods do not matter, then why not allow students to work on their own in independent-study or distance education formats, which provide more convenience to students? Why not use teaching methods that reduce the costs of instruction without any

reduction in student achievement? These questions continue to be important and relevant with respect to most teaching methods.

The same year that Dubin and Taveggia published their findings, Keller (1968) introduced PSI, outlined its basic features, and described the operation of the system in an actual classroom. Keller's initial work led to a boom in PSI research during the 1970s that clearly demonstrated the superiority of PSI over conventional methods of instruction (Johnson and Ruskin, 1977; Kulik, Kulik, and Cohen, 1979). This work showed that: (a) PSI students learned more than students taught using conventional (i.e., lecture, lecture-discussion) methods, and that (b) students rated PSI courses more favorably than conventional courses (Buskist, Cush, and DeGrandpre, 1991; Johnson and Ruskin, 1977; Kulik et al., 1979). With respect to the latter point, Kulik et al. (1979) concluded: "Differences in student ratings of PSI and control classes are also pronounced. Students rate PSI classes as more enjoyable, more demanding, and higher in overall quality and contribution to student learning than conventional classes"(p. 317).

The finding that PSI is more effective than standard methods of university instruction represents an important hallmark in the history of higher education, especially when considered in relation to Dubin and Taveggia's earlier findings. Confronted with the new data showing the benefits of PSI, Taveggia (1976) wrote: "The major conclusion suggested by this summary of research is that, when evaluated by average student performance on course content examinations, the Personalized System of Instruction has proven superior to the conventional teaching methods with which it has been compared" (p. 1032). Taveggia's conclusion was especially important because it came from an individual well known for maintaining that no teaching method is superior to any other.

PSI From 1980 Onward

During the early 1980s, interest in PSI, as reflected in publication activity in professional journals and presentations at conferences, diminished (Buskist et al., 1991; Lamal, 1984; Polson, 2000a). In its heyday, advocates of PSI had hoped that it would eventually either replace the lecture method, or at least firmly establish itself as a teaching method used by a substantial minority of college and university instructors. In a survey of past users of PSI, Lloyd and Lloyd (1986) found that of 43 previous users of PSI, 23 continued to use the system.

Many reasons for the waning of interest in PSI have been advanced. These include: a) The recalcitrance of the educational establishment to change (Buskist et al., 1991; Cracolice and Roth, 1996; Lloyd and Lloyd, 1986; Sherman, 1992); b) implementations of ineffective teaching methods people called "PSI" that did not meet the proper criteria for PSI (Buskist et al., 1991; Gallup and Allen, 2002; Sherman, 1992); c) the time demanded in setting up and maintaining a PSI course (Buskist et al. 1991; Cracolice and Roth, 1996; Lloyd and Lloyd, 1986); d) misunderstandings of the nature of PSI in the academic literature (Buskist, et al. 1991; Gallup and Allen, 2002; Reboy and Semb, 1991); and e) outright prohibitions of PSI courses (Sherman, 1992). Another factor that eroded interest in PSI was that during the 1980s there was a shift in emphasis in academics from teaching to research (Boyer, 1990), which worked against a time-intensive teaching method like PSI.

Perhaps the most important factor that has mitigated the popularity of PSI, is the absence of a focus on empirical evidence of student achievement and student satisfaction as core values and key criteria for selecting instructional methods. PSI's greatest strength is the evidence showing that when students engage in PSI courses, they learn more and tend to like them more than

traditional courses. In addressing the role of data in influencing educational decision-making, Carnine (2000), relying on Porter's (1996) analysis, distinguishes between immature and mature professions:

> *. . . immature profession is characterized by expertise based on the subjective judgments of the individual professional, trust based on personal contact rather than quantification, and autonomy allowed by expertise and trust, which staves off standardized procedures based on research findings that use control groups. A mature profession, by contrast, is characterized by a shift from judgments of individual experts to judgments constrained by quantified data that can be inspected by a broad audience, less emphasis on personal trust and more on objectivity, and a greater role for standardized measures and procedures informed by scientific investigations that use control groups.*

Not surprisingly, Carnine (2000) concludes that education does not meet the criteria for a mature profession. The history of PSI certainly supports this conclusion in the realm of higher education: Although the experimental data support PSI, the typical criteria for educational decision-making are those identified with an immature profession. Indeed, empirical evidence that supports PSI is entirely absent in discussions of how to teach. For example, the Carnegie Foundation's bibliography of the *Scholarship of Teaching and Learning* (Hutchings and Bjork, 1999) contains many thought-provoking books and articles, but few empirical studies and reviews of empirical research pertaining to teaching effectiveness. To be sure, the questions that confront a teacher in deciding how to teach are not solely empirical questions answered in comparison studies, but to be equally sure, decisions of teaching methods should not be made without some attention to the rich empirical literature of teaching effectiveness, a key part of which is the PSI literature.

The decline in use of PSI over time should not be constructed as an abject failure for the system. Although the use of PSI lessened since the period of peak use in the 1970s, many educators steadily continued to use and conduct research in PSI. Lloyd and Lloyd (1986) called attention to PSI users who ceased using the method, but their survey data showed that over half of the early users of PSI continued to use the method. During the 1990s work in PSI has continued. A PSI webpage (*http://ww2.lafayette.edu/~allanr/psi.html*) identifies many current users of the method, and provides helpful articles and papers for new and continuing users (Allan and Gallup, 2002). An online, Web-based tutorial provides information about the basic elements of PSI (Polson, 2000a). In publications from 1990 onward, PSI also continues to extend its strong foundation of research supporting the method (e.g., Austin, 2000; Brothen, 1996; Brothen and Bazzarre, 1998; Brothen and Wambach, 1998; 2001; Buzhardt and Semb, 2002; Cregger and Metzler, 1992; Hambleton, Foster, and Richardson, 1998; Herzberg, 2001; Pear and Crone-Todd, 1999; Price, 1999; Roberts, Suderman, Suderman, and Semb, 1990; Steel, Brothen, and Wambach, 2001).

Misconceptions about PSI

There are many misconceptions about PSI, perhaps because many educators have only a casual familiarity with the method. Among the most troublesome misconceptions are that PSI is not appropriate to teaching higher-order skills and abilities, and that PSI is somehow tied to a particular theory of learning.

Higher-Order Objectives in PSI Courses

Some have maintained that PSI is not suited to teaching higher-order skills such as those involved in concept learning and critical thinking (e.g., Meek, 1977). However, as an instructional system, PSI is a set of practices that is independent of instructional content and instructional objectives (Reboy and Semb, 1991). PSI only demands instructional content that is amenable to observable assessment in the form of unit quiz scores or some other type of performance (e.g., essay-writing, first-aid skills demonstrations, lifesaving demonstration, debating exhibition, poetry writing, experimental design and execution) that may be assessed and graded according to clear and fair criteria. PSI is not well suited to teaching skills like reaching a nirvana state in which the phenomenon is entirely internal without any measurable criteria, although it is not clear that there are any definable teaching methods well suited for teaching this kind of performance.

Teaching higher-level objectives in college and university courses is a challenge for all educators, including users of PSI. However, advocates of PSI have had a long-standing concern with this issue. Semb and Spencer (1976) interviewed 17 university instructors who used the lecture-discussion method. Although the instructors estimated that 33 percent of the content taught in their classes required more than memorization of facts, an empirical analysis of the tests in these courses revealed that less than 10 percent of the content required more than factual recall. These early data showed that any criticisms of PSI in failing to teach higher-order skills were not specifically applicable to PSI, but instead were broadly applicable to university courses in general. Caldwell (1985) stresses that instructors who wish to teach higher-order objectives must explicitly define those objectives during course development and not simply teach textbook content.

Those favorably disposed to the PSI approach have explored instruction in higher-order objectives on several fronts. This includes research in learning abstract concepts and principles (Grant, 1986), the design of entire textbooks to promote conceptual learning and abstract thinking (Grant and Evans, 1994; Miller, 1997; Miller and Weaver, 1976), the empirical validation of methods to teach complex concepts (Grant, 2002; Grant, in press), and systems for identifying and implementing higher-order objectives (Pear, 2002). In a review of the literature of PSI in teaching higher-order skills, Reboy and Semb (1991) documented that PSI has been used in many courses such as critical thinking (Ross and Semb, 1981) that require that students learn higher-order objectives. They also showed that students who take PSI, and similarly designed courses, improve their higher-order cognitive abilities. PSI achieved many of its initial successes in physics, engineering, and the sciences (Kulik, Kulik, and Carmichael, 1974), where students must generally engage in abstract thinking to apply principles to solve novel problems. More recently, researchers associated with the Computer-Aided Personalized System of Instruction (CAPSI) project have studied and developed careful procedures for reliably identifying higher-level objectives using Bloom's taxonomy (Bloom, 1956), and incorporating them into PSI courses (Crone-Todd and Pear, 2001; Crone-Todd, Pear, and Read, 2000; Pear, Crone-Todd, Wirth, and Simister, 2001). All these considerations show that PSI users have been major contributors to the literature of teaching higher-order objectives.

PSI Accommodates Diverse Educational Perspectives

Although PSI was originally designed based on behavioral principles (Keller and Sherman, 1974; Sherman, 1982), PSI is compatible with a wide range of philosophical and theoretical viewpoints with respect to learning and instruction (Coldeway and Spencer, 1982). All of the individual features of PSI have appeared in a variety of theoretical historical contexts. The unit-mastery

criterion, for example, is simply the idea of learning until standards are achieved, a concept implicit even in writings as early as Aristotle's *Poetics*. Proctors or tutors, often PSI-like peer tutors, have assisted students for centuries to achieve practical educational outcomes (Wagner, 1982). Likewise, PSI's use of the written word and the concept of separating complex material into manageable portions are scarcely modern innovations tied to a psychological or philosophical perspective.

By including discovery learning experiences, PSI can incorporate content that is consistent with constructivist approach to education. Pear and Crone-Todd (2002) described how a PSI course can embrace social constructivist principles. Consistent with the constructivist approach, PSI is a learner-centered system that puts the student in an active and focal role (Buskist et al., 1991; Coldeway and Spencer, 1982). As Coldeway and Spencer (1982) maintained, PSI is helpful to educators because it provides a sound instructional baseline upon which the instructor can add content, tailor student assignments, and otherwise structure the course according to their own philosophy of education. Founders of PSI encouraged the development of PSI in different academic fields, permitting Sherman (1982) to surmise that PSI had been used to teach all major academic disciplines. This track record of diversity is compelling evidence that PSI can accommodate a wide range of subject matters, instructor styles, and educational philosophies.

PSI Applied to Distance Instruction

PSI may be broadly regarded as a universal system of instruction that is applicable to diverse teaching environments (Brothen, Wambach, and Hansen, 2002; Coldeway and Spencer, 1982). The key features of PSI are apportioning written material into manageable units, requiring mastery, using proctors, moving at the individual student's pace, and applying sound instructional principles generally characteristic of well-designed instruction. PSI's universality and flexibility are highlighted by its use in diverse disciplines, such as its application in elementary schools (e.g., Klishis, Hursh, and Klishis, 1980; Werner and Bono, 1977); and other instructional programs including bank training (Tosti and Jackson, 1980); military training (McMichael, Brock, and DeLong, 1976); and teaching self-help skills to the underprivileged (Fawcett, Mathews, Fletcher, Morrow, and Stokes, 1976).

As a domain in which to apply the quasi-universal principles of PSI, distance education is a promising field (Coldeway and Spencer, 1982; Kinsner and Pear, 1988; Lauzon and Moore, 1989; Pear and Kinsner, 1988; Schmitt, 1998). Due to the nature of PSI as an integrated package, with its emphasis on the written word, flexibility in relation to distance learners and adoption of computer and telecommunications technologies, PSI is especially applicable to distance education and the emerging scholarship of teaching.

PSI as an Integrated Foundation for Distance Courses

As an instructional package, PSI provides distance instructors with a set of effective practices that can serve as a starting point for developing distance courses. PSI serves as a flexible blueprint for distance course design and delivery, focuses the role of the tutor, and provides students with a degree of structure that facilitates independent learning (Coldeway and Spencer, 1982). In the absence of a system like PSI, many instructors are apt to fall back on merely electrifying the lecture method as an initial foray into distance learning, which represents an awkward application of an ineffective classroom model to distance delivery (Clark, 1983). After initial experiences with PSI, distance instructors can modify the components of PSI to suit their particular

requirements due to PSI's adaptive-ness and flexibility. There is also a rich PSI literature to guide instructors, including a PSI handbook (Keller and Sherman, 1974), a review of all aspects of PSI (Johnson and Ruskin, 1977), and online, distance-learning examples of PSI courses (Computer-Aided Personalized System of Instruction, 2002; Grant, 2002a; 2002b).

The Prominence of the Written Word in PSI and Distance Instruction

Generally, PSI and distance education share an emphasis on the written word as a medium for teaching and learning, effectively bringing distance instruction into greater concordance with PSI than with traditional lecture-based classroom practices. Partly out of necessity, many distance educators have rethought education from the ground up, and this openness to nontraditional practices has resulted in a relatively greater reliance on the written word.

One of the historical impediments to the adoption of PSI in the classroom has been the extra work required for the development of PSI study guides and other written course materials (Buskist et al., 1991; Cracolice and Roth, 1996; Lloyd and Lloyd, 1986). However, distance learning instructors are generally compelled to develop such ancillary study materials as study guides and student manuals no matter which instructional method they select, thereby reducing or eliminating the relative disparity of work required to implement PSI in distance learning. Early in the development of the field of distance education, such pioneering institutions like the Open University in Britain and Athabasca University in Canada, established the precedent of developing course packages that included written study guides for students that specified learning objectives and were divided into manageable units. As a result, much of contemporary distance instruction makes use of unit-by-unit PSI-like study guides.

PSI's Flexibility for Distance Learners

PSI provides considerable flexibility for students just as it does for instructors (Coldeway and Spencer, 1982). Students often turn to distance instruction for reasons of flexibility, and the four main features of PSI: emphasis on the written word, self-pacing, mastery criteria, and use of tutors/proctors provide for this.

Emphasis on the written word in PSI makes it possible for students to do their course work at virtually any physical location at which they can read. In this respect, PSI students are freed from geographic barriers to learning due to the nature of the written word, which, in turn, makes learning more flexible.

Most distance learners have work and family interests apart from their distance courses, and PSI's self-pacing feature permits students to adapt their course work to other activities in their lives, rather than the reverse. In a PSI course, students take an active role in managing their own learning and scheduling their own assignments, providing them with the opportunity to function as independent learners, albeit with the support of PSI materials, tutors/ proctors, and other structured elements of a PSI course.

The mastery-learning feature of PSI courses is also helpful to distance learners who must fulfill multiple responsibilities. If a PSI learner fails to budget enough time to pass a quiz or other assignment, there is an educational safety net in the form of the opportunity to retake the quiz or redo the assignment.

Proctors or tutors in a PSI course serve to humanize the course for distance learners, who often feel isolated and alone in their studies. These course personnel are available to adapt the course content to the requirements of individual students, provide inspiration and emotional support, go over troublesome points, set up a study schedule, suggest further readings, etc.

The self-paced and mastery-learning features of PSI also have considerable appeal to disabled learners (Brothen et al., 2002). Many of these students are drawn to distance education as a means of overcoming physical barriers; the addition of the flexibility of PSI to distance learning further accommodates students with disabilities.

Technology in PSI and Distance Education

Both PSI and distance education have been facilitated by the developments in computer and telecommunications technology, and have generally embraced technology as a means of both reaching students and improving instructional effectiveness. For example, the use of computer-based assessment in PSI classrooms and in distance-learning courses (Barnes, Swehosky, and Laguna-Castillo, 1988; Buzhardt and Semb, 2002; Crosbie and Kelly, 1993; Grant, 2002a, 2002b; Pear and Kinsner, 1988; Pear and Crone-Todd, 1999) has automated the process of quiz administration and quiz record keeping. PSI courses and well designed distance learning courses require instructors to keep detailed records of student quizzes and assignments in order to track student progress (Keller and Sherman, 1974; Pear, 2002). Computer-based versions of PSI all substantially ease the burden of record-keeping and other logistical requirements for a PSI instructor, in addition to providing students with the increased flexibility of taking unit quizzes 24 hours per day, 7 days per week. In Grant's (2002a, 2002b) distance learning courses, for example, course tutors once administered all unit quizzes over the telephone in a variant of Ferster's (1968) oral interview technique. This required that course tutors spend considerable time in the mechanical process of administering the quiz and recording students' answers. However, once online quizzes were introduced in 1996, course tutors were freed from these routine clerical tasks and were able to devote a greater proportion of their time to discussing course content with students, correcting student misconceptions, providing students with help with procrastination problems, etc. Currently, approximately 90 percent of students enrolled in the courses take quizzes online, although the option to do the unit quizzes over the telephone remains for students who do not have access to an Internet-enabled computer.

Both PSI and distance education courses share the benefits of extending the traditional medium of the printed word to computer-based and online self-instructional resources (Coldeway and Spencer, 1982). Research showing the effectiveness of computer-based learning over traditional print-based alternatives (Bangert-Drowns, Kulik, and Kulik, 1985; Kulik, 1994; Kulik, Kulik, and Shwalb, 1986) indicates that print-based study guide materials can, and should, be transformed into interactive computer-based self-instructional resources. Computer-based instruction makes for a more active learning experience by allowing students to receive ongoing feedback regarding their knowledge, comprehension, application, analysis, synthesis, and evaluation of course content, as well as providing a more convenient and rapid interface to knowledge databases. For example, students engaged in online PSI courses can make use of interactive computer-based tutorials and exercises (Grant, in press; Grant, 1996; Polson, 2000a; 2000b, Parsons and Polson, 2000; Randall and Grant, 2000), an interactive online glossary of terms (Polson, LeBoeuf, Schwartzberg, and Grant, 2002), and a History of Psychology Timeline (History of Psychology Visual Timeline, 2002). Computer-based and online instruction serve to make PSI even more effective, student-friendly, and applicable to distance learning.

The Model of the Teacher-Researcher in PSI and in Distance Education

A third common aspect of PSI applied to distance education is its potential contribution to a scholarship of teaching and learning capable of aligning the two areas, allowing distance educators to draw upon the rich PSI literature as a source of teaching applications and research ideas, while allowing PSI teacher-researchers to extend their work into distance instruction. Since its inception, PSI users have often been teacher/ researchers who have critically examined their teaching practices, often from an empirical standpoint, and have disseminated their findings in professional forums. This model of teacher/ researcher became popular in PSI, partly because those who collected data about the method found results that favored the method, consistent with the empirical reviews discussed earlier.

The model of teacher/ researcher is also consistent with Boyer's (1990) landmark call for a reformulation of university scholarship to reestablish teaching as a valued academic activity. Boyer found that many university teachers were generally dissatisfied with the traditional incentive systems that rewarded disciplinary research at the expense of teaching, one of the factors that led to the decline of PSI and other innovative forms of effective instruction. To address this problem, Boyer called for an expanded definition of scholarly publications to include a broader range of writing. Properly implemented, this expanded definition of academic writing could encompass PSI and distance education study guides that have not been traditionally considered publications for purposes of tenure review and promotion, despite the considerable scholarly effort that goes into developing these materials. The expanded definition of academic writing could also include teacher/ researcher reports of course delivery activities, including empirical studies of the effects of variations on PSI formats and study guide materials.

A prototypical example of a teacher/ researcher program that combines PSI and distance education is the Computer-Aided Personalized System of Instruction (CAPSI) program (2002), described earlier. The materials at the site extend PSI research to distance education. CAPSI represents a scholarship of teaching that merges the empirical foundations of PSI with distance instruction, and promotes leading-edge research in areas such as teaching higher-order objectives. The site includes interesting position papers, a list of publications, and discussions of research in progress.

Summary

Measured according to the criteria examined earlier, higher education has yet to become a mature data-driven field. In the absence of data as a guide, educational trends and fashions are often driven by charismatic authority figures and opinion leaders who come in and out of vogue. Educational theories and practices become popular for several years, only to wane in importance and be replaced by new trends that are similarly as unsupported by data as their predecessors. In the midst of this ebb and flow, predicting future trends in educational practices is difficult because the practices typically do not have a solid foundation of empirical support.

PSI, nonetheless, continues to offer the prospect of more effective instruction. Recent developments in higher education and in technology have provided the basis, at least in principle, for growth of PSI courses in distance education. Colleges and universities seem to be inching toward greater attention to teaching, and the scholarship of teaching promises to elevate the profile and status of instructional research, which should assist PSI users who have a strong commitment to teaching. Distance education continues to grow and provide a new platform for the teaching/ learning process that requires consideration of alternative models like PSI. Research

in PSI continues to break new ground in exploring the learning processes involved in achieving higher-order educational objectives. Educational technology makes PSI easier to implement and operate than ever before and expands the range of self-instructional learning resources available to distance learners. All these considerations provide grounds for optimism about the future of PSI, but until education matures into a data-based field, PSI may lay dormant in much the same way as Mendel's original discoveries in genetics lay unheeded for decades before they provided a foundation for modern biological science. Whatever the ultimate future of the system may be, PSI now provides distance educators with a teaching/ learning method that will allow students to achieve more and to like their courses better.

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An E-Learning Experience: A written analysis based on my experience with primary school teachers in an e-Learning pilot project

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Abstract

This article reports the experience of an e-Learning pilot project selected by the Educational Technology Unit (EduTech) of the Centre for Academic Development (CAD), University of Botswana (UB). This e-Learning package was designed and delivered in connection with the three-credit course "Issues and Trends in Early Childhood Education" (EPI-642), which is required for the first year of the master's program in the Department of Primary Education. The course was taught via a flexi-time, gradual, phase-by-phase transition from traditional face-to-face teaching to the electronic medium of an e-Learning lab (called SMART classroom). This course utilized a student centred e-Learning package that retained the learning qualities of traditional teaching, personal guidance, and mentoring, while seeking to enhance students' research and computer skills.

E-Learning is "the use of Internet and digital technologies to create experiences that educate fellow human beings" (Horton, 2001). E-Learning was born during the dot-com frenzy, and the term "e-Learning" was not well known until a few years ago. But now the term is common, especially in the University community. In 1999, more than 50 percent of US college students were planning to have Internet access from their dormitory rooms, and virtually all were planning to have access from campus locations. Today, more than 90 percent of students have accessed Internet, with 50 percent accessing Web daily, and nearly 40 percent of all college courses using Internet resources (OECD, 2001).

As a network technology, the Internet creates, fosters, delivers, and facilitates learning, anytime and anywhere. In distant modes of education, it provides connections to outside computers (Wheeler, 2003). Network technologies also make possible delivery of individualized, comprehensive, dynamic learning content in real time, aiding in the development of knowledge communities. By making them accountable and accessible, it links learners and practitioners with experts and enables people and organizations to keep apace with the rapid changes that define the Internet world. It is a force that gives people and organizations the competitive edge, permitting them to participate in the rapidly changing global economy (elearning.com, 2002). Clearly, the penetration of Internet in the post-secondary sector is significant.

An initiative was undertaken to introduce e-Learning at the University of Botswana (UB), where e-Learning was defined as "The appropriate organisation of information and communication technologies, for advancing student-oriented, active, open, and life-long teaching-learning processes" (Thurab-Nkhosi, 2003). With this guiding principle for e-Learning in hand, UB's Centre for Academic Development (CAD) invited proposals from different faculties and departments to conduct a pilot study in December 2002. The author of this article submitted a proposal for design and delivery of a three credit course "Issues and Trends in Early Childhood Education" to first year Department of Primary Education Masters' students using an e-Learning approach. The course was approved and a development team lead by the author, who was also the content expert, was established. The course was developed collaboratively by the entire team, after which the author acted as the instructor and the moderator of the e-Learning component of the course. The course was delivered successfully in January to May 2003.

Resources used for the development of this e-Learning package were all an integral part of the University's EduTech, Centre for Academic Development, and contributions to this development were a part of the EduTech's regular activities; all content development aspects of this course was undertaken by the University's Department of Primary Education. The only additional resource required was a research assistant, employed for a total of 40 hours at a cost of Botswana Pula 1850, which is equivalent to US $370.

Purpose of The E-Learning Course

A Flexi-Time Approach

An e-Learning course offers a flexible time and location approach by changing the learning environment. It enables learning to take place in a variety of different places, both physical and virtual. Learners now have a choice and as a result increasingly wish to combine the options, choosing when and where they study and learn. For education providers, preparation and integration of materials and services have now become a challenge, because it fundamentally changes the learning environment (OECD, 2001, p. 22).

Students who work full time and have tight work schedules, who have young children, or are disabled, or for whatever reason are unable to attend regular classes at a specific time and location, often require and really appreciate a flexible time and location course. But to be successful, such courses require self-motivated and independent learners (Mantyla and Woods, 2001).

In this project, most learners in the target group were part-time UB students. They were full-time working professionals (i.e., primary school teachers living in the outskirts of Gaborone City, Botswana) who travelled anywhere from 30 to 60 kilometres from their schools to attend classes held the University. Classes could only be held in the afternoon and/ or evening, after work/ school hours. Many students were also mothers and who had to look after their families. Thus it was determined that a flexi-time e-Learning course would enable the delivery of the course material at students' work place, home, cyber café, or at campus, making it easy and convenient for primary level teachers who now must carry out lifelong learning concurrently with their normal workload and personal obligations.

A Mixed-Mode, Blended Approach

E-Learning was misinterpreted after it was first introduced. It was oversimplified and wildly optimistic. Some described e-Learning as putting all learning on computers. They felt that e-Learning could result in savings in instructor salaries, and could keep students out of the classroom. They felt students could learn anywhere, whenever they wanted, and could save time by studying only what they needed, and could learn at an optimal pace, neither to be held back nor bypassed by the rest of the class. But they forgot that learning is a social experience. Even in the classroom much learning takes place informally in exchanges between students. Most people learn better when computer-mediated lessons are combined with virtual classes, study groups, team exercises, mentors and help desks, off-line events, and online coaches. The act of learning itself has not changed. Computers can make aspects of learning more convenient, but they do not eliminate the need for human intervention. The presumption that e-Learning would automate every aspect of learning sounds unnatural and is unnatural (How People Learn, 2003).

Thus a mixture of both face-to-face and distance mode was thought to be most appropriate for the target group. In fact, all conventional universities are becoming mixed-mode where a convergence of distance education and conventional education is becoming apparent. Dual mode institutions are emerging in many countries, and the distinction between traditional and distant mode is disappearing. Institutions are being replaced by "mixed-mode" education systems, which are substantively centred on communication and technology (OECD, 2001).

A Student-Centred Approach

An e-Learning package not only provides a marriage of Internet, digital technology, and learning, it also facilitates student/ learner centred learning. In recent years, there has been a shift from the teacher/ instructor-centred approach to a student-centred approach. A teacher-centred approach believes in teachers disseminating and pouring content into empty heads as students passively listen, rather than proactively engaging with what is incoming and what is already there. With this approach, students usually recite, often by rote memory, some concepts on examination scripts. In this form of instruction, teachers are seen as the "gatekeeper" of knowledge, which is acquired from textbooks. However, teacher-centred, textbook-based learning is not conducive to our ever changing information rich, global society. This situation is well put by Cook and Cook (1998) who said: "Rapidly changing political, social, and economic environments often made textbooks and articles outdated soon after they are published" (p.1).

In an extreme situation of the teacher-centred approach, students never learn how to find out the right information, or how to discover and learn to use higher-level thinking skills such as analysis, synthesis, and evaluation to disseminate information to others. On the contrary, a student/ learner-centred approach believes that students are active participants and construct their own knowledge by interacting with the information available. Such an approach believes in rewiring the brain by sculpting new pigeonholes and adding new connections. It places students at the centre of the teaching/ learning process, and believes that teachers should act as mentors, navigators, facilitators, or "guides" to help students access, organize, construct, and transfer information to solve authentic problems. According to Harmon and Hirumi (1996) "Student-centred learning is where students work in both groups and individually to explore problems and become active knowledge workers rather than passive knowledge recipients" (p. 1).

In this approach, students gain expertise not only in the content area being studied, but also in learning process itself – i.e., how to learn through discovery, inquiry, and problem solving. Thus it was felt that a student-centred e-Learning package would be appropriate for the UB target group.

ICT Empowerment

E-Learning generally promotes greater proficiency in Information Technology (IT) skills, which helps in personal employability and corporate competitiveness (Stephenson, 2001). The world is changing towards an Information age – and Botswana does not want to be left behind, a fact that is clearly articulated in the government's Vision 2016 (2000), which states: "Botswana must recognise the importance of information and of developing efficient information systems and networks for the support of research, education, development and communication with the rest of the world" (p.20).

This aim can only be realised, however, by educating the nation's people about the importance and use of technology by facilitating Information and Communication Technology (ICT) empowerment. Use of ICT can be of great help in this regard. As it is stated in (OECD, 2001):

> *ICT can empower the learner by offering choice and potentially more engaging and effective means of learning. ICT can accommodate a whole range of different learning styles and preferences. Individuals differ markedly in their appreciation for ability to learn from different types of communications, learning processes and materials. Interactive multimedia and the opportunity to combine various media resources, styles and methods is a key feature of ICT-enabled learning* (p.23).

An e-Learning course, which requires a repeated use of ICT resources like computers, floppy discs, printers, multimedia projectors, Internet connections, email and discussion forums to send, retrieve, and process information, ultimately empowers students via the development of their computing skills. After all, the only way to learn a skill is to practice it. A student may not have any interest in how a system works, but might be interested in knowing how to use it to receive information. Moreover, the essence of real education is repeated practice (Schank, 2002). The author was thus interested to establish the best practices required to create high quality e-Learning packages, since this would not only cover the important issues of the subject area, but also enhance students' basic computer skills through repeated use of computer resources.

Enhancement of Research Skills

A key component in an e-Learning approach is students' ability to obtain information and research materials (Lynch, 2002). The author determined that an e-Learning course, with Internet access to online materials with hyperlinks to relevant websites, would encourage students to actively participate in the search for materials and answers, active learning that would enhance their research skills.

To optimise resource management through interaction, counselling, coaching, assessment, and evaluation, the author determined that it would be beneficial to establish a phase-by-phase, student-centred, flexi-time course. She also felt that UB would be able to make better use of its resources in terms physical place and human resources, as well as regularly update the course to

take advantage of technological advances and development, and to deliver newly digitised course materials. The author also felt that the propagation of such courses would increase the market opportunities for the ICT industry in terms of hardware, software, and related services such as Internet Service Providers (ISPs). Thus a phase-by-phase, mix-mode/ blended e-Learning course, that strived to be individualistic, flexible, competency-based, and varied in methodology – as well as unconstrained by time or place – was proposed for the target group at UB. The plan was to achieve this objective through the use of a variety of instructional tools and methods, as well as flexible learning arrangements in terms of time and place. The course evolved and was ultimately delivered in three phases using a combination of face-to-face and independent/ online learning.

Course Design

"Issues and Trends in Early Childhood Education" (EPI642) was a three-credit course. UB students enrolled in this course were required to devote at least three hours per week. The Course Outline was as follows:

1. Early Childhood Education
2. Historical Perspectives of Early Childhood Education
3. Theories of Early Childhood Education
4. School, Community, and Home Resources
5. Current Trends and Issues in Early Childhood Education
6. Research Relevant to Early Childhood Education

The objectives of the proposed e-Learning course were to:

1. Provide students' the basic course contents
2. Provide students' a flexi-time course
3. Provide students a mixed-mode/ blended course in phases
4. Provide student-centred teaching/ learning processes
5. Provide ICT empowerment to students
6. Provide instruction to enhance students' research skills

The objectives of the basic contents of the course were formulated.

Course Development

"The most effective e-Learning, whether it is delivered as an e-Learning solution or conventional face to face instruction, occurs as a result of careful planning derived from the needs of the organisation and learner" (Syrtis.com, 2001, p.1). This statement articulates how it is important to

design a course systematically. In the present project an attempt was made to design the course systematically. Once the course was approved, an EduTech team was formed which consisted of the following members:

1. Project leader/ Content Expert/ Author
2. Instructional Designer
3. Graphic Designer
4. Library Representative
5. Editor
6. Research Assistant
7. Research Project Leader

The team worked in a collaborative manner to develop the course, and the project leader received constant support from the instructional designer to develop the course structure, create the course webpages, and upload them on *WebCT*. It was a rich learning experience for all involved. The project leader underwent training and learned techniques involved in creating the structure of a webpage, creating a hypertext mark-up language (HTML) page by using *FrontPage* software, and in uploading these webpages to the *WebCT* platform. This learning experience will no doubt greatly help in developing future e-Learning courses.

A rough course schedule and a curriculum/ topic structure were developed. The structure of the website was finalised, which actually determined the structure of individual webpages and subject areas. The proposed structure consisted of a homepage with icons for establishing links to the course outline, schedule, content, email, discussion board, and research.

All webpage content was created in-house. Also, with the assistance of the research assistant and library representative, the content expert searched and extracted the right list of readings, list of relevant website links, handouts, and presentation materials. The instructional material was generated electronically by using ICT resources. The created material was then converted to HTML and uploaded to the *WebCT* platform with the help of the instructional designer. The e-Learning package developed was hosted on the *WebCT* platform housed on the UB server. The graphic designer provided the logo and Icons, which made the *WebCT* course look truly striking indeed. Finally, and most importantly, course material contents were regularly updated.

Course Implementation

After the e-Learning course was launched, students met at the SMART classroom (e-Learning lab) of EduTech, Centre for Academic Development. The SMART classroom was comprised of numerous computers with a *WebCT* platform. The instructor also had access to a multimedia projector for delivering the required material. In sum, the lab had every facility that could be required by both students and instructor.

The course consisted of six modules and was delivered in three phases. A mixed-mode, blended course approach was used. There was a gradual shift from teaching face-to-face to online

presentations using *WebCT* tools. In the first phase, face-to-face contact occurred three hours per week. During the second phase, face-to-face contact was reduced to two hours per week, and by the third phase it was further reduced to one hour only. Because students were curious to use the online material, the first phase took place in one session. The second phase continued for approximately eight sessions, and the third phase continued for three. Each session was a blend of face-to-face and online teaching. Using a *PowerPoint* presentation projected by a multi-media projector, the instructor guided the students who spent first part of the session face-to-face accessing course materials online, while discussing and receiving the summarised version of the course module. After summarising the course content, the instructor uploaded the *PowerPoint* presentation to the *WebCT* platform for students' to access. The second part of the session was then spent making preparations for the next classroom presentation. This was achieved both face-to-face and online. During second and third phase, students accessed course materials and made preparations mainly online, either during class time or at a time convenient to them. As such, preparatory materials like references, website links, and handouts were provided to students via the *WebCT* platform.

Students engaged in an orientation course during the first session, at which time they were given an Internet account, which was password protected to access the course materials from any Internet resource available. They also received special training on how to use *WebCT* platform, how to use diskettes to copy and print, and how to access the course information online. On the first day, some students could not even hold the mouse, so the author spent extra time and effort to bolster students' enthusiasm and motivate them to use computer effectively.

Communication between teacher and students through the use of a discussion forum was an important aspect of this course; the discussion forum contained links to learning event information, announcements, and questions (Jolliffee, Ritter, and Stevens, 2001). During the second and third phase, students participated in online discussions and made comments on the issues that were ultimately posted on the discussion forum.

Because email can be effectively used inform students about activities, grades, and reminders on upcoming events, the instructor's use of email was a central to efficiently conducting the course (Stephenson, 2001). In this project, students sent email to the author. The author was also in regular email contact with students (e.g., sending assignments, grades, making announcements, responding to queries, etc).

The design of this course encouraged students to participate in active research. As such, a sizable amount of personal tutoring took place along with face-to-face teaching. Students searched relevant materials, made copies on the floppies, printed documents, and used the materials they gathered and synthesised in classroom presentations. Towards the conclusion of the third phase, students indicated that they felt quite confident working with the Internet without assistance.

Employing a student centred approach the instructor evaluated the students' progress towards the achievement of learning objectives, helping them acquire the basic skills to learn, and thus providing the basis for lifelong learning. In this course, students were assessed at regular intervals. Since it has been found that a combination of online quizzes and tests work best to facilitate students' mastery of course material assigned (Mantyla and Woods, 2001), students were encouraged to submit assignments via email, and by actively completing online quizzes and tests. At the conclusion of the course, students presented an electronic version of their research paper, along with submitting a traditional hard copy. The assessment criteria for this course are found in Table 1.

Table 1. Assessment Criteria for "Issues and Trends in Early Childhood Education"

Assignments/Tests	30%
Presentations/Discussions	20%
Research Paper	50%
Total	100%

Course Outcome

Most of the desired objectives of this pilot project were achieved. A blended, mixed-mode course was provided with a balance between content and process. It offered students a student-centred, active, open, and life long teaching/ learning environment. The main focus was to maximize student productivity, knowledge acquisition, skills augmentation, as well as facilitate the development of personal and professional abilities (Arizona Faculties Council, 2000). The adoption of this process implied active involvement on the part of students, and the integration of academics with the students' total development. Students performed quite well in this course, and indicated that "initially they felt it was imposed on them, but later they found it's better than reading a book as you are not aware that you are learning, and actually they are learning more things at once." In sum, two students achieved a final "A" grade, two achieved a "B" grade, and one managed a "C+" (but this was primarily due to personal problems that prevented this particular student's participation in some of the quizzes, presentations, and discussions). Students were engaged in active research of content materials, provided on the *WebCT* platform. Students made revealing comments like: "Now I know how to find information, my research competence increased." They enjoyed the course and found this approach to be educative, informative, and a facilitator of research skills. Students selected and researched the topic of their research paper independently. They discovered the Internet to be an "eye-opener," offering comments like: "I can find information, bring it home, and evaluate in context of Botswana, and can see from the current information that early childhood education is not done properly in Botswana."

During this course, students enhanced their basic computing skills. Students who could not hold the mouse prior to the course, could later access the materials on the class website, take active part in the discussion forum, send and receive emails, type documents, attach files/ documents to emails, engage in online quizzes and tests, and copy information to disks for later use and archiving. One student reported: "Normally I would pay somebody to type assignments for me and now I did it on my own, slowly, but I did it." Another student said: "We were computer illiterate at the beginning and learned a lot now." In sum, students assessed themselves as "Computer Illiterate" prior to the course, and as "Good" in computing skills by course completion.

The design of the course and the architecture of Web allowed the course content to be accessible from any computer anywhere, so as long as it was connected to the Internet and the user assigned a requisite user account and password. All that was required for students to access and engage in the course was access to *WebCT* enabled computers and an Internet connection. In reality, however, external limitations did not allow student access to computer and Internet outside the University of Botswana. Access to computers, let alone to an Internet connection, was absent in

Botswana's primary schools system (the students' place of employment). Cyber Café or public Internet outlets, which were often not locally available, were also exorbitantly costly, thereby creating significant barriers to education based not on access to technology, but on individual students' economic circumstances.

There was also an internal problem within the University. Students encountered limited access to computers in good working condition outside the SMART classroom. Thus, students could access the course materials, anytime, in the SMART classroom only, a condition that placed constraints of anywhere, anytime learning. Another problem was the access to Internet was inconsistent, and in many cases the bandwidth so slow that many webpages could not be downloaded. This finding was not surprising, however, as Internet penetration in Botswana is currently extremely low.

The most important outcome of our endeavour is that course and content quality is now standardised for this particular e-Learning package. As such, it is felt that a relatively new instructor will be able to deliver this particular e-Learning course without experiencing any major problems. Based on this e-Learning experience, the author also feels that it would be feasible to offer the same course much in the same way next year. But in order to design, develop, and deliver another similar e-Learning course, the author will need the same level of technical support and infrastructure that was available to design "Issues and Trends in Early Childhood Education." In other words, it was the author's experience that it takes substantial time and effort to design and administer an e-Learning course such as the one described. As Mantyla and Woods (2001) correctly stated: "Whether you are developing the course, reading a Web-based article, doing an assignment, or grading a project, it will take twice as long as you think. Although there are many times when technology can be a time saver, at least in the beginning technology can be a time drainer" (p. 330).

Conclusion

The quality of the e-Learning course "Issues and Trends in Early Childhood Education" was standardised using e-Learning approaches. Most pilot project objectives were achieved. The author (course instructor) found it feasible to design and deliver a mixed-mode, blended, flexi-time, student centred course, which in turn provided students with the basic course contents, facilitated the development of research skills empowered them with basic computing skills, and, more significantly, provided them the basis for lifelong learning. The author is of the view that a step-by-step approach with student-oriented-active learning, designed to encourage students to explore information and materials available on a wider spectrum (e.g., Internet access), and provide a basis for their active participation in collaborative life-long teaching/ learning processes, would enable them to reap the real benefits of an e-Learning course. The author hopes that this approach may be one day popularised in the region. It is important to remember, however, e-Learning requires planning, which is especially important for courses reliant on a particular technology (Mantyla and Woods, 2001). The author hopes that for the benefit of its entire population, the Government of Botswana will adequately plan for greater Internet connectivity and increase computer and Internet access accordingly. By increasing access to technology, only then will the people of Botswana become truly engaged and thus competitive in today's global economy.

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Critical Success Factors in the Infusion of Instructional Technologies for Open Learning in Development Settings: The case of the University of Botswana

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Abstract

This article seeks to identify critical success factors for the appropriate infusion of instructional technologies to advance open learning in higher education within developing settings. Describe here is a descriptive account of a two-year case study based on the author's personal analysis of, and reflection on, factors that contributed to the infusion of instructional technologies to advance open learning at the University of Botswana. The first critical success factors identified in this article include: a clear vision, support of committed leadership, and dedicated personnel/ change agents to ensure successful project implementation. The second critical success factor identified was the need for all involved to fully appreciate and understand the systemic nature of the infusion of instructional technologies for open learning purposes, as well as garner the commitment of strategic partners working in related systems. Finally highlighted, are the requirements needed to address the complex nature of the infusion of instructional technologies into the University's educational offerings. It is hoped that those involved in education in developing countries, and particularly those desirous of advancing open learning through the use of instructional technologies, will find this descriptive analysis useful. Indeed, those of us involved in implementing instructional technologies in developing nations are still in the initial stages of this exciting yet challenging endeavour.

Keywords: infusion; open learning; instructional technologies; critical success factors; developing settings; development; Botswana; LASO model

Introduction

This article's aim is to identify critical success factors necessary for the appropriate infusion of instructional technologies into developing settings. It examines the initial stages of a project designed to advance open learning in higher education in Botswana. Currently, there are no theories and models for educational change and development in terms of introducing instructional technology within developing settings. Cannon (1986) further points to the absence of a general theory of educational development.

Higher education institutes, particularly those operating in developing settings, can therefore benefit by taking cognisance of the 'critical success' factors presented here, for if the infusion of instructional technologies are not systematically and appropriately infused into the educational setting, they can hinder student access, thereby working as an impediment to open learning. Ljosà (1992, p. 91), for instance, asserts "every time we introduce a new technology in a distance education system, we run the risk of introducing a new barrier to participation and learning." Bates (1983, p. 283) points out that ease of access, and thus openness of education, is an important criterion for measuring the success of new technologies in distance education. New instructional technologies can therefore negatively influence equity of access to education as learners, and this is particularly so in developing settings, where learners often find it difficult, if not impossible, to access such technologies. Mason (1999, p. 86) highlights this issue in the European context:

> *And although the rhetoric about virtual education is that it will extend to the disadvantaged, the remote, the housebound, and the unemployed, those who are signing up for virtual education are the advantaged, the upwardly mobile, the "over-employed" (i.e, those who are already incredibly busy), and the well educated. There is evidence from practitioners that virtual education is more appropriate and more successful for the advantaged learner: one who is motivated, has good learning skills, and has easy access to technology.*

This article describes a two-year case study based on the author's personal experience, analysis, and reflection on factors that contributed to the infusion of instructional technologies to advance open learning at the University of Botswana. The insights in this article are based on the author's experiences in spearheading the implementatio phase of new instructional technologies (e-Learning) at the University of Botswana. The author served as Deputy Director: Centre for Academic Development (Educational Technology) in the Educational Technology Unit (EduTech, 2003) in the Centre for Academic Development. Since its launch in 2001, the author also led the University of Botswana eLearning (UBel) programme, the purpose of which was to transform teaching and learning at the University through the appropriate use of instructional technologies.

Clearly, those working in developing settings must contend with issues that contrast dramatically with those in developed settings. Many aspects of the socio-economic and technological environment that are taken for granted in developed settings must be explicitly addressed when introducing instructional technologies for open learning in developing settings, such as in Botswana. These include, among other things, participants' unfamiliarity with new instructional technologies, inadequate telecommunications infrastructure, unreliable power supply, competition for limited educational sector resources, and the need to provide basic educational facilities. It is from this viewpoint, that this article analyses elements of the "Leadership, Academic and Student Ownership and Readiness" (LASO) model that guided this extended study. The purpose here is to provide pointers to factors critical to successful infusion of technology to advance open learning in higher education in developing settings.

The factors critical to success identified in this article have emerged from an analysis of the elements of the "LASO Model for Technological Transformation in Tertiary Education" (Uys, 2001a) (see Figure 1) that provided guidance during the first two years of technological implementation at the University of Botswana. The purpose here is to share this experience with other higher education institutions in developing settings.

UBel was initiated in response to the need for educational reform to mitigate the impact of radical change brought on by growing globalisation and trans-national exchanges in many fields and sectors of society (Marquardt, 1996, p. 3). Scholars such as Evans and Nation (1993) indicated that in "these circumstances politicians, policy-makers, and citizens are making demands upon education systems to reform. Open learning and distance education are at the forefront of educational responses to the changes that are taking place locally, regionally, nationally, and internationally" (p. 7).

The University of Botswana has committed itself to 'open learning' as described by Lewis (1992) as "a conglomeration of educational approaches that aims to transcend the traditional barriers of tertiary education: namely physical, educational, individual and financial barriers" (p. 14). The traditional barriers that Lewis refers to, namely specific locations and times, sequencing of the content and method of delivery, lack of awareness of what is available, and costs of course materials, are also present in higher education in Botswana. The University of Botswana, the nation's only university, has included in its vision statement, 'life-long and open learning approaches' as focal points for the institution. The University further identified student-centred learning as a key component in its vision, which Lewis likewise has identified as a vital feature of open learning.

Open learning at the University has been provided in the past through paper-based distance education and some isolated yet innovative approaches involving face-to-face classroom-based learning. However, in spite of its former reliance on more 'traditional' modes of distance education delivery, e-learning has emerged at the University of Botswana over the last two years as the vehicle through which instructional technologies are being infused to address the above mentioned barriers to education. It is anticipated that the adoption of such technologies will create new avenues for learners to access, open learning opportunities both on and off-campus. The definition of e-learning at the University of being "the appropriate organisation of information and communication technologies for advancing student-oriented, active, open, collaborative and life-long teaching-learning processes," for instance, reflects the University's core goals of providing open learning opportunities, and highlights its commitment to provide e-learning as a means to create such open learning opportunities for Botswana's people.

The technological transformation process at the University has been guided by literature on the infusion of instructional technologies in higher education.

Selected Literature on the Infusion of Instructional Technologies

Current literature does not provide a neatly formulated theory of generic change or a general theory of educational development (Cannon, 1986). Furthermore, there are no theories or models for educational change and development in the area of instructional technology within developing settings.

Nonetheless, according to Rogers (1995), innovation diffusion theory provides a general explanation for the manner in which new entities and ideas, such as instructional technologies, diffuse through social systems over time. Rogers reviewed studies examining the diffusion of innovations from many technological contexts, and advanced a model for adoption of innovations that described key roles and the desired behaviours that typically occur during the adoption of new innovations. Innovation diffusion theory is essentially a bottom-up approach based on individual responses. The critical importance of visionary leadership during the infusion of

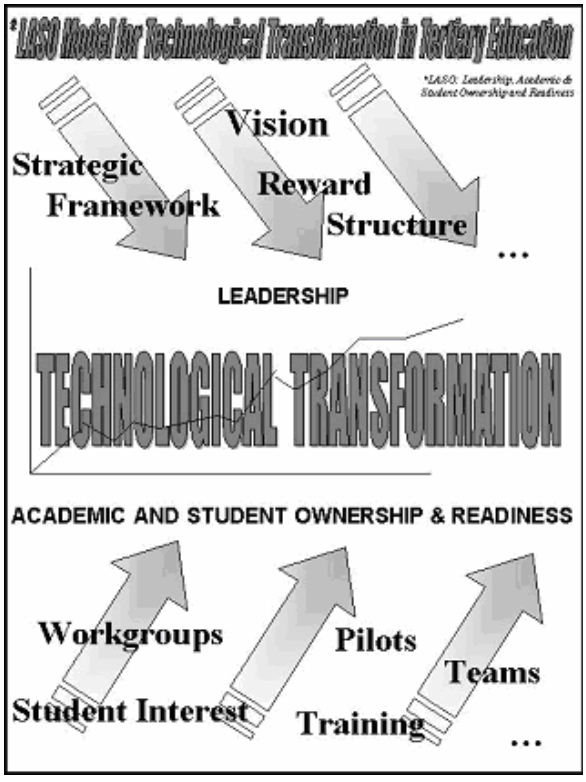
instructional technologies at the University of Botswana correlates with a central finding of the author's doctorate research (Uys, 2000) that show that when the innovation emerges from outside of senior management, Rogers' diffusion of innovation theory needs to be augmented with a top-down component that includes the support of both senior and middle management in order to accomplish the effective diffusion of instructional technologies within a given higher educational setting.

Szabo, Anderson, and Fuchs (1997) developed a change model called the Training, Infrastructure and Empowerment System (TIES) for implementing alternative delivery systems at the University of Alberta in Canada. The TIES model suggests the following five phases for infusion alternative delivery systems: vision building, identification of departments, development of ties workshop and modules, TIES Leadership Task Force (TLTF), training and follow up support. The TIES model, however, does not provide a strategic framework to guide the implementation of instructional technologies in an institution of higher education.

Bates (2000) highlights the importance of leadership in the technological change process by asserting "...the widespread use of new technologies in an organization does constitute a major cultural change. Furthermore, for such change to be successful, leadership of the highest quality is required" (p. 42).

At the University of Botswana, the LASO Model for Technological Transformation in Tertiary Education (Uys, 2001a) (see Figure 1) was selected to guide the implementation and selection of appropriate strategies.

Figure 1. The Leadership, Academic and Student Ownership and Readiness (LASO) Model for Technological Transformation in Tertiary Education



Based on the implementation of instructional technologies in higher education both in developed and developing settings, the LASO model emphasises the importance of integrated top-down and bottom-up processes, as was proposed by Gunn (1998) and suggests that effective technological infusion occurs when leadership is matched with corresponding academic staff and learner ownership and readiness. Leadership is achieved through mechanisms such as defining a clear vision for the infusion, providing a reward structure for those engaging in the change process, and the creation of a strategic framework to guide the infusion process.

The LASO model suggests that ownership and readiness for change on the part of learners and academic staff, can be achieved by using strategies such as pilot projects, extensive training, establishment of workgroups and learning communities in every faculty, and use of teams for e-learning courseware development. The curve of technological infusion is indicated in the LASO model as a ragged line used to signify the complexities and dilemmas with which the infusion of instructional technologies in higher education is often associated. The LASO model also describes an integrated view of the systemic nature of the infusion of instructional technologies.

In sum, this article attempts to identify the critical elements of the LASO model that led to the increased use of instructional technologies for advancing open learning at the University of Botswana.

Instructional Technologies for Advancing Open Learning at the University of Botswana

Technological transformation is supporting increased student access to open learning opportunities at the University of Botswana. Overhead projectors, for example, were first introduced on a large scale in 2000. Yet two years later, the University of Botswana now finds itself using an online learning content management system whereby courses are offered via WebCT within various cutting-edge facilities and systems. Online learning has made open learning a reality for learners in many of the faculties and departments at the University. More than 4,000 learners, enrolled in over 70 courses, are currently conducting a portion of their learning activities online.

While conventional paper-based distance education is still widely used in the University's Centre for Continuing Education, in 2003 two pilot studies were identified to introduce newer instructional technologies. Such pilots support the Centre for Continuing Education's open learning activities.

A state-of-the-art e-Learning Support Centre (see Figure 1) has been implemented as the first wireless network application at the University of Botswana. Computers, which are laid out in clusters to support collaborative work, are placed so as to facilitate eye contact among group participants. A Mimio-board is used to display, via a data-projector, what is written or drawn on the white-board. Microsoft-NetMeeting is used to project the white-board or any other aspect of the instructor's screen on the screens of all the participants, or the screen of any participant to all other participants.

The eLearning Support Centre, which held more than 60 workshops, has been used to train more than 30 percent of the UB 720 member academic community in various educational technologies. A new 'eLearning Certificate,' issued by the Centre for Academic Development, has been designed by EduTech and is being offered since the beginning of 2003.

After rigorous evaluation, in 2002, the University acquired WebCT, an online learning management system. More than 70 courses are currently online, providing approximately 4,000 (of the 12,000) learners with open learning opportunities. WebCT offers a full suite of online learning tools including chat facilities, bulletin boards, online calendar, assessment tools, learner tracking, email, content uploading, and learner administration.

In 2003, a video-conferencing system, POLYCOM, was installed for synchronous teaching and learning, linking the main campus in Gaborone with Maun and Francistown via ISDN and leased lines. The University of Botswana can also conduct video-conferencing internationally through this system using IP addressing or ISDN.

The Internet and particularly the Web is playing an increasingly important role as e-learning expands. Learner use of the Web has increased exponentially; so has the demand for more computers and faster access.

EduTech has a central equipment outlet and has seen a dramatic increase in the demand and use of laptops and mobile data projectors by academic staff. A satellite model is being implemented whereby each faculty will have its own educational technology and e-learning centre (eCentre) to provide customised support, instructional design, training, and equipment services.

Implementation of a computerised system for issuing equipment using a bar-code system at the central educational technology outlet is now at an advanced stage. In the future, academic staff will be able to both check availability and reserve equipment online.

An e-learning Smart Classroom has been co-designed with visiting consultants (Brown and Peterson, 2001) and constructed for technology-based, open, active, and collaborative learning. This classroom is laid out in a similar fashion to the eLearning Support Centre with clusters of computers situated in such a way as to provide eye contact. The Smart Classroom also features a video-conferencing system and a number of motorized screens for maximum flexibility in sharing information.

This article has focused on analysing the elements of the LASO model to determine which elements have been critical to the increased use of instructional technologies for advancing open learning at the University of Botswana.

Critical Success Factors for the Infusion of Instructional Technologies for Open Learning in Developing Settings

Although various factors and elements both within and external to of the LASO model contributed to the increased use of instructional technologies for open learning at the University, the following elements have emerged as the critical success factors in the initial stages the transformation process:

- Vision, leadership, and dedication
- Appreciation for the systemic nature of the infusion of instructional technologies for open learning and a commitment to work with strategic partners in related systems
- Address the complex nature of the infusion of instructional technologies

A strategic framework is indicated as important in the LASO model; however, current progress at the University of Botswana has been made in the absence of clear strategic plans and policies. It is envisaged that such a strategic framework will become critical in the future systematic rollout of instructional technologies for open learning.

A top-down strategy of the LASO model ensures that adequate rewards systems exist. Experiences at the University has supported this notion, but most progress in the technological transformation thus far has taken place without monetary rewards or time-release.

One of the bottom-up strategies in the LASO model is the stimulation of student interest. At the University this strategy has not been used to any significant degree thus far, because student access to networked computers has become a major bottleneck, hindering further implementation of instructional technologies for open learning at this time.

Vision, Leadership and Dedication

An inspiring vision for the use of new instructional technologies for open learning has proved to be critical at the University of Botswana, providing direction and inspiration to the pioneers both within the academic and support dimensions of the University.

At the University of Botswana, the work of the UBel programme links to Botswana's Vision 2016 (Presidential Task Group, 1997) goals of being an educated, productive, innovative, and informed nation as it aims to provide wider and open access while increasing the quality and relevance of tertiary education in an emerging global information society.

The vision of the University of Botswana to transform its academic processes towards an increasingly technological base has strongly influenced the strategic implementation of instructional technologies at the University. The stated vision of the University is to strive for increasing access, thereby opening up tertiary education to meet Botswana's national aims of increasing excellence in the provision of education to the nation, and in particular to use ICTs in the teaching and learning process.

The Educational Technology Unit (EduTech) that is spearheading the UBel programme has as its purpose "to spearhead the appropriate and innovative integration of educational technologies in teaching and learning processes, and to provide a technologically advanced and relevant learning environment." This vision is progressively being realised to create open learning opportunities for the more than 12,500 learners at the University.

Vision without leadership, however, is at best a fantasy, and at worse a farce. Strong leadership for the use of e-learning, however, has been provided on various levels at the University of Botswana and confirms the view of Berge and Schrum (1998) that the support of campus leaders is key to successful campus initiatives (i.e., in technology-enhanced learning and distance education). This further correlates with Drucker's (1985) assertion that a successful innovation should aim from the outset at leadership in order to be innovative enough and capable of establishing itself.

In this regard, the writer has provided direct leadership through EduTech, as champion of the use of new instructional technologies at the University of Botswana and as chair of the UBel Committee. The respective faculty representatives on the UBel Committee have further provided

leadership within their respective faculties. Dedication and committed work from within EduTech, the UBel Committee and pioneers among the academic staff are making a reality the University's vision for advancing open learning through the use of instructional technologies.

Appreciation for the Systemic Nature of the Infusion of Instructional Technologies for Open Learning and a Commitment to Work with Strategic Partners in Related Systems

Technological innovation has often been implemented as an isolated, bottom-up initiative of academic staff for efficiency or experimental purposes. In this scenario, the wider systems within tertiary education are often not considered nor affected by the innovation, which has led to isolated opportunities for open learning. Without being consulted first, senior management often may thus feel justified in disregarding the innovation.

Solely top-down attempts have likewise met with failure when the systemic nature of change and, in particular, academic involvement and ownership were not valued as critical prerequisites to sustainable technological infusion. Tillema (1995) points out that historical studies, based largely on experience in schools, show that top down efforts to achieve educational reform have failed, and suggests that they will be doomed to continued failure until they deal with the cultural and pedagogical traditions and beliefs underlying current practices and organizational arrangements.

Attempts to introduce any significant reform in an institution towards open learning will impact on most of its sub-systems. Bates (2000), for instance, contends, "...using technology to extend the campus on a global basis will affect all aspects of a university or college, but particularly administrative systems." Systems theory in general (Bertalanffy, 1968) also calls for an integrated approach to technological innovation, since a system is defined as a whole that cannot be effectively studied without studying all its part as well as the whole.

Technological change at the University of Botswana to advance open learning has confirmed the need for systemic considerations. EduTech considers integrative approaches with adjoining systems and sub-systems as imperative and is therefore partnering with such units as the Information Technology Department, the Library, and the Centre for Continuing Education, and of critical importance, with academic staff. The Information Technology Department has an important role in providing a stable, sustainable, and appropriate technological infrastructure. The Library needs to provide an increasing number of accessible electronic resources. The Centre for Continuing Education (CCE) is committed to integrating Web-based learning into their largely paper-based distance education systems. CCE will also be the main users of the video-conferencing systems. Additionally, central access to networked computers must increase from the current 200 computers to 800 in the next three years.

A sub-system currently out-of-phase in the implementation of instructional technologies at the University, is the provision of adequate access to networked computers for learners. Academic staff regularly report that students complain of their inability to obtain access to digital materials. A study is underway to determine the exact nature of the problem and to determine possible strategies to overcome this major hurdle.

Academics are deeply involved in the reform process through the UBel Committee and the eTeams that have been established in each Faculty. Two academic staff members on the UBel Committee represent each Faculty, and these staff members, as members of an eTeam, lead the

eLearning programme within their respective faculties. Through the UBel Committee, academic staff members selected the online Learning Management System. They also conducted a University-wide needs analysis and contributed to the design of the 2003 eLearning pilot programme.

The University of Botswana experience concurs with the view of Tillema (1995) who stated that engaging academics in the reform process is one of the significant management issues to address not only in educational reform, but also in education in general. It therefore seems essential to address the concerns and perceptions of academic staff in view of the need for changed attitudes and ownership by academic staff, towards the infusion of instructional technologies for open learning in higher education.

The training programme at the University of Botswana has been vital in preparing academics for this new role. Involvement in training has lead to ownership of the infusion of instructional technologies by academics. As pointed out above, EduTech has conducted more than 60 instructional technologies workshops since February 2001, attended by more than 30 percent of the 720 member academic staff at the University.

Addressing the Complex Nature of the Infusion of Instructional Technologies

The implementation of instructional technologies for open learning is a complex process. Morrison (1995) describes this process in terms of dislocations, dilemmas, and uncertainties, rather than progression from 'what is' to 'what is needed.' The process at the University has proved to be complex due to its systemic dimensions and because people are central to the transformation process (Uys, 2000; Uys 2001b; 2002; Uys, Nleya and Molelu, 2003).

The ragged contour of technological infusion as depicted in the LASO model above has also been confirmed at the University of Botswana in contrast to the smooth contours of Roger's (1995) diffusion of innovation curve. These observations correlate with the writer's findings based on a three-and-a-half year doctoral study of infusing e-learning in a developed setting at Massey University in New Zealand (Uys, 2000).

Difficulties in human relationships, lack of resources at critical stages, bureaucratic interference, change fatigue, and dealing with diverse expectations, all contributes to the complexity of implementing and using instructional technologies for open learning at the University of Botswana. Other complexities evident within the transformation process at the University include managing the relationships among UBel Committee members, providing access for learners to computers, instability of information and communication systems, lack of learner participation, resistance to change among academic staff, and extensive time delays due to administrative processes and procedures. There is also a tremendous need for basic computer literacy among both learners and academic staff.

The role of the teacher in open learning is changing (Collis, 1998). There is an emerging certainty that the role of teacher will become more that of facilitator rather than sole providers of information (Hodgson, Mann, and Snell, 1987; Mason, 1998). Academic staff members, however, exhibit strong resistance to changes in traditional beliefs and practices (Taylor, Lopez, and Quadrelli, 1996).

Learners are likewise required to assume new roles and responsibilities in the University that contrast sharply to the predominant teacher-centric delivery approaches that learners were accustomed to in secondary school. Online learning, for instance, encourages what Hodgson, Mann and Snell (1987), perceive the use of "...new technology as a vehicle for the sharing of discoveries, developments, and reference materials among an expert network of peer specialists" (p, 165). According to Mason (1998), new technologies in global education leads to information being "...no longer something to organise, transmit and memorise, but something to work with, think with, discuss, negotiate and debate with partners" (p. 157).

Summary and Conclusions

The problem that this article sought to address is whether critical success factors can be identified for the appropriate infusion of instructional technologies in the initial stages to advance open learning in higher education within developing settings.

Based on the personal analysis and reflections of the writer, this article employed a descriptive account of a two-year long case study. A more collaborative approach to the analyses could, however, have provided further insights on the infusion of instructional technologies to advance open learning at the University of Botswana.

The study has led to the identification and description of three factors that have emerged thus far as critical to successful technological transformation. The first factor consists of the need for clear vision, committed leadership, and dedicated change agents. The second factor is the need for appreciation of the systemic nature of the infusion of instructional technologies for open learning and a commitment to work with strategic partners in related systems. The third factor is the need to address the complex nature of the infusion of instructional technologies.

The multi-faceted complexities and challenges that militate against effective diffusion and adoption of instructional technologies, particularly in developing settings, necessitate contextualisation of infusion models and processes that might have proven to be effective in developed settings.

In conclusion, the author's objective in writing this article has been to share his analysis and reflection on a two year project of infusion of educational technologies at the University of Botswana with others interested in, or working in, developing settings. While developed nations have already addressed such challenges in regards to infusion technology into educational environments, for those working in higher education in developing countries, such as Botswana, this is very new and exciting territory indeed.

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Getting the Mix Right Again: An updated and theoretical rationale for interaction

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No topic raises more contentious debate among educators than the role of interaction as a crucial component of the education process. This debate is fueled by surface problems of definition and vested interests of professional educators, but is more deeply marked by epistemological assumptions relative to the role of humans and human interaction in education and learning. The seminal article by Daniel and Marquis (1979) challenged distance educators to get the mixture right between independent study and interactive learning strategies and activities. They quite rightly pointed out that these two primary forms of education have differing economic, pedagogical, and social characteristics, and that we are unlikely to find a "perfect" mix that meets all learner and institutional needs across all curricula and content. Nonetheless, hard decisions have to be made.

Even more than in 1979, the development of newer, cost effective technologies and the nearly ubiquitous (in developed countries) Net-based telecommunications system is transforming, at least, the cost and access implications of getting the mix right. Further, developments in social cognitive based learning theories are providing increased evidence of the importance of collaborative activity as a component of all forms of education – including those delivered at a distance. Finally, the context in which distance education is developed and delivered is changing in response to the capacity of the semantic Web (Berners-Lee, 1999) to support interaction, not only amongst humans, but also between and among autonomous agents and human beings.

Thus, the landscape and challenges of "getting the mix right" have not lessened in the past 25 years, and, in fact, have become even more complicated. This paper attempts to provide a theoretical rationale and guide for instructional designers and teachers interested in developing distance education systems that are both effective and efficient in meeting diverse student learning needs.

Defining and Valuing Interaction in Distance Education

Interaction has long been a defining and critical component of the educational process and context. Yet it is surprisingly difficult to find a clear and precise definition of this multifaceted concept in the education literature. In popular culture, the use of the term to describe everything from toasters to video games to holiday resorts, further confuses precise definition. I have discussed these varying definitions at greater length in an earlier document (Anderson, 2003), and so will confine discussion here to an acceptance of Wagner's (1994) definition as "reciprocal events that require at least two objects and two actions. Interactions occur when these objects and

events mutually influence one another" (p. 8). This definition departs from Daniel and Marquis's stipulation that interaction should refer "in a restrictive manner to cover only those activities where the student is in two-way contact with another person (or persons)" (Daniel and Marquis, 1988, p. 339). As was articulated by Moore (1989), and Juler (1990), and as I too will argue, interaction between students and content has long been recognized as a critical component of both campus-based and distance education.

Interaction (or its derivative term interactivity) serves a variety of functions in the educational transaction. Sims (1999) has listed these functions as allowing for learner control, facilitating program adaptation based on learner input, allowing various forms of participation and communication, and as aiding the development of meaningful learning. In addition, interactivity is fundamental to creation of the learning communities espoused by Lipman (1991), Wenger (2001), and other educational theorists who focus on the critical role of community in learning. Finally, the value of another person's perspective, usually gained through interaction, is a key learning component in constructivist learning theories (Jonassen, 1991), and in inducing mindfulness in learners (Langer, 1989).

Interaction has always been valued in education. As long ago as 1916, John Dewey referred to a form of internal interaction as the defining component of the educational process that occurs when the student transforms the inert information passed to them from another, and constructs it into knowledge with personal application and value (Dewey, 1916). Later, from a distance education perspective, Holmberg (1989) argued for the superiority of individualized interaction between student and tutor when supported by written postal correspondence or via real time telephone tutoring. Holmberg also introduced us to the idea of simulated interaction that defines the writing style appropriate for independent study models of distance education programming, which he referred to as "guided didactic interaction." Garrison and Shale (1990) defined all forms of education (including that delivered at a distance) as essentially interactions between content, students, and teachers. Laurillard (1997) constructed an ideal conversational model of learning applicable to all forms of education in which interaction between students and teachers plays the critical role. Finally, Bates (1990) argued that interactivity should be the primary criteria for selecting media for educational delivery. Thus, there is a long history of study and recognition of the critical role of interaction in supporting and even defining education.

Interaction and Education

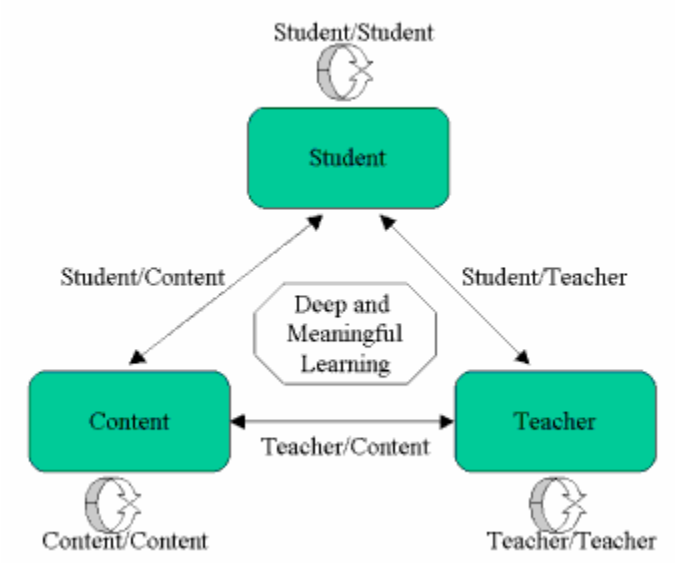
Despite the functional definitions of interaction listed above, it still remains a challenge to define when an interaction has pedagogical or educational value. Certainly not all interactions have formal educational value as illustrated by light social conversation in a pub, or the prescribed interaction between a pilot and an air-traffic controller. However, even those two examples can be the context in which informal learning by either or both parties occurs. For the purposes of this paper, I will distinguish between interaction leading to learning in any informal context and those types of interaction that occur in a formal education context. Informal interaction can, and often does, lead to learning outside of any influence of a formal education institution or accreditation process. However, interaction in formal education contexts is specifically designed to induce learning directed towards defined and shared learning objectives or outcomes. Interaction with a teacher is often an important component of a formal learning experience. However, since both formal and informal learning can result from interaction between and amongst students alone, or as result of interaction between student and content, the participation of a teacher cannot be a defining feature of an educational interaction. Further, it is obvious that there are qualitative differences in the quality and value of interaction as a contributor to learning in both formal and

informal learning contexts. To simplify the arguments presented in this paper, I have not addressed these qualitative differences, although remind the reader that all types of interaction should be assessed by their contribution to the learning process.

Modes of Interaction

Anderson and Garrison (1998) described the three more common types of interaction discussed in the distance education literature involving students (student-student; student-teacher; student-content), and extended the discussion to the other three types of interaction (teacher-teacher; teacher-content; content-content) as shown in Figure 1. In Anderson (2003), I discussed the various costs, benefits, and research questions associated with each of these modes of interaction. I also suggested that due to the increasing computational power and storage capacity of computers (Moore's Law), their increase in functionality when networked (Metcalfe's Law), and related geometric increases in a host of technical developments (Kurzweil, 1999), there is pressure and opportunity to transform student-teacher and student-student interaction into enhanced forms of student-content interaction. Further, the development of programming tools and environments will continue to make this transformation easier and, in some cases, within the technical domain of non-programming teachers and subject matter experts. However, I have not clearly articulated a theoretical basis for judging the appropriate amounts of each of the various forms of possible interaction.

Figure 1. Modes of Interaction in Distance Education from Anderson and Garrison, (1998).



Equivalency of Interaction

After years of sometimes acrimonious debate, it seems clear that there is no single medium that supports the educational experience in a manner that is superior in all ways to that supported via other media. Clark's (1994) and Kozma's (1994) classic debate, and the long list of "no significant difference" studies compiled by Russell (2000), give evidence to a complicated interaction between content, student preference and need, institutional capacity and preference,

and teaching and learning approaches to learning. Despite the high degree of rhetoric from constructivist and feminist educational theorists of the value of interaction in creating interdependence in the learning sequence (Kirkup and von Prummer, 1990; Litzinger, Carr and Marra, 1997), there is also evidence that many students deliberately choose learning programs that allow them to minimize the amount of student-teacher and student-student interaction required (May, 2003; Kramarae, 2003). Over the years, in my own distance teaching, I have been informally polling students about the relative advantage and disadvantage of various forms of mediated and face-to-face, synchronous and asynchronous, educational activities. From these polls, I conclude that there is a wide range of need and preference for different combinations of paced and un-paced, synchronous and asynchronous activity, and also a strong desire for variety and exposure to different modes and modularities of educational provision and activity.

From these observations and from the literature debate, I have developed an equivalency theorem as follows.

> *Deep and meaningful formal learning is supported as long as one of the three forms of interaction (student–teacher; student-student; student-content) is at a high level. The other two may be offered at minimal levels, or even eliminated, without degrading the educational experience.*
>
> *High levels of more than one of these three modes will likely provide a more satisfying educational experience, though these experiences may not be as cost or time effective as less interactive learning sequences.*

This theorem implies that an instructional designer can substitute one type of interaction for one of the others (at the same level) with little loss in educational effectiveness – thus the label of an equivalency theory. There are a number of other corollaries and implications based on the current post-industrial education context that can be drawn from this theorem, and I have attempted to provide a start at this process in the following lists.

Student Interaction

- Quality educational programming requires high levels of interaction by students in at least one area, and can substitute for minimal to no interaction in the other two.
- Student-teacher interaction currently has the highest perceived value amongst students, and thus commands highest market value.
- Some student-teacher interactions can be automated, and thus substituted in whole or part, through the development and use of content resources, and especially those utilizing autonomous teacher agents. This practice migrates Net based forms of student-teacher interaction (emails, conferencing discussion, etc.) to student-content interactions (teacher videos, virtual labs, personalized FAQs, etc.).
- Most forms of student-content interaction can be recorded and displayed asynchronously to substitute for student-student interaction by time or technology bound students.
- Student-student interaction is critical for learning designs based upon constructivist learning theories, but less critical to cognitive and behaviorist learning theory based approaches.

- Student-student interaction is critical for skill proficiency needed for collaborative or cooperative tasks. Thus, most effective learning to reach these goals maximizes student-student interaction.

- Student-content interaction is most accessible, and most readily adapted, via individualized "student portfolios," that can influence design, assessment, or delivery customizations (mass customization).

Teacher Interaction

- Traditional approaches to teaching of each discipline, biases teachers towards different mixes of interaction.

- Teacher-student interaction is generally the least scaleable type of interaction, and thus is usually substituted for by student-content interaction in mass education systems.

- Teacher agents can perform many of the functions that currently consume teacher time, especially those of a bookkeeping, clerical, or organizational nature, thus migrating teacher-student and teacher-content interaction to content-student and content-content interaction.

- Some teacher interaction can be transformed into learning objects (videos, animations, assessment programs etc.), thus migrating student-teacher interaction to student-content interaction.

- As professional students of their discipline, teachers, need professional development and knowledge building opportunities throughout their careers. Deep and meaningful learning to a professional, requires high levels of interaction in at least one of teacher-teacher; teacher-learner; teacher-content domains. High levels of one, allow for reductions in the other two.

- Teacher-teacher collaboration is critical to the current model of university based research production and evaluation.

Content Interaction

- Content, having only volition ascribed to it by humans, is the most flexible of actors, "willing" to undertake any combination and quantity of interaction.

- The cost and restrictions on value of content interaction is falling much faster than interaction involving the other two forms of interaction (Moore's and Metcalfe's Laws), and thus is expanding in all areas, putting a premium value and cost on human based interaction: student-student, student-teacher, and teacher-teacher.

- The semantic Web (Berners-Lee, 1998) provides an environment in which content can be formalized and manipulated, stored, searched, and computed automatically through autonomous agent technologies. Such capacity will allow development of much more useful teacher and learner agents, encouraging migration to content-based forms of interaction.

- The value of the content is dependent on the extent to which it engages students or teachers in interaction, leading to relevant knowledge construction. There is also a direct relationship between this capacity for interaction and resulting engagement, mindfulness, and motivation.

Assessing the Level of Interactivity

Differentiating between high and low levels of interactivity is largely a quantitative exercise in which a researcher, developer, or the participants themselves, count the number of times they are actively engaged with the other participants or content. There is some evidence to suggest value in "vicarious interaction," in which non-active participants gain from observing and empathizing with active participants (Sutton, 2001; Fulford and Zhang, 1993). However, high levels of interaction generally require the actors to be personally active and engaged in the interaction. Although there will be qualitative differences in the extent of individual involvement in the interaction, these differences are largely individualized and difficult to prescribe or assess across the large numbers of participants typically found in current education systems. Thus, for planning or development purposes, designers are encouraged to build into their programs strategic amounts of each type of interaction, and to develop activities that will encourage this amount of interaction.

Examples of Applying the Equivalency Theorem to Popular Education Delivery Modes

The following examples illustrate the operation of the equivalency theorem in most common forms of campus and distance delivered education systems.

Classroom Delivery

The traditional lecture mode of delivery has medium levels of student-teacher interaction, usually low levels of student-student interaction, and medium to low levels of student-content interaction. For these reasons, I am not alone in critiquing the lecture format (Garrison, 2000), and note its historical genesis in being read to from scarce content (hand-scribed books). Its value in an era of ubiquitous content is thus reduced. Recent efforts at enhancing lecture theatres through use of multimedia equipment, and especially enabling access to net resources in "smart classrooms," will increase the quality of student-content interaction, and thus the potential to increase levels of deep and meaningful learning.

Efforts at enhancing teacher-student interaction through an increase in teacher immediacy (McCrosky and Richmond, 1992), or through use of theatrical or multimedia presentation techniques, can also be expected to increase the quality of student-teacher interaction. Further efforts at enhancing student-student interaction in the classroom through case or problem based learning activities, have long been shown to increase not only student achievement, but also student completion and enjoyment rates (Slavin, 1995). In these types of activities, increased student-student interaction is substituting for student-teacher interaction.

When classroom delivery takes the form of a traditional seminar among relatively small numbers of students and a teacher, the levels of student-student and student-teacher interaction increase with generally increased levels of learning and satisfaction. Access to "smart classroom"

technologies is generally less necessary in seminars, as high levels of learning are already being achieved through high levels of student-student and student-teacher interaction.

Traditional Distance Education Delivered via Mail or Electronic Correspondence

In this mode, specially designed independent study materials are constructed with the explicit intent of providing high levels of student-content interaction. As noted, attention to the creation of a personal voice in the content, and attention to ways to create "guided didactic interaction" in the text materials, can create high levels of student-content interaction. In more recent times, independent study materials have been delivered electronically and enhanced through addition of java applets, automated testing, and quiz forms of feedback, simulations, adaptive computer assisted instruction, and other applications of "learning objects." Each of these technologies enhances student-content interaction and thus, if well designed and applied appropriately, is likely to enhance the learning experience. Student-teacher interaction is possible in independent study, but generally does not happen to a great extent with the majority of learners (Coldeway, 1991). Rather, efforts are made to create study paths that allow students to learn with minimal amounts of interaction with the teacher, other than to provide occasional formative and definite summative student assessment. Student-student interaction is also usually minimized allowing for maximum flexibility, start and finish times for courses, and capacity for students to set their own pace through the learning content. Thus, independent study provides high levels of learning by maximizing student-content interaction, and getting away with minimal amounts of student-teacher and student-student interaction.

Having stated that student-teacher interaction is generally low, there are ways in which it can be expanded in a cost effective manner. In particular, the call centre system developed at Athabasca University allows students extended access (7 days a week, 12 hours a day) to call centre staff who are equipped with frequently asked question databases, course syllabi, and a limited amount of content knowledge to answer a wide variety of student inquiries in timely fashion. Adria and Woudstra (2001) report that over 80 per cent of questions and concerns from over 11,000 registered students are handled successfully by call centre staff, thereby reducing the cost of administration related student-teacher interaction, and allowing more time for high quality academic interaction.

Audio and Video Conferencing

Audio and video conferencing provide slightly less accessible and 'leaner' interaction between and amongst teachers and students, due to the inherent technological distance between students and teachers imposed by the mediating technology. There is a further reduction in paralinguistic clues in audio teleconferencing as opposed to video conferencing, so that, in sum, there are only medium levels of student-teacher interaction. Student–content interaction is also at medium levels – if the conferences are enhanced with graphics or Net cruising capability as is supported in many of the new Internet-based conferencing systems now appearing on the market. High levels of student-student interaction are possible and, indeed, this level is the mantra of proponents of synchronous conferencing education systems (Roberts, 1998; Parker and Olgren, 1980). However, there is much anecdotal and some empirical evidence (Kirby and Boak, 1987) that teachers often use the media almost exclusively for delivery of lectures. If the conference is designed to support high levels of student-student interaction, then there is high potential for high levels of learning. I have been particularly struck by the differences in the amount and intensity of

student-student interaction, as delivery of video and audio conferencing has moved from the dedicated learning center to the home or workplace. We documented the extent of 'side-talk' – student-student interaction in the learning center that was not shared with other sites or the teacher. We found that in more than half of the time, these student-student interactions were both on track and conducive to learning (Anderson and Garrison, 1995). Now, as we progress to delivery directly to individual homes and offices, I notice a drop off of student-student interaction as the side-talk channel is reduced or eliminated, and the distractions of home life or alluring availability of Web surfing and email, increase the challenge of engaging students in student-student or student-teacher interaction.

Web-based Courses

The current stampede of educational institutions to mount and deliver "Web courses" has given rise to a large variation of models and modes of delivery. All use the Web differently, making categorization difficult. Web-based courses delivered using audio or video graphic systems such as *Centra* or *E-Luminate* share the same technical and pedagogical strengths and weaknesses of earlier video and audio-graphic systems. Canned streaming video lectures share more characteristics with the delivery classroom in which they were captured, than more radical forms of instructional design that the Web is capable of supporting. Earlier forms of computer assisted instruction are now being ported to the Web, thus reducing the inconvenience and cost of burning and distributing CDs, while retaining most of the pedagogical characteristics of their earlier instructional format.

The most common, and currently most pedagogically attractive, forms of Web delivery described in the literature are those based upon extensive use of text based computer mediated communications. In our content analysis studies of transcripts of these interactions (see papers by Anderson, Garrison, Archer, and Rourke, 1999; 2000 at: http://www.atl.ualberta.ca/cmc/), we have shown how creation of adequate levels of cognitive, social, and teaching presence are associated with high levels of deep and meaningful learning. This form of distance delivery places a premium on quality student-student interaction that is supported in a format that allows for asynchronous reflection and scholarly expression in text format. This high level of student-student interaction capacity allows for reduced student-teacher interaction, the capacity to make effective use of peer moderators (Rourke and Anderson, 2002), and facilitates students sharing and discussing student-content learning resources gathered or created by students (Collis and Moonen, 2001).

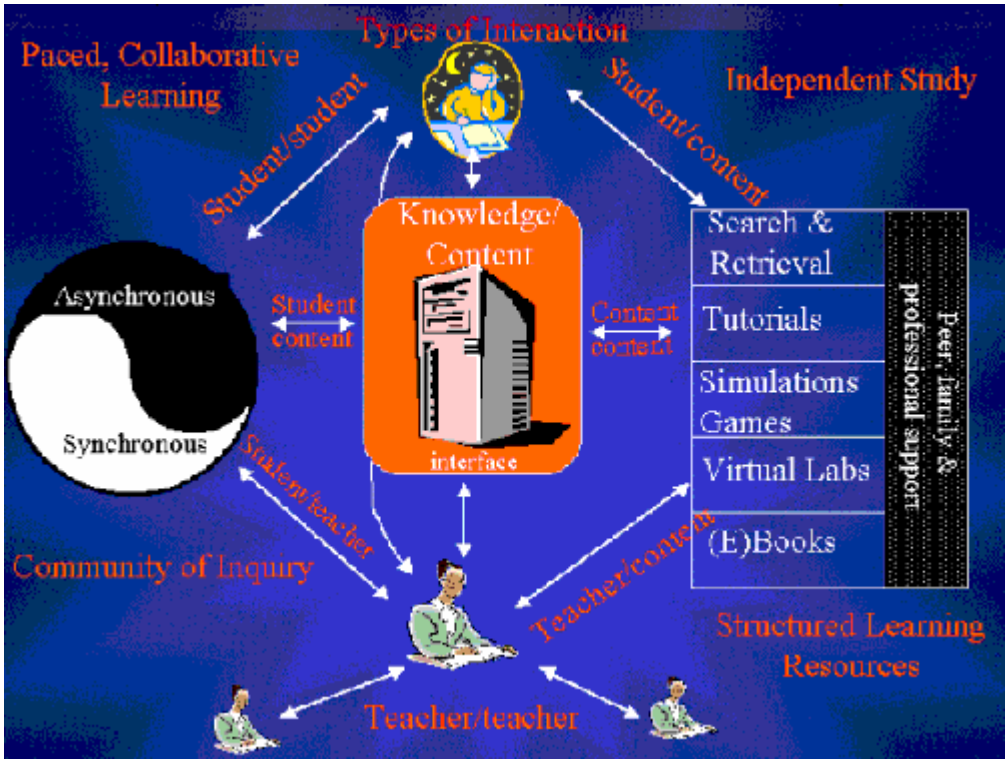
I am also impressed with the capacity of the Web to support enhanced levels of content interaction, and for autonomous agents to be created to assist both teachers and students in the educational process. For example, work by the Open Digital Markup Language defines "an extensible language and vocabulary (data dictionary) for the expression of terms and conditions over any content including permissions, constraints, obligations, conditions, and offers and agreements with rights holders"(ODRL, 2002, website at: http://www.odrl.net/). ODRL can thus be configured to allow content itself control, monitor, and manage access to it by students and teachers. An excellent example of the use of student agents is the *I-Help* system developed by Jim Greer and his colleagues at the University of Saskatchewan (Greer et al., 2001). This system allows each student to create an agent that seeks out and negotiates with other student agents for personalized assistance and help (provided by email by other students). The system selects and values previous student assistance, finds those students who are most available and most knowledgeable, and negotiates a fee for services rendered. Thus, the system is stimulating and

tracking student-student interaction, allowing less dependence on student-teacher or student-content interaction as predicted by my equivalence theorem.

An Interaction-based Model of e-Learning

This interaction theorem leads us to view education as resulting from the creation of opportunities for each of the three major actors to interact with each other. This interaction is modeled in Figure 2.

Figure 2. A Model of Online learning



The model in Figure 2 illustrates the two major human actors – learners and teachers, and their interactions with each other and with content. Learners can, of course, interact directly with content that they find in multiple formats, and especially on the Web, however many choose to have their learning sequenced, directed, and credentialed through the assistance of a teacher. This interaction can take place within a community of inquiry (left side of Figure 2) using a variety of Net-based synchronous and asynchronous (video, audio, computer conferencing, chats, or virtual world) interaction. These environments are particularly rich and encourage the development of social skills, collaborative learning, and the development of personal relationships amongst participants as components of the learning process. However, the community binds learners in time, forcing regularly sessions or at least group paced learning. Community models are also generally more expensive as they suffer from an inability to scale to large numbers of learners. For example, many proponents of computer conferencing based learning place a practical limit less than 30 students per teacher facilitated class (Turoff, 1997) . A second model of learning (on the right of Figure 2) illustrates the learning tools and activities associated with independent learning. Common tools used in this mode include computer assisted learning tutorials, drills, synthesis of content retrieved from the Net and simulations. Virtual labs in which students

complete simulations of lab experiments, and sophisticated search and retrieval tools, are also becoming common tools for learning individually. Texts in either print (and now distributed and read online) have long been used as the basis for conveying teacher interpretations and insights into knowledge in independent study. However, it should also be emphasized, that although engaged in independent study, the independent study student is not alone. Often colleagues in the workplace, peers located locally or distributed across the Net, and family, have been shown to be significant sources of support and assistance to independent study learners (Potter, 1998).

The model helps instantiate the interaction theory by showing a sample of particular technologies and learning activities that a designer or teacher selects when developing an effective course or learning sequence.

Conclusion

The equivalency theorem proposed in this paper is not as complicated nor as technically detailed as other theories relevant to distance education (e.g., Jaspers, 1991; Saba and Shearer, 1994). However, its simplicity allows it to function as an accessible heuristic for distance education delivery design. The role of theory in science, education, and particularly instructional design has been much discussed (Seels, 1997; Garrison, 2000) and is seen as multifaceted. My intent with this article has not been to generate "grand theory" that explains and predicts behavior in a system as complex as an educational interaction. Nor has it my intent to develop the type of logico-deductive theory valued in the natural sciences for their capacity to generate testable hypotheses. Rather, it has more in common with grounded theory investigation (Corbin and Strauss, 1990), in which researchers are urged to go beyond description of data to generate inferences about phenomena they encounter in order that both researchers and practitioners are better able to interpret their findings, and meaningfully and purposively change their practice.

Wilson (1997) described three functions that a good educational theory performs. First, it helps to envision new worlds. The interaction equivalency theorem illustrates our capacity to effectively substitute one form of interaction for another. Getting the mix right involves a series of tradeoffs, and knowing how one type of interaction can effectively substitute for another, provides an essential decision making skill in the distance educators' knowledge base. Second, a good theory helps us make things. As new communications technology are brought to market, they seek their place in the arsenal of available tools, propelled by often effusive praise of early adopters and salespersons with vested interests. This theory helps us to position them and make judgments as to their potential effectiveness and efficiency in program planning. Finally, Wilson argues that a good theory keeps us honest. I hope this small theoretical piece encourages dialogue within our community of practice. It challenges us to critically evaluate just how much of the educational process can be composed of interaction with non-human entities, and further, to consider how much of the human interaction should take place face-to-face or in real time. These questions are not easily answered, but such reflective discourse is critical to the growth of our discipline and individual practice. It is also apparent that this theorem is a developing work that will benefit from comments, critiques, and expansion by other researchers and distance education practitioners.

Many distance educators come to their profession with a profound commitment to humanize the distance education process through provision of effective student-teacher interaction. These educators are threatened by models of distance education that are designed to reduce cost and access, primarily by reducing or even eliminating student-teacher interaction. The theorem and model described in this paper provides examples of many types of effective distance education

programming based upon a variety of types and mixes of interaction. I am convinced that many of these alternatives should be focused on creating the most cost effective and accessible alternatives that can scale to meet the burgeoning global demand for effective and affordable life long learning opportunities. In most cases, these models will drastically reduce the amount of teacher-student interaction, and substitute it with increased student-student and student-content interaction. For many, this scenario is a frightening one, but one that is in keeping with our tradition of expanding educational access and opportunity, and thus not one we should abhor.

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Computer-Mediated Communication: A vehicle for learning

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Abstract

The axiom of humanity's basic need to communicate provides the impetus to explore the nature and quality of computer-mediated communication as a vehicle for learning in higher education. This exploratory study examined the experiential communication perceptions of online doctoral students during the infancy of their program. Eighty-five students were electronically queried through a 32 item open-ended questionnaire within a 13 day time frame. Preliminary findings supported the experience of Seagren and Watwood (1996) at the Lincoln Campus of the University of Nebraska, that "more information widens learning opportunities, but without interaction, learning is not enhanced" (p. 514). The overarching implications stress that faculty development and instructional planning are essential for the effective delivery of online courses, and even more so when collaborative learning is used. Facilitating group communication and interaction are areas beckoning attention as we continue to effectively organize the online classroom of this new millennium.

Keywords: Computer-mediated communication; online instructional pedagogy; virtual classroom; online learning; higher education; interaction; immediacy

Computer-Mediated Communication: A vehicle for learning

One much higher than ourselves indicated with the creation of the universe, that it was not good for man to live alone. Inherent in this Judeo-Christian declaration is the implication that communication is a fundamental necessity for our longitudinal survival. Reinforcing this supposition the German philosopher Karl Jaspers (1954) went so far as to advocate that, "man's supreme achievement in this world is communication from personality to personality" (p. 71). This basic need for communication begins at birth with our first exhalation of air when we exhibit an innate cry to be heard and to socially interact with those in close proximity. This belief of man's innate need for social interchange permeates the writings of such psychosocial theorists as Freud (1935), Skinner (1953), Piaget (1959), and Erikson (1963), while manifesting itself in the plethora of communication venues abounding in the new millennium.

Whereas not long ago the delivery time for Pony Express ranged from days to weeks, trans-global communication is now possible with the mere touch of a button. With the advent of the Internet, computer-mediated communication (CMC), aptly described as synchronous and asynchronous communication using text messages sent via the computer (Walther, 1992), has increased both the

breadth and depth of interconnectivity between individuals. This scenario is a far cry from communicative transactions of the past, particularly within the halls of learning.

Shortly after the beginning of time, itinerant wanderers began traveling from place to place delivering information by word of mouth to the many eager recipients they encountered along the way. Surviving the test of time, this form of knowledge dissemination was the norm for centuries; however, with the evolution of print, the potential to spread the ever-growing body of information became much more far-reaching. Later, in the mid to late 1800s and via the development of correspondence courses, venturous institutions of higher education began to expand their traditional boundaries of classroom walls (Brown and Brown, 1994; Misanchuk, 1994; U.S. Congress Office of Technology Assessment, 1989). With the initiation of radio broadcasts, the early 1930s heralded the birth of the current technological explosion, which was soon followed by the use of television and video instruction. From this proliferation of technology, computer-mediated instruction has now been catapulted to the forefront of distance education.

With the exponentially burgeoning population of eager adult learners, the knowledge explosion, and the ubiquitous nature of CMC, institutions of higher education are currently undergoing a paradigmatic shift from the more traditional face-to-face delivery mode to online course delivery. In his national study of 67 land-grant institutions in the US, Kambutu (2002), found that 81percent of administrators surveyed perceived distance education as critical to institutional survival, citing computer technology as the preferred mode of distance delivery. Concurrently, Bianco and Carr-Chellman (2002) stated that online delivery was becoming an increasingly integral and prevalent part of institutions today.

Lewis, Farris, Snow, and Levin (1999) predicted these findings in the second nationally representative survey of distance education undertaken by the US National Center for Education Statistics (*http://nces.ed.gov/*). In that report, 44 percent of all US institutions of higher education were noted as offering some form of distance education during the 1997/ 98 academic year, one-third more than two years prior. Lewis et al., further cited that “the percentage of institutions using asynchronous Internet-based technologies . . . nearly tripled, from 22 percent of institutions in 1995 to 60 percent of institutions in 1997/ 98” (p. 8). Furthermore, 82 percent reported plans to increase this usage in the subsequent three years.

These figures suggest that greater numbers of students are seeking graduate degrees, possibly due to the increased complexity of human life, in addition to the surging availability of interconnectivity made available through CMC. Where previously individuals often had to relocate their families in their quest to seek higher quality educational opportunities, they now can enter the boundary-less walls of the online classroom.

The possibilities for interaction introduced by CMC, provides a powerful environment for collaborative learning across the globe. As students enter any virtual environment, the nature of the entire communication process is transformed. Where social context clues were once vitally important, the text-based medium of CMC eliminates this variable; however, social presence (Short, Williams, and Christie, 1976) or “the degree to which a person feels ‘socially present’ in a mediated situation” (McIsaac and Gunawardena, 1996, p. 408) remains significant. Rourke, Anderson, Garrison, and Archer (1999) reinforced this need for social presence as a necessary element in what they identified as the community of inquiry. This type of environment in which instructors and learners engage in deep, meaningful learning is typical in the traditional doctoral level classroom, and Rourke et al., believed it particularly important for asynchronous text-based computer conferencing. As students become self-directed and active participants engaged in

CMC, instructors become organizers and facilitators of group communication (Berge and Collins, 1995; Harasim, 1990; Hiltz. 1994; Kaye, 1989). Thus, CMC provides a tremendous pedagogical vehicle, providing a collaborative learning environment for a community of learners. However, with alterations to the communication process, the transformation of instructional delivery is inevitable.

With a growing number of institutions using some form of CMC when entering the arena of electronic delivery systems, it becomes increasingly important to gain a better understanding of student perceptions of this learning environment (Bianco and Carr-Chellman, 2002). Because there is a close match between learner perceptions and reality, at least in Sorensen and Baylen's (2000) study with interaction in interactive television courses, there also appears to be a need to ascertain learner perceptions of the general communication climate emerging within the online community. Once cognizant of these perceptions, implications in planning for the online classroom of the future can be inferred.

This exploratory study was constructed to examine the experiential communication perceptions of students in an online doctoral level course. To guide this inquiry, the following two questions were investigated:

1. What are the learners' perceptions of the nature and quality of the computer-mediated communication that occurs within the online doctoral classroom?

2. From these communication perceptions, what are the pedagogical implications?

Methodology

Participants

Participants in this study were enrolled in Regent University's School of Leadership Studies (SLS), which has been actively involved in the delivery of a doctoral program to mid-career professionals since 1996. Espousing both professional and ethical leadership paradigms, and applications for a variety of organizational settings – business, religious, communication, education, and government – the online classroom has been the cornerstone of this multidisciplinary program. With the exception of three brief summer residencies, all courses are designed and delivered primarily using CMC or asynchronous instruction via the Internet.

At the time of this investigation, and although in its infancy, SLS had two cohorts or groups of doctoral students actively engaged in academic pursuits. The majority of the 31 learners in the first cohort were in their second full year of coursework, while the other 54 learners were concluding their first semester.

Data Collection

Voluntary participation was solicited from the entire population (n = 85) on a 32 item open-ended questionnaire. After its initial electronic distribution, two follow-up reminders were issued to reiterate the value of learner input. In addition, a total of 114 email exchanges occurred, the majority of which specifically addressed technical issues raised by participants. Following a 13-day data collection period, 28 students responded, yielding a total response rate of 33 percent.

Two interesting phenomena might account for the rate of response. Upon entry into the SLS program, it was strongly suggested that students obtain a particular word processing program to ease technological issues of document conversion. However, the sheer number of email exchanges reflecting specific technological problems revealed that some students were using alternative programs, and this may have possibly be hampering their ability to download the questionnaire, and thus affecting their ability to participate. Another important variable potentially impacting the number of responses was the timing of the survey. This was a busy time in the semester for a survey of this magnitude to be administered. Participation in an optional academic activity outside the parameters of students' course work might have been an additional stressor inducing many to choose not to engage. The strength of this investigation, a broad open-ended survey, also became its greatest weakness. The lengthy questionnaire format was utilized for the specific purpose of gathering as much descriptive data as respondents could tolerate. Even with the relatively low rate of response, based upon the demographics of the population, respondents were a fairly representative sample.

Demographics of the respondents revealed that 46 percent (n = 13) were male, and 54 percent (n = 15) female. The mean age range was between 35 and 50 (68 percent; n = 19), and of the five cognates, 46 percent reported they were in the individualized track, 29 percent in education, 18 percent in business, and 3.5 percent in religious and government respectively. Fifty four percent (n = 15) were from the first cohort, and 46 percent (n = 13) from the second.

Instrumentation

Upon review of the available instruments in the field, it was determined that no appropriate assessment measure existed to meet the specific needs of this study: to collect a broad spectrum of descriptive data concerning a spectrum of communication perceptions of online doctoral learners. Based upon the existing literature and designed to gather general descriptive information, the *Communication Perception Questionnaire (CPQ)* was comprised of 32 open-ended questions specifically targeting perceptions of both general and group online communication, while an additional four questions to ascertain respondent demographics. Although each question contained one general idea, several had multiple parts. For example, one question addressed student perceptions concerning the nature and quality of the general CMC process with SLS, with faculty, and with peers. Although this question solicited student perceptions regarding three distinct relationships, to facilitate aesthetics and to not give the appearance of increased length, the sub-questions were collapsed into one major conceptual question with multiple parts.

Face validity for the *CPQ* was based upon a review of the experiential literature on CMC and the online classroom, the needs of SLS, and the researcher's experience, while content-validity was determined by expert reviews made by members of the administration and the faculty. A sample of potential respondents was randomly selected to pilot the instrument. Upon completion, follow-up communication sought to determine potential issues or concerns in wording, format, sequence, and length. An overview of the distribution of questions for the *CPQ* may be seen in Table 1.

Table 1. *Communication Perception Survey* Question Distribution

Topic	Number of Items	Information Collected
General CMC Process	3	Importance, nature, and flow of communication
Information Exchange and Instructional Pedagogy	4	Quality, volume, overload, and gaps of information
Immediacy and Interaction	7	Importance of immediacy, nature and medium of response, response frequency, time demand comparisons, and isolation
Online Group Process	3	Perceived purpose, most important gains, greatest difficulties
Online Group Membership	4	Assignment vs. selection, group repetition, homogenous vs. heterogeneous, group size
Online Group Protocol	6	Asynchronous vs. synchronous, decision-making, conflict, leadership skills
Faculty role expectancy	3	Overall role, accessibility, and responsiveness
Learner motivation	1	Self-directedness
Program Strengths	1	Perceived programmatic strengths
Demographics	4	Gender, age, cohort, cognate,
Total	36	

The open-ended questions were grouped into the following nine categories: 1) CMC Process; 2) Information Exchange and Instructional Pedagogy; 3) Immediacy and Interaction; 4) Online Group Process; 5) Online Group Membership; 6) Online Group Protocol; 7) Role Expectancy of the Online Faculty Member; 8) Learner Motivation; and 9) Greatest Perceived Program Strengths. A systematic analysis of the responses examining key adjectives and other descriptors revealed several recurrent themes.

Results and General Conclusions

CMC Process

Questions concerning the overall importance, nature, and flow of communication in the CMC process provided a general overview of learner perceptions. Respondents' disclosure concerning these issues paralleled those mentioned in subsequent responses.

All respondents articulated the fundamental importance of communication in the online program. Specific descriptors relating to its significance repeatedly resonated with words such as: "very important," "vitally important," "absolutely vital," "essential," "crucial," and "paramount."

Concerning the nature of online communication, the virtual pioneers of this program expressed the desire to be informed of all current developments and future plans for SLS. In an effort to bridge the communication gulf created by sheer physical distance and to maintain a sense of connectedness, which some researchers consider critical (Eastmond, 1995; Kerka, 1996; Kimball, 1995), respondents expressed a desire to periodically engage in some form of real-time or synchronous activity. This appears to support Wilson's (1997) assertion that "an important element of any virtual classroom [is] synchronous activity in which students and instructors interact through live voice or video" (p. 52). Two respondents offered suggestions that could easily facilitate this need for synchronous communication. One suggested online town meetings perhaps once a semester, in which there would be a synchronous open forum where administrators and faculty would be available to share programmatic updates, and students would have an opportunity to ask questions and offer input. Another student suggested an electronic bulletin board to facilitate posting of pertinent personal information. This need for connectedness resonated throughout the responses.

Regarding communication flow, respondents in this study clearly mirrored the concerns of Hiltz (1994) and Miller (1994), in that non-respondents or lurkers are a potentially problematic occurrence. To thwart this issue, respondents suggested the need for instructors to continually encourage the participation of all.

Information Exchange and Instructional Pedagogy

Learners' responses to the quality and volume of information exchange elicited suggestions, which once again reflected their desire for connectedness and interactivity, while also acknowledging the reality of overload. In terms of information exchange within the confines of instructional pedagogy and supporting the work of Chen (1997), Kimball (1995), and Poling (1994), students collectively expressed the need for early delivery of syllabi and timely, regular, and encouraging feedback and direction from faculty.

Supporting Wilson's (1997) assertion that the goal of the virtual classroom is "to provide the distant learner with as much of the classroom experience as possible" (p. 52), this particular group of learners unswervingly expressed the need for intellectual dialog with the faculty, perhaps even on a weekly basis. A suggestion was offered that after the completion of student assignments, instructors could culminate units of study by sharing their scholarly insights and wisdom with the collective group. Another respondent described this need for a community of inquiry (Rourke et al., 1999) as "just picking the brain of the professor" much like sitting around the collegial table discussing the deeper things of life.

In addition to meaningful discussion with faculty, respondents expressed their desire to enter the intellectual dialogue with their peers, although several felt it necessary to articulate that the quality of information received varied with the individual sender. Supporting Lowry, Koneman, Osman-Jouchoux, and Wilson (1994) and Seagren and Watwood (1996), respondents praised the use of asynchronous discussion for its allowance of reflective time to stimulate deeper thought. In spite of having more time available to engage in online communication to challenge and critique the thoughts and ideas expressed by peers, many respondents confessed their hesitancy to do so.

The asynchronicity of the program, one of its perceived greatest strengths, was also identified as one of its greatest communication challenges. Often learners felt their postings to the discussions were merely a response to the instructor's weekly questions, or what one termed "a broadcasting of responses," rather than intellectual discourse with either the professor or their peers. Factors cited as influencing the quality of intellectual dialogue included: learner preparation, internal locus of control, motivation to be original, and ongoing feedback from both peers and faculty.

Although information overload is a given in any doctoral program, one student keenly described this as occurring "when one is expected to read a very prodigious amount of material and constantly be able to assimilate all the information on a deep level of analysis." This appears to be compounded in the online environment. Two predominant factors emerged as possible contributors to this issue: (1) the need for attention to detail, and (2) the sheer volume of text-based communication. In support of the work of Barnes and Greller (1994), McCandless (1997), and Miller (1994), respondents acknowledged that written message composition needed to be approached with immense care. According to Albrektson (1995) such message composition is a process in which participants, "knowing their input would be carefully scrutinized by the group, . . . think through their proposals carefully, research them fully, and argue them persuasively" (p. 105). Respondents agreed that in order to avoid confusion and ambiguity, particular attention to detail was required. Also contributing to overload, and supporting the work of Hiltz (1994), Kerka, (1996), and Kimball (1995), was the sheer volume of the text-based communication platform. Heavy amounts of reading are commonplace in a doctoral program, but the added dimension of CMC and the perceived need to respond to every message contributed significantly to this perception. Within the time constraints of the semester format and the increased time needed for online communication, it could be surmised that survival in an online doctoral program greatly depends on one's rapid adjustment to CMC.

Immediacy and Interaction

Several questions elicited learners' perceptions of communication immediacy, which included such interaction variables as the nature and medium of response, response frequency, and time demand comparisons. In addition, learners were queried as to their experience with what may appear to be the opposite of overload – isolation.

Learners predictably expressed the vital importance of immediacy, or involvement and closeness. Supporting the phenomenon of student need for social-emotional interaction (Miller, 1994; Grooms, 2000), respondents indicated their use of online communication for both social and spiritual interaction (e.g., prayer and the sharing of scriptures or devotionals of encouragement), in addition to academic and informational purposes. About half of the respondents reported exclusive use of electronic communication for all university and class-related interaction; the remainder reported using a combination of both electronic and synchronous avenues.

The frequency that respondents opened their email varied dramatically: from 2-4 times per week, to throughout the day. Average response time ranged from within a day or two, to immediately. Concerning frequency and response time, Poling (1994) offered two admonishments for instructors that are also equally applicable to students: check email several times throughout the day and always respond in some manner to each and every message received.

As previously discussed, time demands are a serious concern for most doctoral students. A little over one-third of respondents reported that online communication significantly increased the demands placed upon them in comparison to what might be expected in the traditional classroom.

Sample comments follow: “It can have adverse effects if one is not careful, such as utilizing all ones’ time.” “I always feel like I’ve left something undone, or someone unattended.” “Many tasks are lengthened because of the online nature of the course.” “Group collaboration is very challenging.”

At the other end of the interaction continuum, the literature refers to the physical separation from the institution that precipitates some degree of isolation and loneliness (Eastmond, 1995; Kerka, 1996). An overwhelming majority (86 percent) of respondents expressed the belief that their fellow learners may have experienced isolation at one time or another, while notably fewer (9 percent) candidly confessed their own personal times of loneliness. Cognizant of this potential peril, it would behoove faculty to remain mindful of designing instructional protocols to facilitate the needed communication and interaction, particularly in an asynchronous environment.

Online Group Process

It was enlightening to ascertain what students believed to be the primary purpose of online group communication, what they considered to be their most important gains, and what they perceived as their greatest online group difficulties and frustrations. In soliciting the perceived purpose of online group communication, access to the knowledge of others was repeatedly cited. The preponderance of respondents reported that their group experience broadened their individual perspectives through the sharing of information and ideas, and through posting and responding to thought-provoking questions. Once again, the need to include faculty in this community of scholars was articulated, supporting the paradigmatic shift from the traditional lecture method of higher education (e.g., sage on the stage), to the more learner-centered and learner-controlled environment with the professor acting as learning facilitator (e.g., guide on the side).

Concerning valuable gains from this virtual group communication experience, students reinforced their earlier responses regarding the general CMC process: 1) stimulation of thought; 2) openness to new perspectives and ideas; 3) continued growth in the ability to communicate without the advantage of nonverbal cues; and 4) the realization of the importance of choosing words carefully and precisely so as not to be misunderstood. Additionally, relationship building was highlighted as a valued by-product of the social and spiritual interaction occurring between individuals.

Frustrations with online groups clustered around two issues: 1) lack of responsiveness of fellow group members; and 2) problems with technology. These online difficulties echoed the problematic acknowledgements of Miller (1994) concerning the non-participation of lurkers, and the variations of technology cited by Kerka (1996).

Online Group Membership

Concerning online group membership, despite the relative inexperience of the second group at the time of this study, the responses of the two cohorts were similar. Due to their tenure in the program, the first cohort had the distinct advantage of working in a variety of groups: those assigned and those self-selected, those groups that were heterogeneous (from varied disciplines of study), and those that were homogeneous (similar disciplines), as well as groups of varying size.

Respondents noted distinct advantages to both assigned and self-selected groups. General feelings of those preferring group assignment focused more on the *negatives* of group self-selection than on the *positive* aspects of group assignment. Concern was expressed that if students self-selected

their groups, cliques were possible leaving some learners feeling "left out." Others feared polarization within the cohort, the limitation of potential experiences, or the possibility of "getting into a rut." Apprehension concerning the time required for online group self-selection was also articulated. Some asserted that homogeneous self-selection defeated the purpose of the multidisciplinary program. If groups were assigned, respondents overwhelmingly preferred heterogeneous rather than homogeneous clustering, thus creating opportunities for wider exposure to a diversity of perspectives.

On the opposite end of the spectrum, trust and mutual respect were the overarching issues of those preferring group self-selection. Because rapport building was both time-consuming and extraordinarily difficult with unresponsive peers, several expressed the view that CMC was enhanced when working with others whom they knew and were comfortable. By selecting others with either similar interests or similar motivation and skill levels, some believed that this time could be applied more advantageously to assimilate unfamiliar academic content.

Based upon the differences of longevity in the program, more group opportunities had availed themselves to the first cohort who frequently found they were working with the same individuals semester after semester. Again, "trust" was the clarion determinant for this repetition of group membership. Other results reported included: "comfort," "ease," "dependability," "mutual respect," "rapport," "convenience," "common interests," and "personality also arose."

The preferred group size was between three and five students. This size was considered manageable yet equitable in terms of workload and accountability. Learners articulated that the communication process for this size of a group resulted in less confusion, complication, and miscommunication. They also believed this to be a better size in terms of online consensus building. For those that preferred larger groups, variety was the only reason cited.

Online Group Protocol

Reinforcing earlier findings concerning immediacy, learners confirmed their use of a combination of both asynchronous (e.g., email) and synchronous (e.g., telephone and face-to face-meetings) communication for group interaction, particularly in the completion of assignments. Protocol for the completion of these group assignments varied. Some circulated documents for editorial comments, while other groups selected one compiler/ editor, and still others established synchronous times to simultaneously communicate. Once again, these learner preferences concretely reaffirmed the need for communicative interaction throughout the learning process.

Active decision-making occurred due to the nature of groups themselves, and the ongoing demand for collaborative projects. Increased opportunities for group work naturally elevated the potential for conflict. Typical issues cited as stimulants for conflict were: 1) procrastination; 2) lack of experience and expertise in effective critiquing; 3) communication difficulties which included inexperience with the medium, conversation drift, lack of responsiveness, misperceived attitudes; and 4) misunderstandings regarding assignments. Slightly more than half of the learners reported that participation in the online group process had increased their leadership skills.

Role Expectancy of the Online Faculty Member

Respondents un-hesitantly verbalized their role expectations of the online faculty member. The following 15 descriptors were offered: 1) to guide; 2) to facilitate; 3) to teach; 4) to mentor; 5) to

encourage; 6) to challenge; 7) to provide direction and timely feedback; 8) to interact; 9) to respond to students both collectively and personally; 10) to empower; 11) to moderate; 12) to monitor intellectual development; 13) to communicate clearly and explicitly; 14) to grade consistently; and to 15) help steer research and discussion.

Learners mentioned the importance of the professor to participate actively in the discussion forum, not only in asking probing questions, but interacting in that process, once again reinforcing the need for social presence in the community of inquiry (Rourke et al., 1999). Faculty accessibility and timely responsiveness were also critically important to these learners, and could easily be accommodated through virtual or electronic office hours (Bailey and Cotlar, 1994; Chen, 1997; Hiltz, 1994; Willis, 1993b).

Learner Motivation

Participants in this study declared their self-motivation, claiming to be driven by an internal locus of control, which distinctly supports the self-direction tenet of adult learning theory (Brookfield, 1986; Knowles, 1968; Knox, 1977; Tough, 1979). Other factors which appeared to inspire these learners were the challenge, the spiritual motivation and benefit, the applicability and practicality, deadlines, grades, the degree itself, feeling connected with others, feedback, thought-provoking questions, stimulating resources, and self-discovery.

Greatest Perceived Program Strengths

Respondents noted several significant programmatic strengths: the Christian foundation and its inherent moral and spiritual support; flexibility of asynchronous communication; multidisciplinary nature of the program; required on-campus summer residencies; possibilities of communication immediacy; commitment and pioneering spirit of SLS to be on the cutting edge; warmth and friendliness of the staff; appropriateness of course reading materials; and the challenge.

Conclusions and Implications

In summary, although the findings of this investigation were not surprising, they offered support to the existing literature, raised additional questions, and served to mold and shape a virtual program in its infancy. Examination of learner perceptions of CMC in the online doctoral program revealed that communication and interaction were considered vitally important. To accommodate the perceived need for connectedness, and in an effort to close the gulf of interactive differences between the traditional and online classrooms, it was suggested that this program implement periodic town meetings along with an electronic bulletin board to facilitate the exchange of information beyond the expected content-related discussion. These information-sharing forums would facilitate a feeling of “belonging,” which was considered a basic communicative need of the virtual learner. Although the program was praised for its asynchronicity, this was also considered its greatest weakness. To overcome this barrier, one might seriously consider the addition of some form of regularly scheduled synchronous communication.

The literature strongly supports the belief that faculty development and instructional planning are essential for the effective delivery of online courses, and even more so when collaborative learning is used (Barnard, 1997; Boettcher, 1997; Brown and Brown, 1994; Chen, 1997; Dennen

and Branch, 1995; Kerka, 1996; Martin and Taylor, 1997; Seagren and Watwood, 1996; Willis, 1993a; 1993b, 1994). In an effort to ride the crest of computer-mediated instruction while planning for the online classroom of the future, instructional designers must continue to recognize man's basic need for communication and make a conscious attempt to facilitate this within their instructional protocol. Although Boettcher (1997), and Martin and Taylor (1997), claimed that technology amplifies the negatives in any teaching, several preventative measures may be taken. Several suggestions for faculty communication emerged from this study:

- Facilitate the communication of all learners to promote and enhance interactivity
- Deliver syllabi early
- Provide regular, timely, stimulating, and encouraging feedback and direction
- Be cognizant and watchful for information overload
- Approach all written correspondence with extreme care and encourage learners to do the same
- Recognize that increased time is required to respond to the sheer volume of messages generated through online communication
- Become an active participant in the intellectual dialogue, leading the community of scholars
- Facilitate trust within groups
- When designing online courses of study, consider motivational issues
- Consider having virtual office hours

In this study, the recurrent theme of the importance of communication and interaction, particularly in the desire for true intellectual discourse with faculty, raises additional questions: Do learners prefer specific types of interaction? Does frequency, amount, or speed of communication and interaction come into play? Could this expression of need for high caliber scholarly dialogue, particularly with the faculty, possibly relate to the doctoral level of academic endeavor? Is this group representative of online learners from other disciplines or educational levels?

As the concept of the virtual classroom continues to be widely embraced by the global higher educational academic community, the field is ripe for scholarly research and development. While this study of two groups of online learners provided qualitative support for the current literature, experimental studies in the areas of interaction and isolation and their impact on CMC are needed.

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Appendix

Communication Perception Questionnaire

1. What is your perception of the nature and quality of the online communication between you and the SLS staff? Between you and faculty? Between you and fellow students?

2. How important do you feel online communication is between you and the SLS staff? Between you and faculty? Between you and fellow classmates?

3. Do you believe online communication flows smoothly between you and the SLS staff? Between you and faculty? Between you and fellow students?

4. Is the information that you receive from SLS meaningful, useful and in a useable form? From the faculty? From other students?

5. Do you ever experience "information overload?" If so, what do you believe attributes to this?

6. What types of information do you believe students are not receiving that you feel may be necessary?

7. Is communication immediacy (i.e., involvement and closeness) between student and faculty important to you? Between you and fellow students? How are you obtaining/maintaining this?

8. Do you perceive that any student may feel isolated? If so, to what do you attribute this? Do you personally ever experience isolation?

9. How often do you open your e-mail? How quickly do you typically respond to it?

10. What types of formal and informal communication networks do you utilize within your cohort?

11. Which communication channel (e.g., electronic, telephone, written, etc.) do you use most often when communicating with SLS staff? With the faculty? With fellow classmates? How do you feel about its effectiveness? Why?

12. In what ways do you feel online communication effects the demands placed upon your time?

13. What do you think should be the primary purposes for online group communication?

14. What have you gained most from the experience of working with groups online?

15. What have been the greatest difficulties you have experienced in working with online groups?

16. Would you prefer to choose your own group members or would you rather that they be assigned? Which do you think works best for online communication? Why?

17. Do you find yourself frequently working with the same individuals semester after semester? Why?

18. If groups were assigned, would you prefer that they were grouped heterogeneously or homogeneously in regards to your relative interests?

19. What size online group have you found to be the most ideal? Why?

20. For your SLS classes, what methods of group interaction have you found work best (e.g., telephone, e-mail, get together)?

21. What types of protocol have you used in group communication (e.g., set times to simultaneously communicate through e-mail, conference calls, chat rooms, pass around the document, have one editor/compiler)?

22. Have you found true intellectual interaction in your group communications? What do you think stimulates this? What could be done to improve this?

23. Do you ever find yourself posting an answer just to satisfy a requirement? How often?

24. What methods of decision-making have occurred in your groups?

25. Have you experienced any conflict in your online groups? What do you feel are the most common sources and nature of this conflict? How have they been resolved?

26. Do you feel that you have gained any leadership skills in your online group communication? If yes, what skills have you gained?

27. What do you feel is the primary role of the online professor?

28. How do you envision the online professor facilitating group discussion? How do you envision this occurring?

29. Do you feel that your professors are readily accessible via your choice of communication channel?

30. What motivates you as a learner? How do you feel this method of online learning/communication is meeting your learning needs?

31. Do you use the Internet to communicate with fellow students purely for class-related purposes? Do you ever use it for social and spiritual interaction with fellow classmates? Which? How often?

32. Overall, what do you see as the greatest communication *strengths* in this online program?

Demographic Information

33. Male _____ Female _____

34. Age _____

35. Cohort _____

36. Cognate _____

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Research Notes

Second Language Acquisition Theories as a Framework for Creating Distance Learning Courses

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Abstract

Moore and Kearsley (1996) maintain distance educators should provide for three types of interaction: a) learner-content; b) learner-instructor; and c) learner-learner. According to interactionist second language acquisition (SLA) theories that reflect Krashen's theory (1994) that comprehensible input is critical for second language acquisition, interaction can enhance second language acquisition and fluency. Effective output is necessary as well. We reviewed the research on distance learning for second language learners and concluded that SLA theories can, and should, be the framework that drives the development of courses for students seeking to learn languages by distance technology. This article delineates issues to consider in support of combining SLA theories and research literature as a guide in creating distance language learning courses.

Keywords: Distance learning; second language acquisition and distance learners; interactionist second language learning; ESOL and distance learning; SLA theories and creating distance-learning courses; language learning and distance technology

Second Language Acquisition Theories as a Framework for Creating Distance Learning Courses

Following the trend of distance learning courses in other domains, distance learning courses for second or foreign language learners are on the rise throughout the world, thus confirming the prediction that "distance learning will soon become the hottest education fad in decades" (Gonzalez, 1997, p. 8). Fad or not, the boom in language distance learning opportunities is evidenced by the number of search results evoked by searching Dave's ESL Cafe (www.eslcafe.com/) and other language search engine sites. Much of the appeal of distance courses stems from their ability to provide access to individuals who are motivated to learn or improve proficiency in another language, but who are geographically isolated or restricted by work, schedules, and/or other considerations.

Current thought about distance learning calls for courses to be designed in ways that follow the constructivist philosophy in which learners are seen as constructors of their own knowledge through active participation in the learning process, using computers as a problem-solving tool (Dixon-Krauss, 1996; Gavelek and Raphael, 1996; Lapp, 2000; Passerini and Granger, 2000; Willis, Stephens, and Matthew, 1996). This type of learning is based on ample interaction in the learning process that allows students to resolve cognitive quandaries through concrete experience, collaborative discourse, and reflection (Brooks and Brooks, 1993).

Moore and Kearsley (1996) maintain that distance educators should provide for three types of interaction: a) learner-content, b) learner-instructor, and c) learner-learner. According to interactionist second language acquisition (SLA) theories, two-way interaction is critical in learning a second language (Pica, 1996). Interaction must consist of "comprehensible input" (Krashen, 1985, 1994), which allows the message to be understood, as well as "output" (Swain, 1995), which provides opportunities for expression and negotiation of meaning.

When distance second language course design and practice adhere to quality distance learning pedagogy and are driven by SLA theories and research, the subsequent courses can provide learners with opportunities to acquire other languages in more flexible and accessible settings than traditional classrooms and language labs. In this article, we discuss SLA innatist and interactionist theories and research to examine the appropriateness of using Moore and Kearsley's distance learning interaction model to design lessons for second language learners. Due to the paucity of research about interaction and distance language courses, we include literature that highlights computer-assisted language learning in English as a second language (ESL) and foreign language traditional classrooms and language laboratory settings. We have taken this approach to the literature because of the potential application to distance learning practice and the possible influence it can have in defining a second language distance learning research agenda.

To better understand the issues and ramifications of language acquisition on distance learning courses, we begin this discourse by presenting an overview of major second language acquisition theories that advance the notions of comprehensible input, comprehensible output, and interaction, differentiating this term from Moore and Kearsley's usage of interaction.

SLA Theories

Theorists place different values on the role of interaction in second language acquisition (SLA). Krashen's (1985, 1994) theory became a predominant influence in both second language teaching practice and later theories. Krashen postulates that SLA is determined by the amount of comprehensible input, that is, one-way input in the second language that is both understandable and at the level just beyond the current linguistic competence of learners. Similar to Vygotsky's "zone of proximal development" (1962), Krashen's scaffolding theory is referred to as *i+1*. Viewed as an innatist perspective, this theory maintains that a second language is acquired unconsciously in a manner similar to the acquisition of a first language. According to Krashen (1996), acquiring language is predicated upon the concept of receiving messages learners can understand (1996). Teachers can make language input comprehensible through a variety of strategies, such as linguistic simplification, and the use of realia, visuals, pictures, graphic organizers, and other current ESOL strategies.

While Krashen (1994) believes that only one-way comprehensible input is required for SLA, others take an interactionist position acknowledging the role of two-way communication. Pica (1994), Long (1985), and others assert that conversational interaction facilitates SLA under

certain conditions. According to Lightbrown and Spada (1999), "When learners are given the opportunity to engage in meaningful activities they are compelled to 'negotiate for meaning,' that is, to express and clarify their intentions, thoughts, opinions, etc., in a way *which* permits them to arrive at a mutual understanding. This is especially true when the learners are working together to accomplish a particular goal . . . "(p. 122). Pica (1994) goes on to say that negotiation is defined as "modification and restructuring that occurs when learners and their interlocutors anticipate, perceive, or experience difficulties in message comprehensibility" (p.495). A variety of modifications, which may involve linguistic simplification as well as conversational modifications such as repetition, clarification, and conformation checks, may be used to gain understanding. The interaction hypothesis of Long and Robinson (as cited in Blake, 2000) suggests that when meaning is negotiated, input comprehensibility is usually increased and learners tend to focus on salient linguistic features. Cognizance of these language forms and structures is seen as beneficial to SLA.

Other interactionist theorists apply Vygotsky's socio-cultural theory of human mental processing to define the role of interaction in SLA (Lightbrown and Spada, 1999) and hypothesize that second language learners gain proficiency when they interact with more advanced speakers of the language, for example, teachers and peers. Scaffolding structures such as modeling, repetition, and linguistic simplification used by more proficient speakers are believed to provide support to learners, thus enabling them to function within their zones of proximal development (Vygotsky, 1962).

Although theorists adhering to interactionist thought consider both input to, and input from, the learner as important, output is often viewed as secondary. However, Swain (1995) in her "comprehensible output hypothesis" asserts that output is also critical and hypothesizes that it serves four primary functions in SLA: 1) enhances fluency; 2) creates awareness of language knowledge gaps; 3) provides opportunities to experiment with language forms and structures; and 4) obtains feedback from others about language use. Comprehensible output assists learners in conveying meaning while providing linguistic challenges; that is, ". . . in producing the L2 (the second, or target language), a learner will on occasion become aware of (i.e., notice) a linguistic problem (brought to his/ her attention either by external feedback or internal feedback). Noticing a problem 'pushes' the learner to modify his/ her output. In doing so, the learner may sometimes be forced into a more syntactic processing mode than might occur in comprehension" (Swain and Lapkin in Chapelle, 1997, p. 2b). From this perspective, comprehensible output plays an important role in interaction.

In summary, interactionists elaborate upon the innatist notion of comprehensible input explaining that interaction, constructed via exchanges of comprehensible input and output, has at least an enhancing effect when meaning is negotiated and support structures are used. Based on this premise, distance second language learning courses should be designed to provide interaction that includes negotiation of meaning where comprehensible output results from input.

Using SLA Theory and Research for Quality Design of Distance Language Courses

SLA theory and research can be useful in designing quality second language distance education courses when applied to the three-component model of distance learning interaction supported by Moore and Kearsley (1996). By reviewing the literature, we can determine implications for

developing distance education courses that are most appropriate for the learning of a second language.

Moore and Kearsley (1996) describe three types of interaction that they believe should be integrated in distance learning courses in general. We offer an overview of each category and make reference to complementary SLA literature that supports the interactionist SLA view. Based on their overlap, the information can be helpful in generating and establishing distance second language course practice.

Learner - Content Interaction

According to Moore and Kearsley (1996), a major role of the distance educator is to present appropriate content and to promote interaction between this content and the learner in ways that will cause the learner "to construct knowledge through a process of personally accommodating information into previously existing cognitive structures" (p. 128). Such interaction should induce the learner to develop new or modified knowledge and skills. In addition to textual materials used to present subject matter via distance learning, a wide array of options exist such as audio and video recordings, computer software, radio and television broadcasts, and interactive media such as CD-ROM and videodiscs.

Learner-content interaction cannot occur if learners do not understand the content; therefore, a critical design feature for second language learners includes comprehensible input. Creed and Koul (1993), among others, developed two models, the concurrent model and the integrated model, that make the meaning of text more accessible in materials for non-native speakers. Components of the concurrent model include attention to vocabulary selection, text form and rhetorical structure, and learner support. The integrated model calls for the use of illustrations, explications, and a variety of genres to provide motivation and increase accessibility.

Graddol (1993) points out that many language issues need to be addressed to ensure learner understanding. He counsels that the linguistic and communicative competence of learners needs to be determined, such as familiarity of particular discourses, including the media discourses of distance learning. Cultural issues pertaining to the subject matter, prior knowledge, and nonverbal language issues may also affect understanding. Diaz-Rico and Weed (2002) suggest that teachers find out about the cultural background of students. Additionally, implications of page design and visual representations should be considered in course design. Warschauer (1998) finds that the use of strategies such as re-reading the text, soliciting help, or using a dictionary aids the comprehension of text-based, computer-mediated discussions. Anderson (2002) maintains that the teaching of meta-cognitive strategies can help students develop stronger language learning skills.

Because of the limited skills of beginners to access materials in the target language, Lambert (1991) believes that distance instruction is best suited for learners with intermediate and advanced second language skills. However, Davis (as cited in Boyle, 1995) maintains that audio and videocassettes provide comprehensible input for beginners and thus may mitigate anxiety. Krashen's (1985) insistence upon a non-threatening environment to facilitate language acquisition by lowering the affective filter is yet another strategy to enhance learning for both beginners and advanced language learners. The use of multimedia may provide additional support for comprehension and also accommodate different learning styles. For example, an individual who needs more cooperative learning to interact with others, may respond better to an assignment that necessitates group communication (e.g., synchronous activities, group discussions), while a more

field independent individual might prefer an individual assignment with time to be introspective (Savard, Mitchell, Abrami, and Corso, 1995).

Software programs that have inherent learner-content interaction, such as one described by Chapelle (1997) in which the computer acts as a participant while learners construct questions about past actions to solve a crime mystery. The computer responds to moves and queries, asking for clarification when it does not "understand." Such computer-assisted language learning activities have pragmatic and linguistic objectives structured into tasks to allow second language learners to learn while doing. Distance second language course designers should plan for interaction that results in the use of targeted language objectives, allowing learners to practice new forms, functions, and structures.

Another software program described by Chapelle (1997) uses hotspots that learners click when they do not understand idioms. This technique helps make input comprehensible and may also cause learners to notice form, which is beneficial in language acquisition. This and other computer-assisted language learning practices, such as highlighting forms and signaling when errors occur, may be integrated in learning applications. Chapelle cautions that using links to provide lexical meanings does not provide appropriate interaction because it does not require comprehensible output from learners. Activities should be planned so that they provide interaction demanding comprehensible output in the form of learners attending to and modifying problematic forms.

Learner-content interaction can occur through cooperative learning activities while providing opportunities to develop linguistic and communicative competence. In Blake's study (2000), findings indicated that the cooperative learning strategy called "jigsaw" is superior to information gap, decision-making, and opinion tasks. Jigsaw activities combine learner-content interaction with learner-learner interaction.

Learner - Instructor Interaction

According to Moore and Kearsley (1996), most learners regard learner-instructor interaction in distance learning environments as essential. The instructor's role is to present content and then maintain the learners' motivation and interest, while assisting them as they interact with the content. Individualized attention is essential because it addresses the needs, motivation, and performance of each individual learner. The instructor's responses to learners' application of content are seen as especially valuable, as they provide constructive feedback concerning learners' achievement of instructional objectives.

In distance learning environments, the instructor acts as facilitator, providing guidance and support while presenting content in ways that encourage engagement. Creed and Koul (1993) recommend that the instructor help to make linguistic features and content comprehensible. Repetition, comprehension checks, and other strategies can be used in learner-instructor interactions to negotiate meaning. Even though techniques may be embedded in course design and strategies explicitly taught to learners, some learners might need additional assistance in order to increase their understanding and reduce anxiety.

In discussing asynchronous computer-mediated-interaction, Lamy and Goodfellow (1999) remind instructors that "self-sustaining threads arise in response to questions deemed worth asking by the learning community, but these questions may not necessarily coincide with those deemed worth asking by the teacher" (p. 57). Recognizing that formal learning programs require that a syllabus

be followed, Lamy and Goodfellow caution that this situation may cause the dialogue to be controlled by the teacher, which discourages learner reflection and facilitative interaction. A goal of their online course was to discuss language and learning strategies. As a result of this emphasis, findings indicated that learners engaged in what they termed reflective conversations. Although online instructors did not control the shifts in topics of the postings, they did encourage students to "talk about words," which did provide adequate control while allowing learners certain freedom. In addition, instructors interrupted on occasion to re-focus students on form, a practice that, according to Chapelle (1997), causes learners to notice form without interfering with the overall communicative goal. Because of this input, Lamy and Goodfellow believe that students viewed instructors as experts who modeled language use, which they hypothesized would encourage learners to practice these terms and phrases.

Learner - Learner Interaction

Moore and Kearsley (1996) describe learner-learner interaction in distance education as "interlearner interaction, interaction between one learner and other learners, alone or in group settings, with or without the real time presence of an instructor" (p. 131). They point out that younger learners may find this more stimulating and motivating than adult and advanced learners. Different types of learner-learner interaction should be thoughtfully planned to address goals. For example, inter-learner discussion can promote reflection about content, while group settings are appropriate for other types of collaborative projects.

Many researchers believe that computer-mediated interaction for second language learners has beneficial features (Blake, 2000; Lamy and Goodfellow, 1999; and Warschauer, 1998). Warschauer believes it is less threatening than face to face interaction and may encourage risk taking while allowing students to set their own pace. In addition, it allows learners to have access to their texts, which can be later analyzed (Lamy and Gooddfellow, 1999; Warschauer, 1998) as well as provide an equalization effect on participation. Warschauer (1998), citing his own study, found that computer-mediated interaction has greater syntactical and lexical complexity than face to face exchanges, which may be as a result of increased planning time. Citing the findings and conclusions of Pellettieri's study of interactional modifications in synchronous electronic discussion by intermediate level learners, Warschauer also infers that computer-mediated interaction is more beneficial than oral exchanges because the extended time to process and view language increases the possibility that learners will monitor and edit their speech (Krashen, 1985), resulting in interlanguage of higher quality. Blake (2000) is convinced that computer-mediated interaction is similar to face to face interaction, and is "without the temporal and spatial constraints imposed by the classroom" (p. 132).

Lamy and Goodfellow (1999) suggest that asynchronous computer-mediated-interaction may be better for encouraging meta-linguistic reflection, because it allows learners more time to think about their own and others' messages. Based on their study, Lamy and Goodfellow argue that reflective conversation ". . . that is, computer-mediated asynchronous discussion around language topics and language-learning issues" (p. 43), should be integrated in the design of distance second language courses. It is seen as beneficial because it has features that facilitate SLA, including negotiation of meaning and attention to form and strategy use.

Lamy and Goodfellow (1999) also found that for learners to be effective in asynchronous chat settings, they needed linguistic skills that enabled them to produce texts that:

> *Are well formed and unambiguous not only linguistically but also as pieces of interactive discourse . . . [and] move the topic on in a way that takes account of what precedes and creates curiosity for what might follow, that is, that contains the combination of familiarity and unpredictability typical of "contingent interaction* (p. 54).

These points made by Lamy and Goodfellow suggest that this type of activity may not be appropriate for beginning second language learners, a view supported by Lambert (1991) in referring to distance second language courses overall.

Designers of distance language learning courses should consider learner, pragmatic, and linguistic goals in planning learner-learner interaction tasks. Chapelle (1997) reminds us that the type of learner goal affects the interaction. Communicative goals focus on the construction and interpretation of linguistic meaning, while non-communicative goals focus strictly on form. Embedding language function and linguistic objectives in interaction offers learners opportunities to develop linguistic and communicative competence.

Conclusion

Based on this review of literature, SLA theory, research, and practice, an interactionist model may be applied to Moore and Kearsley's three-component distance education interaction model (1996). If these factors are considered, distance second language courses appear to hold promise for providing students with comprehensible input and output while they interact and negotiate meaning. However, this review also reveals that a need exists for more extensive research about distance second language course design.

With careful planning, instructors can design courses that encourage comprehensible input, output, interaction, and negotiation of meaning, characteristics identified by interactionist theorists as crucial for SLA. While distance second language courses may lack valuable face to face interaction, they do provide viable alternatives to learners that are geographically isolated or need flexible learning environments.

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Research Notes

Investigating Triggers in CMC Text Transcripts

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Editor's Note: Based on a paper presented at the Athabasca University Centre for Distance Education annual Distance Education Technology Symposium (DETS), Edmonton, Canada, May 2003.

Background

Computer Mediated Conferencing (CMC) provides the opportunity for interaction in distance education courses. Successful asynchronous text-based conferencing overcomes *transactional distance* (Moore, 1991), permitting student-student as well as instructor-student communication. This interaction is thought to foster the development of an on-line learning *community*.

Strategic initial messages, *triggers,* in asynchronous text conferencing can lead to rich cognitive discussions. Such initiating messages or triggers have been reported in previous literature, defined either in relation to their effects (number of actual responses received), or their intentions (the writer's evident purpose of evoking responses by being in some way provocative). In Zhu's (1996) study, a good student *starter* usually pointed to a few major discussion themes for a weekly discussion. Fahy (2001) defined "response triggers" as messages that generated large numbers of subsequent postings. *Triggers* in the *Community of Inquiry* model are defined more in the latter sense, as messages that are intended by the writer to evoke discussion, *whether or not they actually succeed in doing so* (Garrison, 2002; Garrison, Anderson, and Archer, 2000; Garrison, Anderson, and Archer, 2001). The characteristics of postings which succeed in triggering responses, as compared with those which fail to do so, was the focus of this inquiry.

Purpose

This report briefly summarizes the findings from the thesis *Trigger Analysis in Computer Mediated Conferencing* (Poscente, 2003). This study explored the frequencies and characteristics of *trigger postings* in asynchronous CMC conferences in a moderated, graduate-level, online course environment. The study focused on observing, identifying, and describing patterns in *true triggers* and *true duds.*

True triggers and *true duds* were identified by a combination of two assessments: 1) responses to the posting by other CMC participants (the number of replies received; and 2) the apparent intentions of the writer (revealed by internal evidence, such as the presence in the post of questions, new issues, or provocative statements). True triggers were defined as postings which included both internal evidence of intending to trigger interaction (by asking questions or attempting to take the discussion in a new direction), and of actually doing so (receiving 4 or more responses). True duds, on the other hand, were postings which, though apparently intended to trigger interaction (as above), failed to do so (received no responses). Once identified, *true triggers* and *true duds* were scrutinized for any *structural* or *communication patterns* that might distinguish them.

Method

The study analysed the redacted (identifying personal information removed) text transcripts of the complete CMC conferences from two Athabasca University (AU) 13-week Master's of Distance Education courses (AU 1 and AU 2), and one three-week professional training course from a non-degree granting Alberta post-secondary institution (the "non-AU" group). The non-AU course was part of a professional development program for online instructors. Conferences in the Non-AU course were three weeks in length and all were open concurrently. The moderator and students of the non-AU course had little prior experience with CMC.

The Athabasca University courses were both from the Masters of Distance Education (MDE) program, and were beyond introductory level. Conferences in the AU courses ran sequentially over the 13 week course, both AU moderators were experienced CMC facilitators, and the students had prior CMC experience. Students in both courses were mature learners, and were employed as teaching or training professionals. The average age of the Athabasca MDE students involved was 44 years (this information was not available for the non-AU group).

The *TAT* model (see below) was used to code each of the three course transcripts at the sentence level (Fahy, 2001; Fahy, 2002a; Fahy 2002b), while *cognitive presence* criteria were used to code each message as a trigger, reflection, integration, or resolution event (Garrison et al., 2000; Garrison et al., 2001). The number of responses received by each message was also recorded. *ATLAS.ti* software was used for recording, categorizing, and statistical analysis of the coding.

The "Transcript Analysis Tool" (TAT) is a means of categorizing interaction in an online conference transcript by designating each sentence as one (or, as required, more than one) of the following (Fahy, Crawford, and Ally, 2001):

1. Questions (type 1A, *vertical*; type 1B, *horizontal*)
2. Statements (type 2A, *non-referential*; type 2B, *referential*)
3. Reflections
4. Scaffolding/ engaging
5. Quotations/ citations (type 5A, *quotations* and *paraphrases*; type 5B, *citations*)

Reliability of the TAT tool was addressed by a code-recode process: each conference was coded by two individuals; coding disagreements were identified, discussed, and resolved to obtain a joint coding, which became the final TAT result. The percent agreement between *TAT* coders ranged from 75 percent to 99 percent and kappa values (Cohen, 1960) were 0.62 to 0.93. A similar code-recode process was used to test the reliability of the coding using the *cognitive*

presence model. Cognitive presence agreement between coders ranged from 84 percent and 95 percent (kappas were 0.65 and 0.72).

Results

The results of the analysis consisted of three key findings about true triggers: 1) triggers were associated with open-ended questions; 2) experience and maturity of the Community of Inquiry appeared to influence student responses to triggers; and, 3) moderator behaviour appeared in one circumstance to be mirrored by the students.

The presence of open-ended or horizontal questions (T1b) was the only TAT indicator that distinguished true triggers from other messages. Horizontal questions (T1b) occurred almost four times more often in true triggers than in other types of messages. In horizontal questions, "there may not be a correct answer of solution; thus, others are invited to help provide a plausible or alternate answer, or to help shed light on the question" (Fahy, 2002a).

There was some evidence that the frequency and occurrence of true triggers could be related to the level of CMC experience and, thus, the maturity of the online community. This observation was based on the variation in the frequency of true triggers amongst the courses. Even considering the shorter course length, the transcript of the non-AU course contained far fewer true triggers than did the AU courses. (The occurrence of true duds was rare in all courses, and there was no significant difference amongst the courses.) While the effect of experience in online interaction clearly requires further exploration, the finding that less experienced CMC users generated fewer true triggers in their postings is noteworthy.

Other differences included the nature and duration of the AU and non-AU programs. While the education levels of the students were similar, the AU courses were more academic, in that AU courses were part of a graduate program, whereas the non-AU course was a professional development program. The durations of the individual conferences were comparable, but, as noted above, the non-AU course was much shorter than the AU courses (3 weeks, versus 13 weeks).

The moderator behaviour, which may have been reflected by the students, was incidentally observed when moderator and student messages were examined separately. The AU 2 instructor was the only moderator to use citations (T5a) and quotations (T5b) in his true triggers. The AU 2 moderator's use of references (TAT type 5 sentences) coincided with a higher frequency of citations (T5b) in his students' postings. Further research is needed to determine the interaction of online moderator modelling and subsequent student behaviour.

Discussion

The nature of initial messages, which trigger cognitive discussions in CMC, was investigated with two different text analysis approaches: the TAT (at the sentence level), and the Community of Inquiry model (at the message level). This study confirmed the importance of open-ended questions for initiating discussion: asking questions that invite discussion was found in this study to result in more responses from other participants.

Open-ended questions, however, may not be the only factor contributing to triggers. Observed differences in frequency of true triggers amongst the courses suggest that the maturity of the

community may play an important role in how or whether participants respond to triggers. Students and moderators need time to familiarize themselves with the potentially intimidating text-only medium. Absence of non-verbal cues slows development of the interpersonal component of online interaction (Walther, 1996). Social presence is essential to the Community of Inquiry, but requires time to develop and mature (Anderson, Rourke, Garrison, and Archer, 2001; Archer et al., 2001; Garrison et al., 2001; Garrison et al., 2000; Garrison et al., 2001; Rourke, Anderson, Garrison, and Archer, 2001). In online communities, the interpersonal component will develop eventually, but it will take longer and require more diligence from participants. Triggers are the means by which the participants build this component of their online community.

The moderator's role in modelling appropriate behaviour may have been seen in the study, and deserves further investigation. If it can be shown that moderators are able to model the behaviour they hope to see reflected in student interaction, both cognitive and social presence objectives may be effectively promoted with CMC.

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Research Notes

Development of a Defence Learning Network for the Canadian Department of National Defence

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Introduction

The idea of an online learning network for members of the Canadian Department of National Defence (DND) has surfaced several times over the past decade and a half, but has never reached the level of development seen in the current Defence Learning Network (DLN) initiative. Past attempts at creating a learning network failed primarily because of the lack of a champion within DND's senior leadership, and the ability of traditional residential learning to meet the training and education needs of the Department. Recently, however, the rising cost of residential learning, coupled with recognition of the benefits afforded by distance learning, particularly learning flexibility and the ability of learners to engaged in requisite learning at their home base rather than at dispersed locations across Canada, have greatly enhanced the attractiveness of distance learning as a viable learning delivery option.

Once fully implemented, the DLN is expected to offer learners, wherever they reside, the opportunity to participate in much of the training and education required for military career advancement and professional development at a home base or at a location anywhere in the world that DND personnel are deployed. Learning services will be provided through a combined Learning Content Management System (LCMS)/ Learning Management System (LMS), or through a blended delivery strategy that includes face-to-face learning at a number of Learning Career Centres (LCCs) located at military installations across Canada. The final version will ensure DND personnel are afforded maximum accessibility and flexibility in meeting their learning requirements.

The Need for a Defence Learning Network

Members of the Canadian Forces (CF) are regularly deployed to the far reaches of the world for peacekeeping, humanitarian, and operational missions. In recent years, reductions to the force structure have increased the number of rotations that individual members must undertake to meet Canada's international military obligations. (Rotations of military members in and out of a theatre of operations vary, depending on the nature of the deployment. Typical deployments are six

months in duration, but prior to deployment members spend approximately three months in specific training for the task. A normal cycle, based on current military force strength, is six months in theatre followed by two years in Canada, at which point a military member is liable for deployment to a theatre once again.)

When the time spent on deployments is coupled with the need to attend professional development courses at locations often removed from CF members' home base, the time members are required to spend away from home may reach levels that can adversely affect quality of life. Although there is little DND can do to directly influence the operational requirements of Canada's defence initiatives (these are political decisions), professional development programs can be reoriented to reduce the time members spend away from home by focusing more on distance learning delivery strategies, and less on residential learning conducted at locations removed from the member's normal place of residence.

The Department of National Defence is unique in its organizational structure in that it contains two distinct yet highly integrated components: uniformed members of the Department (CF), and civilian employees who support the CF in the conduct of DND business. CF members are commanded by the Chief of the Defence Staff (CDS), while the civilian employees of the Department report to the Deputy Minister of National Defence (DMND). Although the need to improve quality of life by reducing time away from home for professional development purposes most greatly affects members of the Canadian Forces, the DLN project will also benefit civilian members of the DND through improved access to a wide spectrum of professional development programs.

Origins of the Defence Learning Network

The DLN began life as two projects: the Defence Distributed Learning System for the CF, and the Learning Career Centre Network for civilians. In April 2001, the CDS and DMND ordered the two projects to merge into the DLN. Representing the best elements of its two predecessor programs, when implemented the DLN will:

- Enhance learners' quality of life by enabling them to study at their home base and, when deployed, to continue to pursue professional and self-development opportunities
- Provide the basis for lifelong learning opportunities
- Combine a number of current activities, thereby eliminating redundancies and enabling the Department to improve training and education efficiencies
- Allow the sharing of learning with Canada's allies and external educational institutions such as universities, community colleges, industry, and professional institutions that offer courses similar to those of DND
- Provide course access to a wider community of learners than previously possible through the traditional residential model
- Provide the opportunity for courses to be offered across the entire rank spectrum, both military and civilian, without the difficulties associated with a similar residential offerings normally encountered within the military hierarchical structure

The resultant network will offer a blended solution to education and training delivery that captures the best attributes of each learning strategy.

The DLN project also represents DND's response to the Government of Canada's 1999 throne speech, which mandated Government departments to affirm themselves as "learning organizations." In the wake of this direction, a development committee composed of Deputy Ministers and Associate Deputy Ministers was formed to shape an ambitious learning agenda for the creation of a public service learning network. DND originally formed two projects for CF and civilian members of the Department; however, as previously mentioned, these two projects were merged to create one project intent on meeting the Government's 1999 direction.

DND recognizes that in today's knowledge-based society it must increasingly provide its members opportunities to expand their knowledge, not only as a means of better serving the Department's needs, but also to compete with industry as an "employer of choice," where access to learning is increasingly viewed as a benefit. Through the provision of learning opportunities, DND hopes to attract and retain the best and the brightest in a highly competitive employment marketplace.

Proof of Concept

The project team of 25 military and civilian members (many with instructional design backgrounds) recognized early in the project that they faced an enormous task in implementing complex learning network, and that they were introducing to a traditionally conservative military institution a new and somewhat radical learning concept. Rather than run the risk of failure, as experienced in previous attempts to develop a similar learning network, the team elected to conduct a "proof of concept" consisting of limited elements of the entire network.

Although the CF has been an integrated force since 1968, many traditions of the former army, navy, and air force remain. In the provision of a total force structure, each element performs a unique role, with each element catering to the needs of its members, not only to retain a sense of identity, but also to nurture team spirit and operational capability. Consequently, the DLN must appeal to three reasonably distinct cultures (four when including the civilian cadre), by ensuring the operational environments of the army, navy, and air force are considered in the establishment and delivery of a DND-wide learning network.

In addition to internal concerns related to military culture, industry experience has shown that the concepts of operations and support structure must also be validated before moving towards full implementation in large conceptual networks. History has demonstrated the risks associated with implementing a comprehensive system such as the DLN, without first applying a proof of concept, can be high. Using the proof of concept approach will allow the progressive introduction of the DLN across the DND and, through the conduct of formative evaluation under controlled conditions, determine the viability and validity of the DLN model.

The proof of concept will also be used to validate the intended governance and policy structure for the DLN. Governance will be managed from within the Assistant Deputy Minister Human Resources group. Because of specific army, navy, and air force requirements, courseware development and delivery responsibilities will remain within each of the three elements. Courses common across all CF elements will be developed and delivered by the Canadian Defence

Academy located in Kingston, Ontario. The civilian group within DND will design and deliver its own professional development programs.

Various policies affect the delivery of distance education in the CF, but the most controversial will be the policy that permits professional development distance learning to take place on company rather than personal time. Traditionally, CF members were required to conduct any distance learning outside their normal workday. Because most professional development is mandated learning that CF members must complete for advancement, quality of life considerations have forced such learning to take place during members' normal work schedule. The idea of personnel undertaking training and education by distance learning during work hours will require a cultural shift on the part of many supervisors. Policies will therefore need to be examined, and changes to the military hierarchy change will need to be managed to ensure that the acceptance of distance learning is viewed as equal to residential learning, which members normally attend away from their home base.

Learning Career Centres

The Learning Career Centre (LLC) is a product of the former civilian distance learning program, that will witness the establishment of learning centres at most military installations across Canada. There is also a proposal to develop mobile learning centres that can be deployed with major Canadian operations anywhere in the world.

The LCC is the jewel in the DLN crown. Each LCC and its subordinate network will offer one-stop shopping to DND employees for a variety of professional development services. CF members and employees will obtain information on DND and civilian courses that meet their professional aspirations, plus undertake various aspects of their distance learning. Each LCC will include a resource centre that offers print and other media products, computer workstations, meeting rooms for small group learning, and staff office space. Each LCC, which will be staffed by several learning advisory specialists, will be capable of advising DND employees or CF members on the wide array of courses and programs available for both professional and self-development.

DND is somewhat unique in that employees and CF members operate in two distinct computer environments. The more commonly used environment is the Defence Wide Area Network (DWAN), a password-protected Intranet requiring specially programmed computers for access. In recognition of the wealth of information available online that DND employees and CF members must use in the conduct of their day-to-day responsibilities, the DND has also begun providing Internet access. The difficulty, however, is that Internet-configured computers cannot access the DWAN. Consequently, civilian employees and members who participate in learning from home cannot access courses and other materials resident within the DWAN environment. The LCC offers a solution to this dilemma by hosting a number of DWAN-configured computers that learners can use to undertake courses hosted on the DWAN, or to search DND documents maintained exclusively in the DWAN domain.

The LCC structure consists of three tiers. The largest element of the LCC structure is the "hub" office, which will contain classrooms, a resource centre, private counselling rooms, a computer centre, a reception area, and support facilities. Hub offices will be located at selected military centres where there are large concentrations of military and DND civilian personnel. The next level down from hub offices are "satellite" facilities, which will be located at smaller DND

installations within the geographic area of a hub. Satellite facilities will have some features of a hub, such as a computer facility and advisory staff, but will lack such hub components as classrooms and a resource centre. At the lowest level in the LCC hierarchy will be the "kiosks," which will be located at individual units and will consist of computer workstations from which learners will be able to access course materials and distance learning instructors. For the proof of concept, six LCC sites will be established across Canada. They will be connected to a Learning Management System, hosted from Ottawa, which will connect learners to a variety of courses delivered by the various elements and civilian organizations within DND.

The Future

The DLN proof of concept began in May 2003 and will continue for 18 months (concluding, if data are sufficient, by October 2004). During that period, a variety of data on learner populations, computer usage, staff consultation, resource centre utilization, technical problems, etc., will be gathered and analyzed in order to refine the DLN system. Once the proof of concept data are analyzed and the DLN concept refined, a separate project will subsequently be funded and launched to expand the DLN into a full DND-wide distance learning service provider (sometime in 2006). By evaluating the DLN concept through a controlled proof of concept project, DND hopes to reduce the risk of costly errors that might otherwise adversely affect the future of a distance learning network across the entire Department.

For the proof of concept, the army, navy, air force, and the Canadian Defence Academy, will host a number of distance learning courses that will be accessed by learners across the Canadian Forces. The DLN project team will gather data generated by the LMS selected for the proof of concept, and by conducting online surveys of learners. Data will also be gathered from LCC, administrative, and technical staff on the functionality of the DLN concept. The resultant data will be analysed by DLN project staff, and will form the basis for documentation that will seek departmental approval for a fully funded Defence Learning Network.

The DLN has increased awareness of distance learning attributes and has helped introduce distance learning as a viable delivery strategy for professional development within DND. As DND personnel begin to recognize the possibilities of the DLN concept, in the form of well delivered distance learning programming, improved accessibility to DND courses, and improved quality of life, the bias toward residential course delivery is slowly giving way to distance learning.

Conclusion

Distance learning is not a new concept to DND. Correspondence style distance learning has existed for years, albeit to a limited degree, as compared to the multitude of residential courses offered by the Department. Previous attempts to move towards a more technically managed and delivered form of distance learning have met with limited success, principally because of an absence of champions within the Department's senior leadership, and due to the cost overruns of previously ambitious programs which moved the distance learning goal posts too far, too fast. Using a proof of concept approach to manage the risks associated with introducing a large-scale distance education offering, the DLN project promises to succeed where previous projects of a similar nature have failed. By constructing and operating a much smaller version of the full DLN, the Department will build a community of support for distance learning, better understand the

attributes and limitations of distance learning, and reduce the risk of the failure associated with previous attempts to move towards full implementation of distance education in one stroke.

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Book Review

e-Research: Methods, Strategies, and Issues

Authors: Terry Anderson and Heather Kanuka (2003). *e-Research: Methods, Strategies, and Issues*. 192 pages, soft cover. Boston, MA.: Allyn & Bacon. ISBN: 0 205 34382 1

Reviewed by: Christine von Prümmer, Senior Researcher Referat Evaluation, FernUniversität, Germany

The book *e-Research: Methods, Strategies, and Issues* is a comprehensive introduction to Net-based research, covering all steps of a research project as well as different types of research. True to its title, it also deals with important issues of e-research, focussing especially on the issue of ethics.

According to the authors, *e-Research: Methods, Strategies, and Issues* is "a guide and reference for both experienced and novice researchers" who "have an interest in expanding their research skills by using the Internet . . . " (p. xv). As an institutional researcher with 25 years' experience of distance education research, I clearly belong to the first target group, and my review of the book necessarily reflects this fact. From where I stand, the book is primarily geared to the target group of (graduate) students and beginners, setting out basic research considerations and leading the reader step-by-step through different research scenarios.

The book is organized into 14 chapters, six of which deal with specific research methodologies (Chapters 7 through 12). The authors "have structured the chapters based on a model of academic research that we commonly use with senior undergraduates, masters, or doctoral projects and/ or these" (p.xv). Looking at the book for purposes of conducting this review, I did not follow the authors' advice that, "*E-Research* need not be read sequentially; rather, your are invited to proceed directly to the section that most immediately meets your research needs" (p.xvi). If I had followed the authors' suggestion and had used *e-Research: Methods, Strategies, and Issues* as a handbook, I might not have had the feeling of repetition and redundancy, which overcame me increasingly as I progressed through the text.

Before I discuss the book's chapters, I wish to refer to the supplementary website located at *www.e-research.ca*. While I did not spend a lot of time exploring this website, I can say that it appears to be useful as it presents one-stop access to "chapter summaries and links to the sites, resources, and online papers referenced in the book" (p. xvi). It also contains an additional chapter on "Website Construction," which was omitted from the published text due to space constraints. All the links I tried worked, and I am sure I will return to this resource whenever I need additional information on any of the topics covered in the book.

Chapter 1 "Introduction" lays the groundwork by defining "research" and "e-research," and discussing the terminology to be used throughout the book. Here the authors "have settled on the use of the adjective *networked* and the noun *Net* (with a Capital) to describe this context [of networking]" (p. 13).

Chapter 2 "What is the Net?" provides information on the history and functions of the Internet, and deals with the uses of search engines and subject guides to find information, which are both useful and relevant.

Chapter 3 "Designing e-Research" rightly says that this task "will in most ways mirror the design process for non-Net-based research" (p. 29), typically including "the following:

- A research methodology paradigm
- The use of related and relevant literature
- The purpose and/ or objectives of the study
- A problem statement, research questions, or hypotheses
- An acknowledgement of limitations and a setting of delimitations
- A statement of the significance of the study. A plan for data collection and analysis
- A statement of how the study advances methods and procedures for data collection and analysis." (p. 29-30)

Chapter 4 "The Literature Review Process in e-Research" is a basic introduction to the reasons for doing a literature review, the process of doing it, and the criteria for evaluating the literature. Principles covered in this chapter are the same as that would apply to any form of research, but e-research "does provide new tools and techniques to increase both the efficiency and effectiveness of the researcher" (p. 39). As in any research process, the literature review serves to identify relevant literature and to help focus the research question. Its quality is measured against "five basic elements that academic researchers require of information sources" (p. 40), all of which are affected by the Net.

- **Accessibility:** On the Net, literature is increasingly available with less expenditure of time and effort
- **Timeliness:** There is a proliferation of official and unofficial publications on the Web, and (preliminary) findings may be posted immediately without undergoing a review process. The danger is that there may be an illusion of currency if sites are not maintained and updated
- **Readability:** On the Net, online viewing preferences can be accommodated and multimedia formats can be introduced
- **Relevance:** On the one hand, it becomes easier and faster to locate texts through search engines; but on the other, it may become more difficult and challenging to assess the veracity and relevance of the information found on the Web

- **Authority:** In order to judge the reliability of the information turned up in the literature search, researchers "must be able to authenticate" their authority. This requires "a new set of critical evaluation skills" (p. 40-43)

The authors provide suggestions to "guarantee the reliability and credibility" of information retrieved without the benefit of peer or editorial review: "Hallmarks of what is consistently considered to be valuable, credible, and high-quality information that can be used when evaluating publications found on the Net are clustered into the categories of authority, accuracy, bias and objectivity, and coverage" (p. 43). Lastly, the chapter deals with finding formal and informal literature sources, and with the issue of "plagiarism and networked sources" (p. 51).

Chapter 5 "Ethics and the e-Researcher" deals extensively with the issue of ethical concerns in academic research generally, and with the way these "concerns are becoming increasingly multifarious in our post-modern society, which is defined by complexity, multiculturalism, and media saturation" (p. 57). The authors argue that, "a number of dilemmas, issues, and problems with respect to ethics... pertain to all types of research, but they have a tendency to acquire added and more complex twists when undertaken in an electronic format" (p. 56). This is held to be especially so "when applying e-research to study behaviour that takes place on the networks" (p. 59).

The chapter sets out clearly the challenges presented by different applications and details the "standing ethical guidelines and principles" of e-research (p. 59-60). Much room is given to the question of "obtaining consent from online participants" (p. 62-68), and sample letters and consent forms are provided together with suggestions on addressing potential participants and processing their answers. Also discussed are the "public versus private dilemma" and ways of "reducing the potential to harm," followed by practical "tips for ethical e-research" (p. 68-71).

This chapter, as a whole, as well as the numerous references to ethics throughout the book, reflects more than any other, the Canadian origin of *e-Research: Methods, Strategies, and Issues.* The opening sentence "Researchers associated with academic institutions need to submit an ethics proposal prior to conducting their research" (p. 56) does not, for instance, apply to my own country, Germany. While we are also concerned with ethical research, and especially with issues of "data protection" (privacy and confidentiality), as academic researchers in Germany our research proposals are not vetted beforehand by bodies such as "institutional ethics review boards" (p. 56). To me, as a non-Canadian, the extent of this book's concern with ethics seems somewhat excessive.

Chapter 6 "Collaborative e-Research" discusses ways in which research collaboration may be enhanced through the application of Net technologies. Since many research projects involve more than one researcher or geographically distributed research teams, they can profit from – and some are only possible with – the tools for communication and cooperation provided through the Net. These tools fall into five categories: 1) communication; 2) data and document sharing; 3) application sharing; 4) project management; and 5) community management. This chapter would be particularly useful to researchers who are new to the Web, or have not yet used it for collaborative purposes. The section on "collaboration tools in action: a failed example," however, leaves me with the impression that, at least today, the benefits of using Net-based collaboration tools are largely offset by the time and effort needed to implement them, and to train and motivate all members of the research team(s) to use them effectively and continuously.

While these initial chapters deal with general research issues, Chapters 7 through 12 each deal with a specific research method. They are best seen as a research handbook or manual, consulted either for the purpose of choosing between different methodologies or for the purpose of carrying out a research project using a specific methodology. Taking each of these chapters on its own merit, they are well organized and clearly written, fully serving these purposes. Five of the chapters include sections with practical tips for doing the research under consideration. The chapters are:

Chapter 7 "Semi-Structured and Unstructured Interviews"

Chapter 8 "Focus Groups"

Chapter 9 "Net-Based Consensus Techniques"

Chapter 10 "Quantitative Data Gathering and Analysis on the Net"

Chapter 11 "Surveys"

C**hapter 12 "Content Analysis of Online Documents"**

With one exception these chapters strike me as introductory methodology texts, which are equally as valid for non-Net-based research. The fact that we are dealing with e-research is an added consideration, broadening the range of research instruments as well as confronting us with new methodological challenges. The exception, of course, is Chapter 10, which deals with the Net as the research problem as well as the research tool.

Chapter 13 "Net-Based Dissemination of e-Research Results" starts out by offering basic advice, which applies to any research, not only to e-research. The authors observe that the "dissemination phase of e-research is the climax of the research cycle, and it occurs when researchers share the results of their important research studies with the world" (p.184). This, of course, is true for any other form of research as are the reasons for publishing the results (p. 184-186), and the need for creating quality content (p. 187-188). Dissemination of results through peer-reviewed articles is not fundamentally different in the case of e-research, although considerations of the status of electronic journals may affect one's choice of publication (p. 189-193). There are some channels for publishing research results, which are unique to the Net, although not confined to e-research. Findings may be disseminated through a website, through email lists or usenet groups, or through a virtual conference.

Chapter 14 "The Future of e-Research" concludes the book "by examining features of the Net and the components that are driving significant change. Through this examination of the driving components, we hope to illuminate a future path for e-researchers that will help in the selection of the best Net-based tools and in applying them to significant issues worthy of research" (p. 202-203). Four factors are named in this context:

1. **Volume**, which refers to activity and applications as well as to geography and to languages used on the Net (p. 203-204)

2. **Velocity**, which refers to the "raw speed and throughput capacity of the Net" (p. 204)

3. **Variety**, which refers to communication and interaction formats and ways to retrieve information (p. 205)

4. **Value**, which "is directly related to quality." This in turn must overcome the present "chaotic organization of content," and is "enhanced by "the increased communications capacity of the Web," and "the capacity to disseminate results much more quickly and economically" (p. 205-207)

In conclusion, the authors are confident that "as e-researchers we have a tremendous opportunity to make a profound difference in the rapid evolution of network-enhanced research" (p. 207-208).

On balance I consider *e-Research: Methods, Strategies, and Issues* to be a well-written, easy-to-follow handbook which keeps its promise to show "students how to become active practitioners and informed consumers of Internet-based research, its tools, and its techniques. This text takes the learner through the complete research process. It is written in clear, non-technical language with educational research examples that illustrate how each component of the research process changes in a Net-enabled context" (back cover). In my opinion, the authors achieved their "goal in writing this book," namely "to share our knowledge and experiences," and provide "at least one good idea that makes your research easier, more productive, and more rewarding" (p. 208).

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Book Review

Handbook of Online Learning Innovations in Higher Education and Corporate Training

Editors: Kjell Erik Rudestam and Judith Schoenholtz-Read (2002). *Handbook of Online Learning Innovations in Higher Education and Corporate Training.* 400 pages, softcover. Sage Publications. ISBN: 0 761 92402 7

Reviewed by: Doug Shale, University of Calgary, Canada

If you take this volume at face value, based on the title, you will likely wonder, as I did, how the combination of "online learning," "innovation in higher education," and "corporate training" could coherently co-exist within a "handbook." However, the old adage about not judging a book by its cover certainly applies to this body of work. Yes, it is about online learning. It does have something to say about innovation in higher education. In part, it is also about Corporate Training. And it can, indeed, work as a handbook – there are all sorts of field tested, helpful practices described here. But in my view the whole is much, much more than the sum of these parts (for this reason I will refer to it as a "book" notwithstanding the choice of "handbook" for the title).

The organization of the book reflects the notional conceptual diversity among the themes identified in the title. There are 20 chapters organised into two parts. The first part, "Changing Philosophies and Theories of Learning," contains Chapters 1 to 5, all deemed to constitute a single section. Part 2, "Implementing Online Learning," has three sections to it. Section A, "Programs/ Environments: University," is made up of Chapters 6 to 11; Section B, "Programs/ Environments: Corporate" consists of Chapters 12 to 15; and Section C, "Courses" contains the remaining chapters, 16 to 20.

The chapter authors all seem to have some affiliation with the Fielding Graduate Institute in California and the case study material presented reflects this background. The emphasis is on graduate level education – with "students who are most likely to succeed" being described as independent active learners, accomplished, busy mid-career professional people with superior verbal and analytic skills (Barbara Brown, Chapter 17, p. 386). This is important backdrop to an essential thesis of the book – that online learning represents an educative experience different in kind from that represented by the traditional face-to-face format. When I finished reading this book, I wondered if the arguments offered and lessons drawn are more widely applicable to other kinds of learners in other educational contexts. Does this thesis still hold in higher education in

general, as the title would seem to imply? Comments by a number of the authors suggest not – which ought to prompt a new line of inquiry that would elaborate on this question.

On the basis of the organisational arrangement of the book and the titles given to these components, one would likely assume that Part 1 is theoretical and philosophical in nature, and Part 2 has to do with practical applications. To some extent this is true, but one of the striking features of these chapters, taken as a totality, is how much the theoretical/ philosophical is explicitly grounded in the authors' practical experience – and in turn how much the practical application of online learning was informed by deep, conceptual thought.

Chapter 1, entitled "Overview" illustrates the challenges of bringing these disparate themes together when they are considered to be the separate and distinct efforts that a strict, literal interpretation of them would suggest. However, the other chapters (admittedly to differing degrees) seemed to me to exhibit a remarkable convergence of thought about "online learning."

The first, and to my mind, the most important point of convergence, is that most of the chapters deal in some way with the fundamental issue of what it means to teach and learn – and not just at the superficial level of the delivery mechanisms used to bridge spatial and temporal separation of students and teacher. From that point of view, this book has much to say to anyone associated with education regardless of whether it is classical face-to-face teaching or whether delivered through some mediating technology. Chapter 13 in particular (by David Smith, entitled, "Real-World Learning in the Virtual Classroom") offers a useful, succinct characterization of the educational process. A defining condition in this characterization is the social process required to transform private, personal knowledge into knowledge that is publicly understood and acknowledged. Much of what is presented in the various chapters has to do with what that social process needs to be in an online environment – but again, the lesson of what this is extends far beyond the context of online education and there is lots of thoughtful material here for anyone interested in education in general.

This book has also helped me better understand a number of other issues that seem to me to have been only weakly argued elsewhere. For one, I could never really apprehend claims made that because online communication is a more egalitarian mode of communication it would lead to more effective learning. Nor have I found a convincing account of what the nature of the interaction among learners and teachers should be, and how that would support a more efficacious educational experience. However, it seems to me that the theory and practices described in this book do provide a substantive basis for clarifying these issues.

A related matter that has always puzzled me is why electronic communication should make any difference to the amount and kind of learner participation – and how that would relate to a more effective learning experience. Before I read this book, I was of the view that claims about computer-based telecommunications technology in education were largely cyber-hype, full of presumptive assertions about how technology will transform this, that and whatever. Now that I have read the case made by many of the book's contributors, I am more inclined to wonder whether online technology (appropriately used) might actually result in a fundamentally different kind of educational experience. See, for example, Barbara Brown's beguiling statement that: "There is a type of intimacy achievable between teachers and students in this medium that is quite extraordinary, reminiscent of what Sproull and Kiesler, (1995) refer to as 'second-level' social effects of the technology" (Chapter 17, p. 384).

In a different vein, although I have read a number of accounts of the ethical implications of distance education, and online education in particular, these seemed to me to be so general and superficial that they are hardly noteworthy. However, a number of the chapters in Part I of the book present convincing points of view that there are particular (and peculiar) characteristics of online learning that require concerted attention. There are, of course, the obvious legalistic considerations (such as constraints on the circulation of email correspondence meant for one audience and a particular purpose to other audiences for purposes beyond those intended by the author). But, in addition, there are the less obvious considerations of the ethics involved in inter-personal communication online and how those considerations can affect the quality of the educational experience of the participants. For one interesting elaboration of this point, see Chapter 5 by Dorothy Agger-Gupta and what she has to say about "logical malleability" and the invisibility of the rules of logic and values in what appears on a computer screen. Interestingly, one could make an analogous point in relation to conventional materials-based distance education and face-to-face teaching.

This book has also reminded me how the timeworn distinction between "training" and "education" can be a counter-productive dichotomy – at least at the level of professional education described in the book. In particular, Chapter 14, by LaRue and Sobol, summarise how practice can inform and modify theory, resulting in the creation of new knowledge – a characteristic usually appropriated solely for the world of canonical theory. However, canonical theory, without reference to some grounding in the real world of application, can be woefully sterile and often absurd (history is full of examples of ugly facts destroying elegant theories). This book, itself, provides occasional illustration of how carried away one can get with unconstrained theorizing – and a few of the chapters are too full of hortatory accounts of how computer-based telecommunications technologies will transform the educational world as we know it. However, the tone and substance of most of these chapters change noticeably as the authors anchor their reflections with reference to what they and their students have actually done in the online experience.

This is not the kind of book to be skimmed in a sitting or two – nor will you want to. It needs and deserves a studied reading. Buy it. You will find it a valuable, interesting addition to your reference collection.

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Book Review

Distance Education in Transition: New trends and challenges

Author: Otto Peters (2002). *Distance Education in Transition: New trends and challenges.* Oldenburg: Bibliotheks- und Informationssytem der Universität Oldenburg. 300 pages, softcover. (Studien und Berichte der Arbeitsstelle Fernstudienforschung der Carl von Ossietzky Universität Oldenburg, Band 5). ISBN: 3 8142 0813 7

Reviewed by: Keith Harry,Council for Education in the Commonwealth, UK

I was delighted to be offered the chance to review this book because, although Professor Peters published *Learning and Teaching in Distance Education: Pedagogical analyses and interpretations in an international perspective,* in 1998, I hoped that this new volume would provide a new and different perspective on the most recent developments in distance education and in the role which Professor Peters has played in them. The subtitle of the new book, "New Trends and Challenges" seemed to justify my sense of anticipation. And to some extent the book does live up to expectations; it draws upon first-hand experience of the author as an online tutor who is clearly excited by the potential benefits of new technology for the teacher and, most importantly the learner.

A quick glance at the contents page reveals, however, that the book cannot entirely live up to the promise of its subtitle. This is not a newly written volume, but a collection of addresses and papers that have all been previously delivered or published. Disappointingly, the first chapter, "Growing Importance of Distance Education in the World," which charts the history of distance education from its beginnings up to the advent of new communications technologies and the Web, is based on a keynote speech from 1997. Some additional new facts and figures have been introduced, but the changes are not sufficient to give the air of freshness and authoritativeness which the introductory chapter deserves and which Professor Peters is uniquely well qualified to deliver. The enthusiasm and broadness of vision however, which are demonstrated in many other chapters of the book, go a long way towards compensating for this initial deficiency.

When I first met Otto Peters in the late '70s, he was the founding Rector of the FernUniversität in Western Germany and was already well known for his writings and reflections on distance education. In 1978, he became a member of the Steering Committee for an International Institute for Distance Learning, which was set up by the late Lord Perry. Although the concept of such a training institute was widely acclaimed, it proved impossible to obtain the major funding necessary to start it up. The fifteen or so members of the Steering Committee, all heads of

existing distance teaching institutions, agreed to use the relatively small sums which each institution had contributed to the Committee to fund an information service to be provided by the small documentation centre, which I had recently set up as part of the Open University Centre for Cooperation and Services in the UK.

Professor Peters was a strong supporter of the service that eventually became the International Centre for Distance Learning, but which at the time of writing has sadly fallen into sharp decline. At the end of his term as Rector, Professor Peters returned to the mainstream of distance education in the FernUniversität, and has become heavily involved in the application of new technologies. The book strongly reflects the breadth and depth of this experience, together with his enthusiasm for the potential of information and computer technologies.

I do not intend to attempt an exposition of Professor Peters' social theory. This has already been ably done by Greville Rumble in his review of the book and of Börje Holmberg's 2001 volume *"Distance Education in Essence: An Overview of Theory and Practice in the Early Twenty-First Century*. The importance which Professor Peters attaches to online learning dominates the book, as is apparent from the titles of Chapters 4 to 9 respectively; "Online Learning: Visions, Hopes, Expectations," "Digitised Learning Environments: New Possibilities and Opportunities," "New Learning Spaces," "A Pedagogical Model FOR Using Virtual Learning Spaces," "Moderating a Virtual Seminar – Reflections on First Practical Experiences, "and "The Pedagogical Flexibility of the Virtual University."

The emergence of what Professor Peters sees as "new learning spaces" made possible by means of new technology, is perceived by him as of major significance to teaching at a distance and to autonomous learning. In his final chapter, "The Transformation of the University into an Institution of Independent Learning," he applies his perceptions to the university of the future. What the book does not do, and does not pretend to do, is address some of the problems associated with the new technologies, most notably the question of access by developing countries. This is a pity, since it is clear even from the account on the back cover of the book that Professor Peters can draw upon experience of working in South America and Asia as well as within Europe. There are also one or two minor quibbles about the book; the editors, for example, have failed to pick up misspellings of the names of three of the distance teaching universities mentioned on pages 17 – 18. This does not detract from the fact that this is a most useful contribution to the literature, and a valuable addition to a new developing series.

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Book Review

Action Learning: Images and pathways

Author: Robert L. Dilworth and Verna J. Willis (2003). *Action Learning: Images and pathways.* Malabar, FL.: Kreiger. 213 pages, hardcover. ISBN: 1 5752 4203 6

Reviewer: Patrick J. Fahy, Associate Professor, Athabasca University - Canada's Open University.

Action learning, as defined in this book, is "a process of reflecting on one's work and beliefs in the supportive/ confrontational environment of one's peers for the purpose of gaining new insights and resolving real business and community problems in real time" (p. 11). The claims made for action learning are impressive. Action learning:

- Allows participants (who work in groups called *sets*) to answer the question, "What is an honest man, and what do I need to do to become one?" (p. viii).
- Is more than learning by doing, action learning "has the potential for putting control of lifelong learning directly in the hands of learners, in ways that alter their perceptions, amplify self-efficacy, and re-connect these individuals to spontaneous curiosity and confidence in the exercise of their own good judgment" (p. xi).
- Is a "sleeping giant in the catalogue of individual and organizational change strategies" (p. xi).
- Is believed to address the five most important needs facing organizations today: 1) problem-solving; 2) organizational learning; 3) leadership development; 4) professional growth; and 5) career development (p. xiii).

Action learning is the product of half a century of development (p. xi), beginning with the work of Reginald Revans, the "Father of Action Learning" (p. 1). Revans' work with action learning in the 1970s and 1980s focused on its corporate and managerial applications, perhaps an example of what the book refers to as the "almost exclusive attention to the business sector" (p. xv) in previous publications. For that reason, this book has "several additional audiences in mind" in its approach, including higher education and training.

The first (and longest) chapter discusses the nature of action learning, placing it within the *andragogical* philosophy of adult learning. (An interesting question, not addressed by the writers, is whether action learning is applicable to pedagogy. Knowles [1978] maintained that andragogical principles were applicable to children who were capable and desirous of self-direction, and a teaching approach based on action learning's fundamental elements of

empowerment, focus on real-world questions, and collaboration in addressing them, certainly sounds as if it could be applied to education at all levels, in some form.)

In chapter 1, the basic systems used in action learning are summarized. *System Alpha* begins the process of seeking novel solutions by thoroughly exploring and describing the nature of the problem at hand (p. 189-190). At this step the questions asked include: What is happening? What should be happening? What needs to be done to make it happen? (p. 16). This phase is "definitional" (p. 157), providing the initial picture frame for addressing and solving the problem at hand (p. 185).

System Beta is "science-in-progress," (p. 55) a phase of "discovery" (p. 157) that elaborates on what was identified in system alpha (p. 190). This is the "scientific method" portion of the process and, like basic science, can include "intelligent trial and error" (p. 190), including fact-gathering (field research), surveys, observations, experimentation, assumption-testing, and evaluation. "System Beta uses whatever is revealed to pursue new avenues of inquiry that might yield a better solution" (p. 190).

System Gamma is the critical reflection stage (p. 55) and is embedded in all action learning processes (p. 190). Reflection is more than evaluation, examining "the changing self in the midst of the changing situation" (p. 157), and is critical in action learning. The reflective process focuses on realities and value systems of participants (journal keeping is recommended to assist reflection; p. 53), since these "guide what people say and do" (p. 190). In System Gamma, the learning process of the action learning participant and the client organization should undergo symbiotic change (p. 185) – the client and the consultant consider together what has been learned, and arrive at an understanding of what must be done.

Although they believe the applicability of action learning has "no known limitations" . . . whatever the recalcitrant problem" (p. 53), the authors concede that it has not made major inroads in higher education (p. 128). Resistance comes from several sources, including the historical autonomy of adult educators (p. 129), the stresses and demands that action learning can impose on participants (p. 131), and the culture of higher education with the dominance of formal curricula and directive, structured teaching methods (p. 133).

Despite the barriers, there is real potential in action learning. The focus on real problems, emphasis on reflection, reliance on collaboration, and importance of dialogue, are all potentially core purposes and values of higher education and skill training. Where do the problems lie in promoting wider adoption (or at least consideration) of action learning in post-secondary teaching?

Uncertainty over the role of the instructor and the definition of curriculum, and the administrative problems of a teaching model which relies heavily on real-world experiences (i.e., outside academe), must be addressed. The authors note that while the action learning process requires coaching, it cannot be scripted and must be egalitarian (p. 31). Coaches do not direct action learning sets so much as they make themselves available as requested by the group. Instructors accustomed to active teaching will not be comfortable in a role where their involvement could be constrained, or if their involvement is deemed to be "interruptive" by their students (the set), they could be asked to leave altogether (p. 25).

Curriculum is also viewed differently from what post-secondary instructors are used to. In action learning, it is considered divisible (p. 38 ff.), eclectic (p. 31), and cross-disciplinary (p. 10). In the

model, there are two types of knowledge and, by extension, two types of curriculum: "P" – programmed, previously learned and based on prior experience (p. 189); and "Q" – questioning insights, the important starting points of action learning (p. 12). All knowledge is important in action learning, but the most important is that which arises from the interaction of motivated minds engaged in real problem-solving activities rather than pre-packaged units of instruction assembled by the professor. Action learning is a product of collaboratively "tackling problems to which there is no right answer" (p. 11), not of "the solving of puzzles, evaluation of case studies, lecture-driven classroom instruction, or simulations . . . "(p. 10).

To engage in action learning, the authors advise that students be given opportunities to find and engage with real problems. Action learning students typically work in organizations in which serious efforts are being made to address actual, challenging problems. This environment is seldom found in the classroom, forcing action learning instructors to find relevant activities outside the ivory tower. Institutions must be linked to environments where useful action learning experiences can be found, and provide access to these for their students. The pressures on instructors, departments, and institutions as a whole can be imagined.

If these problems could be solved, would action learning be for everyone? To date, action learning has primarily been a corporate tool, a means for allowing knowledgeable employees to share their knowledge and experience with each other, and from such pooling to produce creative problem solving. As the authors acknowledge early on, the focus of action learning is on helping *managers* to address corporate issues. The authors claim that action learning, by its nature, is "an organizational change strategy" (p. 73), which requires top management involvement and support. The early successes of action learning were in addressing issues in companies such as General Electric, where knowledgeable employees were permitted by enlightened management to work with each other on internal problems, with which at least some of the participants were already aware.

Action learning really is not so much a method of teaching as it is a method of empowering experienced employees (and others, such as customers, even competitors) to apply their knowledge directly to problems, thereby solving them, improving morale, and increasing the company's efficiency. The five needs of organizations, listed earlier, are principally the needs of corporations facing global competition, rather than of educational institutions.

This is not to say that action learning has no application in post-secondary or higher education. In fact, the authors report using action learning in "capstone" courses, which take students outside the usual lecture-seminar process and "thrust[s] them into the heart of organizational crises" (p. xv). As they encounter real problems, learn from and with each other, help set the agenda, and, most importantly, experience the trust and mutual support typical of the classroom (p. 6), participants are able to practice the tenets of action learning andragogically. Not surprisingly, the authors report that the experience of action learning under these circumstances is highly motivating and deeply affecting. In exploring unfamiliar problems collaboratively, students ask fresh questions. Rather than formulas or prescriptions, the process teaches students to focus on the problem at hand and what is happening (p. 6).

Thus, action learning is similar to problem-based learning and other forms of teaching that enable learning to become more authentic, less prescriptive, and more capable of stimulating and incorporating the learners' creativity through collaboration (Bridges, 1992). What action learning potentially adds to a graduate experience is depth, but it may also create learning conditions too narrow for some students' needs. Not everyone who enters graduate programs has in his or her

existing background the knowledge and experience to address real-world problems, even in collaboration with other highly motivated people. When new inventions (solutions) are needed, enthusiasm and energy are not a replacement for information, skills, and experience. As the authors admit, the result may resemble the blind who take turns leading each other (p. 173). "P" must be present in problem-solving, since without it "Q" has nothing to process in the equation L(earning) = P + Q.

Of the book's eight chapters, the last four deal with how action learning might be adopted or promoted in various contexts. These chapters are useful for those who have concluded that action learning is for them, and now want to adopt it in their own organization. Managers and administrators, who are convinced they have "intractable problems" that their own resources could address, will find these chapters a thorough guide to launching action learning strategies.

Those who still wonder whether they need what action learning offers will need to read these chapters carefully, however. Depending upon the type of training offered, the following facts about and characteristics of action learning may be pertinent to readers considering how action learning might impact their work, students, and institutions:

- The greatest challenge in action learning is striking a balance between action and reflection (p. 21)
- In employee groups, results can include "an opening of communication channels, a deepening of employee networks cross-functionally, and better employee understanding of overall programs and vision" (p. 31)
- Sets are often asked to address problems of which some of the members have little or no knowledge or experience (p. 15)
- Learning in sets can be personally highly *transformational* (p. 27)
- Conflicts with human resources development, especially if action learning goes beyond narrow, traditional training objectives, can be expected (p. 28)
- In adopting action learning, a commitment to large-scale change seems to be necessary (p. 62)
- Climate and culture within the adopting organization must be identified, distinguished, and respected (p. 106), especially in the critical transition from planning to implementation of change

It seems to me that action learning, as part of capstone programs providing real-world apprenticeship or internship opportunities, is potentially of great value in higher education in exactly the way the authors are using it now. In this context, terms such as *transformative learning* are not unfamiliar, nor is it unusual for participants to have little direct, applicable experience prior to involvement. The environment in such situations is educative and supportive, and the curriculum (the term is from the Latin for "race course," surely descriptive of the experience of coursework of many graduate students) is seen to be more flexible and adaptable. In internships and apprenticeships, novices ideally encounter a range of supervisors, colleagues, and customers they will encounter in their careers, including those who care, those who can, and those who know (p. 68). In practical training, the objective is to *do*, and thence to learn, balancing action and reflection/ evaluation. These are the priorities in action learning (p. 21).

The case for action learning made by Dilworth and Willis is intriguing, but somehow unconvincing. As I read on, I felt I should be able to see more uses in my own distance teaching of master's students for what has obviously been a powerful, life-changing experience for the authors' and their students and clients. I must admit, I was surprised that the authors were surprised to find reports of effective teaching and learning among students and instructors who interact 100 percent online (p. 49), as I do with my students. That may be one problem for me: action learning assumes environments in which people interact face-to-face, and problems often relate to interpersonal issues, management rigidity, lack of vision, or other aspects of organizational culture (p. 61 ff.). In such circumstances, task achievement can be affected in curious ways by existing relationships and varying/ competing social agendas (Walther, 1996). The authors comment that the social dynamics of virtual teams is an area which needs further investigation (p. 141). Those of us working in this way already, and accustomed to the power of distance relationships supported by powerful communications technologies, may be able to help.

This book is a succinct (191 pages, including a useful glossary) description of action learning, and a starter's manual for anyone interested in implementing its elements. The tone is promotional, even worshipful – these are believers. Whether the book will motivate higher-education practitioners to become more involved with action learning is another question. I am still wondering how, at a distance, I could do so. I haven't decided I *can't*, but I am still wondering exactly how.

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Book Review

Handbook of Distance Education

Editors: and William G. Anderson (2003). *Handbook of Distance Education.* 872 pages, hardcover. Mahwah, NJ.: Lawrence Erlbaum. ISBN: 0 8058 3924 0

Reviewed by: Bob Spencer, Athabasca University – Canada's Open University

It is important to note that this book is not a book of "best practices" of distance education, nor is it a manual or a practitioner's guide to distance education. The use of "handbook" in the title is more congruent with that of a treatise. That is, a "literary composition dealing more or less formally and methodically with a definite subject" (The Concise Oxford Dictionary, 1976).

The "Handbook for Distance Education" begins with a four- page preface followed by an eleven - page overview, both written by Dr. Michael Moore. The book is then divided into seven sections, each section containing several chapters (55 in total). Each chapter is written by a well known (previously published in *The American Journal of Distance Education*) author or collection of authors. The title of each section and the number of chapters found in each section is shown below:

1. Historical and Conceptual Foundations (9 chapters)
2. Learning and Learners (9 chapters)
3. Design and Instruction (9 chapters)
4. Policies, Administration, and Management (11 chapters)
5. Different Audiences in Distance Education (8 chapters)
6. Economics of Distance Education (3 chapters)
7. International Perspectives (6 chapters)

In the "Preface," Dr. Moore states: "The aim of the book is to provide a broad and exhaustive review of the research on such topic as the best way to practice distance education at the teacher level and the administrative level, the public policy implications of shifting a greater proportion of educational resources to this method, and the implications of the expansion of distance education for the theory of education and the practice of educational research" (p. x).

For Moore, the purpose of this book is to, "open up the imagination of the readers" to ways of addressing the various aspects of education and educational systems that need to change as a result of changing the focus of learning from "where the teacher is to where the learner is" (p. ix).

For me, the most important aspect of the book is that it serves an important need. This need is what motivated Dr. Moore to undertake the huge task of putting this edited book of readings together. That is, the book is "a key for knowing what is known before" (p. xi). The book is an important reference and source of information for students, researchers, and practitioners to use before engaging in research or designing and implementing courses and programs to be delivered by distance education. Far too often one attends a conference session or is asked to review an article for publication, where the presenter/ author is not aware of the literature that pertains to their subject. That is, some researchers are conducting studies without the full knowledge of what research has been previously undertaken, and practitioners are developing and delivering courses and programs without first reviewing previous practice (for example, what works and what doesn't work and why). While this may appear to be stating the obvious, this practice happens far too often, and hopefully this book will help distance educators build new knowledge, learn from our past mistakes, and improve our future practice. The book is consistent with Moore's continual plea for more attention to building a solid theoretical foundation for research and practice.

The book is far too long to provide a review of each chapter or even a review of the seven sections. Dr. Moore provides an excellent summary of each section in his "Overview." The format that each of the chapter author(s) were asked to follow is worthy of noting however, to give one a sense of what one can expect from this book. The authors were asked to adopt a bibliographic essay style of writing. Each author was asked to address the following three questions:

1. "What is the current state of your special research area in contemporary distance education in America?"

2. "What knowledge about this is based on empirical research evidence?"

3. "What further research is needed in light of the changes that are occurring" (p. xiv)?

I believe each author met the challenge and as a result, the book is a valuable contribution and resource for the field of distance education. The book has something for everybody. I certainly have my favorite chapters (yes, I did read the entire book!), but there were chapters that I did not particularly care for. However, I must say that as a result of reading this book, I did improve my understanding of the research and scholarship in the field of distance education. Several articles in the section on future research needs did, indeed, stimulate my thinking and gave me several ideas for future research for both myself and my students, as well as provided me with questions to address at a program and institutional level in my current practice. In addition, the reference sections at the end of each chapter are excellent and make the book a "must have."

But I do have some criticisms of the book and they are three fold. First, I did not find the book "reader friendly." The font size was too small and the contrast between the typeface and the somewhat glossy paper was too hard on my eyes. I also found the right-justified margins, given the above, made it difficult reading. I understand that many of these decisions were likely economic; however, they did effect my level of reading enjoyment. Second, the cost of the book is too high. Currently the book is being offered at a special price. The special price is reasonable and affordable, especially if one wants to include the book in one's graduate program curriculum

or as a personal desk copy. However, the special price is only available to those residing in the United States. If one resides outside the US, one must order the book through a foreign distributor and they do not offer the special price. For example, since I live in Canada, the book would cost me close to $300 (CAN). Third, and related to cost, is the issue of access. Not only is the book quite expensive, many readers will only want to read specific chapters or sections, yet they are forced to purchase the entire book. In today's world, one begins to question the usefulness of a large print-based book. In addition, I have, for example, found myself trying to find a quote or reference to a particular study in the book to bring to the attention of one of my colleagues or graduate students, and I have not always been successful. If the book was available in an electronic format, perhaps I could have found the citation or passages more readily and would have also saved precious time, and perhaps money.

Despite my criticisms, however, I do believe this book is a very important contribution to the field of distance education. I can only hope that the book is able to achieve some of the important goals and purposes that inspired Michael Moore and William Anderson to undertake the project in the first place. Moore summarizes this the best in his closing paragraph of the "Overview" by saying,

> *If anything threatens the potential success of distance education more than the rejection and neglect it has received in the past, it is the danger of overenthusiasm about technology leading to underfunded, undermanned, poorly designed, and poorly managed programs. If the present volume serves to temper some of the more impetuous enthusiasm and replace it with well-grounded understanding of the costs involved and of the need for substantial investment, training, reorganizing of administrations, monitoring and evaluation of learning, and support of learners – of the need, that is to say, for careful, and long-term planning and development of new and different delivery systems – the authors jointly will have made an extremely valuable contribution* (p. xxii).

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Technical Evaluation Report

21. 100 Collaborative Products and their Uses

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Abstract

This report highlights trends that have emerged from the evaluation of 100 online collaborative tools in this series of reports so far (2001-03). Emphasis is placed upon the special requirements of distance education (DE) users of collaborative tools, in the selection of online text/ audio/ video-conferencing, polling and whiteboard methods, and integrated course delivery systems combining all of these features. The technical and didactic skills for using collaborative tools effectively are illustrated in relation to a standard freeware for online audio-conferencing.

Introduction

Many collaborative software tools are initially developed for other markets: e.g., the lucrative corporate training industry and for campus-based uses. Criteria for software selection in these contexts, however, and those of DE usage, are different. Software that works well in an expensively equipped central laboratory, for example, may not work at all for students who are restricted to using less sophisticated home computers in their online studies; and software vendors are often unaware of, and fail to acknowledge these problems in promoting their products to the DE sector. DE students, therefore, provide an important perspective on the tools' benefits and shortcomings, and enable the DE teacher to select software that works efficiently on a wide range of student Internet platforms. The current series of evaluation reports and its accompanying website were established in late 2001 to identify the available products and services for making online DE optimally interactive and collaborative, and to evaluate the tools from the DE student viewpoint. As the project ends its second year, the number of collaborative tools reviewed so far has reached 100. We take this opportunity to identify trends observed during the evaluation project to date.

Types of Collaborative Tool

1. **Text-conferencing:** This is the oldest and most basic form of online conferencing. One of pioneering text-conference software was *CoSy,* conceived at the University of Guelph, Canada, in 1983. Today's text-conferencing tools range from simple threaded formats to elaborate systems involving user and administrative support features. Given the choice, the DE students surveyed during the current project have invariably chosen simple text-conference formats requiring little learning effort (click *here to read Report VIII*).

2. **Audio-conferencing:** 'Internet telephone' tools, which became available in the mid-90s, are usually restricted to one-on-one conversations. Many early audio products, which were restricted to two participants, required each other to check the other's Internet Protocol address (IP) in order to connect. Since one's IP can differ with each Internet connection, this method tended to be cumbersome. Today's audio-conferencing methods provide access to numerous online participants at the click of a single icon, and usually provide parallel "text-box" facilities in support of the audio discussion.

3. **Video-conferencing:** Most of today's audio-conferencing tools also provide the option to make one's Web-camera image available to other participants. This feature, however, can cause computers with lesser "random access memory," or RAM, to freeze up, and in most DE situations the video image is a novelty that soon loses its appeal. Numerous freeware messaging products now include a video-conferencing option with good audio-visual quality.

4. **Whiteboards:** These tools provide a blank display on which conferencing participants can type, draw with a mouse or graphics tablet, visit websites together (co-browsing), and contribute simultaneously to the display's modification. Standard whiteboard tools are available at no cost online, allowing remote users to collaborate on projects while conversing using an audio-visual-conferencing tool.

5. **Polling tools:** Numerous software products and services allow users to create questionnaires, surveys, quizzes, and other types of polls, and to feed the results back to respondents either instantly or subsequently. These tools can give the DE teacher and students rapid, nonverbal analyses of a group's thinking. Polls can be designed in advance or administered "on-the-fly," though such polls need to be designed carefully in order to ensure that they yield valid and reliable conclusions.

6. **Course delivery systems:** During the past five years, all of the above features have been combined into integrated software packages for the administration of online learning processes. (Click *here to check Report V* in the series, which identified 31 such products.) Their aggressive marketing and high cost have become major issues in the educational sector. This trend is similar to that observed in the selection of educational hardware in the 1970s, when separate gadgets (e.g., tape-recorders and slide-projectors) were combined into single devices. The relative clumsiness and high cost of these integrated hardware systems caused the market to return to more flexible "stand-alone" gadgets. During the 2000s, the online software market is moving in the same direction with the development of integrated 'open source' tools (*Please click here to visit Reports 14 and 25*).

Best Practices in Online Conferencing

The evaluations reported in the series so far have had a direct impact on the practices of the graduate school that hosts the project: Athabasca University's Masters in Distance Education (MDE) Program. In the late 1990s, MDE instructors used asynchronous, text-based methods of online collaboration alone. Since 2000, their courses have adopted a selection of course delivery systems (e.g., *Elluminate*, *WebCT*, and *Wimba*), and an increasing range of freeware tools (e.g. *GroupBoard*, *PalTalk*, *Sonork*, and *Yahoo Messenger*), which provides similar functions. Six of the 100 products evaluated between 2001 and 2003 have since failed. Otherwise the market has remained stable, while seeing an explosion of new and largely overlapping competitive products. One of the failed products, *FireTalk*, was arguably the most sophisticated audio-conferencing tool yet developed. Its demise indicates that even the most robust technical product can fail owing to market forces, and provides a warning to institutions that may be tempted to lock themselves into an investment in an expensive commercial product, rather than retaining the flexibility that accompanies the use of good-quality freeware.

In most cases, the MDE Program's software selections are the direct result of the evaluation project's recommendations. The project has provided similar assistance, and a greater awareness of the available collaborative tools, to distance educators and students worldwide. The selection of a good software package, however, only goes part way towards developing effective online practices. Expensive software and freeware alike can be rendered ineffective by inefficient usage, thus the importance of developing user skills and protocols cannot be overstated. Numerous advisories have been published on the skills of effective teleconferencing (see the website's "Sources" section), although at this stage most do not relate to the specific challenges of online conferencing. The online moderator in particular requires a complex set of "multi-tasking" skills, similar to those used in a TV control room, where a director must continually scrutinize the broadcast output while lining-up the stimuli that will be used moments ahead. The software evaluation teams involved in the current project (MDE Program graduate students) develop these moderating skills in testing the software options, and formulate guidelines for their usage.

The following is a list of the recommended "best moderating practices" based on the research, trials, and tribulations of one of these evaluation teams. It relates specifically to the conferencing activities underlying most current online collaborative approaches.

1. ***Technical pre-meeting:***

1. As far as possible, obtain details of the hardware configurations, connection speeds, and operating systems of the conference participants, and ensure that these meet the requirements of the selected software.

2. Provide participants with a guide for software downloading, installation, and instructions on how to add one another to their user list.

3. Encourage first-time participants to pre-test the software at least 24 hours before the meeting, including running the "audio set-up wizard" as appropriate.

4. Urge participants to restart their computers 15 minutes before the conference, and not to open unnecessary applications (e.g., email) during the conference.

5. Ask participants to log-on to the collaborative area at least five minutes before the conference session for a set-up check.

2. Didactic pre-meeting:

1. Ensure participants have a session agenda in advance, specifying the preparation required and the session's expectations.

2. Users should also have a list of participants with their actual names so they can interpret screen ID names.

3. Groups of 10 or more participants are not recommended for novice moderators, owing to the difficulty of keeping track of their text-box postings and speaking order. Unless instructed otherwise, a few students will dominate the discussion, while the majority will "lurk" (Tolley, 2000).

3. Technical meeting:

1. Identify one participant as a technical assistant, whose assignment is to send personal text messages to users who are having trouble obtaining or maintaining their connection.

2. Ask participants to restrict their use of "text-boxes" to central issues of conference coordination, questions, etc. Side chats can have the distracting effect of "whispering in class."

3. Ask participants not to send the moderator private messages as this will disrupt the main conference, and to send technical comments to the assistant moderator.

4. If participants invite others to a side chat, or accept such invitations, they must be aware that they may lose the audio connection to the main conference.

5. Suggest that participants only use a "hands free" audio option when actually speaking, owing to the feedback it can produce for other participants.

6. Provide the facilitator with useful shorthand messages (as provided in some software packages).

4. Didactic meeting:

1. Clarify the protocol for participation. If the audio software program does not feature a "raised hand" icon, explain the use of shorthand messages (if provided).

2. Invite participants to state in the text-box if they lose audio.

3. Check audio transmission and reception periodically throughout the session, as it may come and go without warning.

4. Do not talk for extended periods without relaxing the "talk" button; at times of busy Internet traffic, this will relieve congestion and signal break-up.

5. Give the participants time for feedback. Use open-ended questions to encourage discussion, and direct the question to specific individuals if necessary.

6. Post agendas, dates, article names, Web addresses, and other important information in the text-box, in case participants lose audio connection or are have difficulty with spellings, etc.

7. Summarize discussion threads to clarify audio and text conversations.

8. Save text-box transcripts for future reference.

5. Technical post-meeting:

1. If it is impossible to warn participants in advance of the hardware and connection speeds required by the conferencing software, check with them subsequently about any technical problems they may have experienced. Such follow-up allows the teacher to identify the resources demands of specific collaborative tools, and to diagnose participants' technical problems in using them.

6. Didactic post-meeting:

1. To facilitate continued reflection and feedback about the learning materials and process, provide participants with a supportive bulletin board, or other forms of online communication.

Conclusion

The above user guidelines illustrate that technical as well as pedagogical skills are essential to the efficient use of online collaborative tools, as they are in the use of any educational medium. Johnston (as quoted by Tolley, 2000), states: "We need to take seriously the pedagogical issues arising out of teaching by online courses . . . But we are some way off mastering this new domain, and in the meantime we need to be mindful of the snags and pitfalls hereabouts. Let us be converted, but by deeds and not by faith alone." The current software evaluation project will continue to uphold this maxim as a useful teaching and research activity, and to provide support for international distance educators and their students.

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The next report in the series discusses the potential of polling tools in online collaboration.

N.B. Owing to the speed with which Web addresses are changed, the online references cited in this report may be outdated. They can be checked at the Athabasca University software evaluation site: http://cde.athabascau.ca/softeval/. Italicised product names in this report are assumed to be registered trademarks.

JPB. Technical Notes, Series Editor

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Technical Evaluation Report

22. Online Polling as a Collaborative Tool

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Abstract

This report provides an introduction to online polling in its various forms (questionnaires, quizzes, surveys, assessment products, etc.), and discusses its advantages and problems in online education.

What is Online Polling?

The advent of online technologies during the 1990s has led to the development of numerous new automated data collection techniques and pre-configured Web polls (Ostendorf, 1994). These tend to emulate hand-held keypad systems used for anonymous polling in political and advertising research (Baggaley, 1997). Uses of the term "poll" differ widely. Mancinelle (2003) suggests that polls refer to a single question, while surveys are more complex. An earlier report in the current series (click here for Technical Report XII) however, has recommended the use of the term "online polling" in referring generally to "questionnaires, quizzing, survey and assessment products" (Baggaley, Kane, and Wade, 2002). The online format typically associated with these activities, is one in which participants place closed-ended "votes" in response to fixed questions or statements, and in which the votes are counted. The current use of "polling" as a generic term is thus consistent with the definition of "polling" provided by The Oxford Dictionary (Sykes, 1976), as being associated with voting and mediated by the counting of ballots. For the purposes of the current discussion, an online polling system may be further defined as *an asynchronous or real-time process of information gathering, obtained via responses to question(s) mediated by Web-based formats.*

Advantages of Polling Tools

The current authors have identified over 100 online polling tools to date. Some products offer a reduced-capability, free version that permits limited polling, with restrictions on the software's features, and the number and length of the instrument generated. Typically, the software either generates Hyper Text Markup Language (HTML) code for posting on websites, or the software developer hosts the poll and a Universal Resource Locator (URL) is sent by email to prospective respondents, with an invitation to participate. Access codes and other programming tools can be used to prevent unwanted or repeat responses. A variety of question templates (e.g., yes/ no, multiple choice, open answer, forced ranking, Likert scale questions, and paired comparisons) are available, and "themed" templates (e.g., course evaluations and project planning tools). Polls may be designed to require the completion of all items, and to accept only specific types of data such as numbers or letters. Polling tools vary in terms of the ease of poll construction, extent of customised reporting, degree of feedback available to the respondents, personalized greetings, and branding by the entity using the software (Bonk, 2003).

Email polls embedded in the body of the message have been found to produce a five-fold increase in response over those sent as attachments (Moss and Hendry, 2002). According to Kehoe and Pitkow (1996), "implementation of HTML forms turned the Web into a two-way medium to contact the audience directly." Online polling is regarded as having advantages over the pencil-and-paper alternative, including savings of time and money, and fewer data collection errors (Solomon, 2001). It has been described as yielding faster responses, permitting adaptive responses whereby the questions can be changed according to the users' input (Watt and Van Den Berg, 1995), and reducing fatigue by the use of easy click-response methods and colour graphics (Bonk, 2003). Handverk, Carson, and Blackwell, (2000) have suggested that Web respondents seem more comfortable with providing comments than mail-in poll respondents, possibly owing to "an additional sense of confidentiality." Carbonaro, Bainbridge, and Wolodko (2002) describe advantages of online polling such as built-in security methods and user-friendly editing features (e.g., copy/ paste, data processing, storage and display). Hitherto, Web polling has been regarded as less suspect than telephone surveys in terms of hidden sales motivation (Yun and Trumbo, 2000), although this may change (see next section). A cost-effectiveness benchmark favouring online polling over more traditional methods has been provided by Dillon (2001).

Significantly for distance education (DE) users, online polling has been regarded as helping to build online communities (Kvitka, 1999). Baggaley, Kane, and Wade (2002) have indicated that online polling can contribute to immediate satisfaction and camaraderie in synchronous discussion. Email surveys have also been described as providing a space for reflective conversation and "an exchange of ideas in which the expression and receipt of ideas leads to the construction of new understanding of their own experience among the participants" (Heflich and Rice, 1999). Baggaley (1997) described real-time polling methods in general as yielding frank and confidential responses on sensitive or embarrassing issues such as AIDS, and pointed out that the instant analysis and feedback of real-time polling results can provide timely feedback of individual and group opinions that, in turn, can guide the forum moderator. On balance, it is evident that the World Wide Web has created "an international and amorphous interaction of human agents through the digital transmission of information" (Witmer, Colman, and Katzman, 1999) and is ideal for the sharing of opinions, ideas, and knowledge. Web-based polling can enhance this process and add "collaborative power" to learning (Bonk, 2002).

Disadvantages of Web Polling

At present, the programming ability required by some polling software packages is beyond the scope "of most educational researchers, including those who specialize in technology," and of browsers that do not fully support JavaScript (White, Carey, and Dailey, 2000). The use of complex software features may decrease Web response because of the technical problems and frustrations they can cause for inexperienced users. Web congestion can limit response rates (Solomon, 2001), as can slow Internet connections in the downloading of lengthy instruments and graphic files.

In addition, Carbonaro, Bainbridge, and Wolodko (2002) state that educational survey research conducted via the Web is still largely "devoid of study." Out of 24 newspapers running quick polls, only two used a disclaimer explaining that the poll was unscientific (Schultz, 1999). From the statistical viewpoint, however, skeptical writers suggest that "most of the self-selected, online polls are worthless" and do not usually meet scientific standards (Rosenblatt, 1999). Online polls commonly involve sample/ coverage bias (Solomon, 2001), whereby the polling sample fails to represent the target population due to the exclusion of individuals who cannot or do not choose to access the Internet. Bonk (2003) points to similar design flaws in online polling implementation, including failure to give respondents clear instructions and accompanying URLs. However, any method is as good or as poor as its users, and online polling methods are as susceptible to refinement as any data collection method. Sampling bias, for example, can be reduced by the use of multimode survey techniques (Yun and Trumbo,

2000). Currently, writers differ on basic methodological issues relating to online polling. While Frary (2003) does not recommend the use of open-ended responses, Yun and Trumbo indicate that Web poll responses to well-designed open-ended questions can be more substantial and more self-disclosing than those elicited by mail-in methods. Schultz (1999) suggests that: "If the audience is informed of these deficiencies, online polls could still be used as a means to ignite and channel discussion."

Usage patterns of online polling are shifting, however. Sax, Gilmartin, and Bryant (2003) have shown that recent online polls tend to have a lower response rate than print polls among students. Moss and Hendry (2002) note that response rates for email surveys appear to be declining apace with the growing increase in email traffic. They argue that "Internet savvy" users may have a shorter attention span than users of print polls, may be subject to more online distraction, and may be aware that polling costs are passed on to users who pay for Internet access and download time. Moss and Hendry also note that password access can reduce response rate. A major current issue for those interested in using online polling is thus the development of "best practices" (see Technical Report XXIII in this series).

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Technical Evaluation Report

23. Best Practices in Online Polling

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Abstract

This report summarizes major polling design principles and practices, with particular emphasis on those affecting the integrity of online polls in distance education (DE). Specific consideration is given to the statement of polling objectives, the design of good questions and response options, online poll format, motivation of the respondents, and poll pre-testing.

Adopting Best Practices

The previous report in this series (click *here to read XXII*) recommended the use of the term "online polling" in referring generally to "questionnaires, quizzing, survey and assessment products," and further defined the online polling as *an asynchronous or real-time process of information gathering, obtained via responses to question(s) mediated by Web-based formats*. Prior to this, the major users of polling methods have been in the advertising and political research industries. Currently, online polling methods are becoming recognised as useful in the development of interactive group learning approaches in distance education (DE). *Report XXII* outlined the advantages and problems of using online polling as a collaborative tool in DE. The careful selection of appropriate polling software was discussed, and the need to develop appropriate user skills. The current report discusses these online polling "best practices."

Witmer, Colman and Katzman (1999) have recommended that researchers can benefit from exploring the online medium's potential before blindly applying paper-and-pencil approaches to their online polling methodologies. The current literature includes numerous recommendations for online polling design, including new ways of presenting the study's objectives, its questions and responses, providing incentives to participation, and adequate testing.

1. **Statement of Objectives:** To ensure that the information gathered will be useable, clear articulation of the poll's topic and purpose is of fundamental importance (Dillon, 2001; McNamara, 2003). The poll's objectives should be specific, clear-cut and unambiguous in order for the study to yield valid and reliable statistical information, as opposed to serving as a mere ruse in, for example, marketing, fund-raising, or vote-influencing activities (Best, 2002).

2. **Posing Good Questions:** The formulation of appropriate questions is crucial. The need for every question should be justified. The poll designer should avoid posing "every conceivable question that might be asked with respect to the general topic of concern…resulting in annoyance and frustration" (Frary, 2003). Questions should be avoided prompting recall of details that may never have been committed to memory, or which are beyond a fifth grade reading level (Stinson, 1999). Slang, cultural-specific and technical words,

and pejorative and emotionally laden words should be avoided. The conjunction "and" and the potentially double negative "not" may be indicators of a poorly formed question (Dillman and Christian, 2002; McNamara, 2003). The initial questions in the poll should be comfortable and generic, in order to suggest to respondents that the survey will be easy to complete. They should also avoid advanced features such as drop-down lists and long scrolling demands (Dillon, 2001).

3. **Wording the Response Options:** Frary (2003) cautions against excessive detail in the design of polling items. Instructions such as "check all that apply" should be used sparingly to avoid "category proliferation." A five-point scale is sufficient for most polling needs, and avoids "scale-point proliferation." These precautions help to anticipate the pitfall of "satisficing" – i.e., allowing respondents to be tempted to consider a poll item only until they believe that a satisfactory answer has been given (Dillman and Christian, 2002). The poll's designer should also be aware of to the possibility of order bias (Rose and Gallup, 2002) – i.e., the effects of the order in which questions and response options are presented upon the responses themselves. Poll items commonly contain the response option "other." If the range of response options is adequate for the purposes of the study, however, use of the "other" option can be a design flaw (Dillon, 2001). It may provide respondents with an easy option owing to carelessness or laziness, or because of reading difficulty and reluctance to answer. Frary (2003) recommends the alternative use of "no basis for judgment" or "prefer not to answer" options. Dillman and Christian (2002) recommend giving respondents the option to leave a question blank if viable. McNamara (2003) advocates including item(s) evaluating the questionnaire itself.

4. **Designing the Poll Format:** An attractive and easy-to-read format can improve response rates (Solomon, 2001). Dillman, Tortora, and Bowker (1998) believe that a good poll design will "reduce the occurrence of sample errors through improvement of the motivational aspects of responding as well as the technical interface between computer and respondent." Conn (2003) recommends using the visual message design principles of contrast, alignment, repetition, proximity, and "sufficient open space," so respondents can easily distinguish "between directions and actual questions, between individual questions, between sections of a questionnaire, or between responses for a question." Dillman and Christian (2002) point out that the visual design of questions "has a significant impact on respondent behaviour," and make the following format recommendations:

- Poll design is aided by the judicious use of symbolic, numerical, and graphical conventions (e.g., bullets and arrows)
- Providing a larger space for open-ended responses can elicit answers that are longer and contain more themes
- Double/ triple-column formats should be avoided since they may be read out of sequence (vertically or horizontally)
- A space should be provided after each question, and equal distances between response options
- A "progress bar" is useful to indicate how much of the survey remains to be completed
- Common Web formatting errors (e.g., reduced spacing, centering, and omission of item numbering) should be avoided

5. **Motivating Respondents:** Many of the above principles are aimed at encouraging respondents to complete the poll. The promise of feedback and summary statistics can also

provide an incentive to participation and completion (Witmer, Colman, and Katzman, 1999; Yun and Trumbo, 2000; Dillon, 2001; Sax, Gilmartin, and Bryant, 2003). Moss and Hendry (2002) indicate that in a course evaluation context online polls should be infrequent, short, simply designed, free from password access, and that results should be displayed to students on completion of each poll without revealing the respondents' identities. Dillman and Christian (2002) indicate that the "welcome screen" should motivate participants via emphasizing the ease of responding, time required, nature of the online response tasks, and sufficient technical instruction without excessive detail. Further motivational tips include the use of "give-aways" such as movie tickets and gift certificates (Handverk, Carson, and Blackwell, 2000). Rosenblatt (1999) believes that incentives do not greatly increase the number of respondents in a poll, but do increase the probability that individual respondents will complete it.

6. **Pre-testing the Online Poll:** As far as possible, the poll items and response options should be pre-tested for accuracy (Stinson, 1999). The polling instrument should be reviewed and tested on a variety of computer browsers and platforms (Pitkow and Recker, 1995, Best 2002; Conn, 2002); although Carbonaro, Bainbridge, and Wolodko (2002) suggest that pre-testing should be limited to the most viable combinations of software and hardware, since it is usually impracticable to test the complete range. Bowker and Dillman (2000) recommend that pre-tests of a poll's Hyper coding should apply the "least compliant browser" principle. Conn (2002) recommends that pre-tests should ensure that a minimum of computer skills is required to complete the poll, and that the instrument's design should be sufficiently simple to allow for rapid downloading. Simpler questionnaires also demand less of the computer's random access memory or RAM (Dillman and Christian, 2002). Carbonaro, Bainbridge, and Wolodko (2002) recommend that pilot respondents should use a "think aloud" procedure allowing their verbal reactions to be audio taped.

Conclusion

Currently, online polling methods have not yet become a standard methodology in online education, and in many parts of the world, their delivery is complicated by institutional security policies and network "firewall" technologies. These can interfere with both the transmission and collection of polling data. Detailed liaison is needed between the researchers and network designers in institutions to overcome these obstacles. Meanwhile, the standard textbook literature on the criteria for efficient polling design should be studied as background to the principles of online polling design covered in this report.

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The next report in the series discusses the installation of open source collaborative software.

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Technical Evaluation Report

24. OS Software: an alternative to costly Learning Management Systems

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Abstract

This is the first in a series of two reports discussing the use of open source software (OSS) and free software (FS) in online education as an alternative to expensive proprietary software. It details the steps taken in a Canadian community college to download and install the *Linux* Operating System in order to support an OSS/ FS learning management system (LMS).

Background

The Woodstock College campus of the New Brunswick Community College system is small, with only an on-site seat capacity of 300 students. The College has approximately 250 computers (staff and student labs), connected to two servers (administration and student) operating in a *Windows* environment. Technical support is provided by two individuals who are responsible for all aspects of the Information Technology (IT) infrastructure, including software management. IT staff are called upon to provide technical support for specialized software used by instructors for industry-specific applications. The College's operating budget supports the overall IT infrastructure, including the resources and professional development required by instructors in the use of new learning technologies. As with many educational institutions, this budget is being increasingly stretched by the costs of proprietary software required to develop and support an online learning environment (Reynolds, 2003). Nonetheless, the strategic plan of the College network identifies e-Learning as a priority issue.

Sister campuses of the College use the *WebCT* learning management system (LMS) to support their e-Learning initiatives. Other campuses are being encouraged to use this system to promote collaboration among the campuses in the development and delivery of e-Learning courses. The author's campus does not does not offer a sufficient number of online courses, however, to justify the software's annual cost (approx. CDN $10,000). In this situation, an increasingly viable alternative to expensive proprietary options is the use of free or low-cost open source software (OSS). New OSS products are enabling teachers to develop e-Learning material in a structured and flexible environment without the disadvantages of proprietary software. They represent a significant new stage in the development of online learning methods, not only in terns of cost, but also in relation to reliability, scalability, and performance (Wheeler, 2003).

This report describes the installation and use of OS software as a means to providing an LMS at minimal cost. A follow-up report (click here to see Technical Note XIV in the series) will compare some of LMS software programs currently available using the OS approach.

Open Source Software and Free Software (OSS/ FS)

For the purpose of this report, the acronym OSS/ FS is used (Wheeler, 2003), combining both open source software (OSS) and free software (FS). The distinction between OSS and FS, and a detailed description of each, can be found at the GNU Project's website (*www.gnu.org*). In summary, OSS refers to the availability of the software's source code to the general public, usually with a licensing agreement stating the code's functions. According to the GNU Project, the term "free software" (FS) is ambiguous: 1) a superficial meaning, "software you can get for zero price;" and 2) the more significant "software which gives the user certain freedoms" with regard to its use and distribution. The importance of the FS concept, asserts the GNU Project, is the issue of liberty rather than price, as in "free speech" as opposed to "free beer." [N.B. The term GNU is something of a "hacker in-joke," a "recursive acronym" for "GNU's Not Unix".]

The GNU Project defines four types of freedom associated with the FS concept:

- **Freedom 0:** To run the software for any purpose
- **Freedom 1:** To study how the program works, and to adapt it to one's needs
- **Freedom 2:** To redistribute copies in order to help one's neighbor
- **Freedom 3:** To improve the program, and release improvements to the public, so that the whole community benefits

A precondition for Freedoms 1 and 3 is access to the source code. Many OSS/ FS software programs are available free of charge, but many are also commercial programs. Wheeler (2003) states that OSS/ FS is not the equivalent of "non-commercial" software, nor is it necessarily in the "public domain." Many, but not all, OSS/ FS are released under the GNU General Public License (GPL), which is intended to guarantee the freedoms mentioned previously.

Selection of an Open Source Software / Free Software (OSS/ FS) Conferencing System

The Woodstock College campus has limited experience offering DE courses, and does not have extensive human or technical resources to facilitate the creation of e-Learning materials. As a teacher at the College, the author needs to provide his on-campus students with readily accessible materials and resources (e.g., lecture notes, assignments, and Web hyperlinks). Initially, to set up his courses, the author used the *BlackBoard* system's free website for its many common LMS features and the advantage of the public Web-server. However, students have often been frustrated with the slow connection and download times involved in this method, even though accessing the site using a T1 line.

The author's next step was to program his own website, though this did not provide all the desired options (e.g., calendar, discussion forum, assignment drop-box, etc). The author could have also installed separate software to provide these functions, but preferred a method that would be easier to use and maintain than a collection of disparate items. The author also wanted a tool that could be used by other instructors; and this required the selection of a complete and

fairly straightforward no-cost product. Current OS options include the *Bazaar* and *Moodle* LMS systems, both released free of charge under the General Public License (GPU). Such systems are not yet immediately accessible to the novice user, for they involve a complex sequence of installation procedures and access to, for example, a *Linux, Unix, Windows, Mac OS X,* or Netware system with PHP support. Customising the software can require, for example, *Perl* programing skills, and access to a database such as *MySQL*. The current report gives step-by-step instructions in the relatively complex installation process.

Installation of Mandrake *9.1*

1. Initially, the author attempted to install the *Bazaar* software using *Mandrake Linux* 8.0 (a *Linux* OS system), but was unsuccessful. The problem appeared to be with the version of *Mandrake* the author was using, so instead he downloaded and installed the latest version (9.1), which includes *Apache* and *MySQL*. To do this, go to: *http://www.mandrakelinux.com/en/*, and click on the download link.

2. Scroll down the download page until you arrive at the section asking if you wish to become a member of the *Mandrake Linux* Users' Club.

3. Next, click on the *Mandrake* 9.1/i586 ISO Image. The following is a description of a *Linux* ISO Image, taken from the LinuxISO site (LinuxISO.org, 2003):

   A *Linux iso* is a file containing a CD Rom disk image of a *Linux* distribution. This CD Rom disk image is an exact copy of a *Linux* distribution on a CD Rom. Think of it as the equivalent of a screen capture, but instead of capturing the information on a screen, this image captures all of the information on a particular *Linux* distribution's CD Rom. When burned as a disk image, the .iso file is turned into a duplicate CD of the original CD. If burned as a file, instead of a disk image, the CD becomes a copy of the downloaded .iso file, and not a bootable CD with accessible files and directories.

   This website also explains important aspects of downloading and burning a CD copy of the *Linux* OS.

4. The previous step leads to a screen containing a selection of download sites. Select one. If you are prompted for a user name and password, the site may have run out of anonymous user slots (see the FAQ mentioned in the previous step). Go back and select another site.

5. At this point a file-transfer screen should appear. Download the files and burn them to a CD as instructed in the "readme" file.

6. Read the "Quick Start" documentation before installing the software. Install the *Mandrake Linux* OS on your server. [**N.B.** The author's server uses a *Dell OptiPlex* desktop, with a *Celeron* 564MHz processor, 128MB of RAM, and a 6GB hard drive.]

7. When the installation is complete, set the network connections. Open the "Control Center" by clicking on the appropriate button. You will be prompted to log-on to the Control Center as the super (root) user.

8. Click on the "Network and Internet" button. The *DrakeConnect* assists with the set-up of this of this button.

9. Click on the "Wizard" button. At this stage of the installation, you will need to obtain information from your IT department (static IP address, gateway, etc.).

10. Although *Mandrake* 9.1 comes with *MySQL*, it may not be installed. Click the "Software Management" button. The *RpmDrake* will help you to install the software packages. A "Software Packages Installation" screen will be displayed. Sort the packages alphabetically and install the following: *MySQL*-4.011a-5mdk

    MySQL-client-4.0.11a-5mdk

    MySQL-common-4.011a-5mdk

    Libmysql10-3.23.44-1mdk

11. Once *MySQL* is installed, you will need to start it. While you are in the "Control Center" panel, click the "System" button, and then click the "Open a Console" button.

12. Go to the root directory by typing the following at the prompt (#):

    cd..

    cd..

    This should lead to the following prompt: **[root@localhost/]#**

13. Start *MySQL* by using the following command at the command prompt: (**N.B.** spaces are represented by the "?" symbol:

    ?/etc/rc.d/init.d/MYSQL?start

    Press the "enter" key. Your command line should look like:

    [root@localhost/]#?/etc/rc.d/init.d/MYSQL?start)

14. When installing the LMS software (e.g., *Bazaar* or *Moodle*), you will be asked for the root password for *MySQL*. To be prepared for this, set your password by entering the following command (where xxxxxx is your password):

    Mysqladmin?-u?root?password?xxxxxx

    [**N.B.**Make a note of this password, because you will require it later.]

    Steps 15 and 16 below are unique to the installation of a package (e.g., *Bazaar*) that requires *Perl* programming support.

15. Install the *Perl* CPAN module. The Comprehensive *Perl* Archive Network is a large collection of *Perl* software and documentation. *Bazaar* requires *Perl* modules that may not have been installed with *Mandrake*. To be sure, install them now. To install the *Perl* module, type the following command at the root prompt:

    [root@localhost/]#:?perl?-MCPAN?-e?shell

[**N.B.** During the installation of the CPAN module, the option of manual configuration and auto-configuration is given. Unless you are familiar with *Linux* and *Perl*, it is strongly recommended that you type "no" at this prompt, to trigger an auto-configuration.]

16. The **cpan>** prompt should now be displayed. This is the prompt that you will use to install the other modules. Install the CPAN modules you need by typing the following commands:

    cpan>?install?term::ReadKey

    cpan>?install?MD5

    cpan>?install?Lingua::Ispell

    cpan>?install?Mail::Mailer

    These commands are always typed at the **cpan>** prompt. Wait for the installation of one before you proceed to the next.

All being well, you are now ready to install an LMS system (click here to see Technical Report XXV).

Conclusion

As this report has demonstrated, the installation of OSS/ FS software can involve a steep technical learning curve, and may require expert IT support. But it is apparent that the emerging OSS/ FS options represent a vital and viable alternative to the costly, proprietary LMS software programs previously available. The second part of this report (click here for Technical Note XXV) will compare specific LMS packages that use the OSS/ FS principle.

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The next report in the series compares specific open source software programs for online course management.

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Technical Evaluation Report

25. Open Source Software: Two learning management systems

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Abstract

This report is the second in a two-part series about open source (OSS) and free software (FS) systems in online education. These are rapidly emerging as alternatives to costly proprietary learning management systems (LMS) and content management systems (CMS). This report reviews two LMS systems and one CMS system, all developed on the OSS/ FS principle and available to users free of charge.

Introduction

Mullinix and McCurry (2003) describe the current wide range of faculty experiences with educational technologies. While some teachers develop and use advanced Web-enhanced learning materials effortlessly, others struggle to acquire basic computer literacy skills. Where previously teaching staff were divided in their ability to use word-processors and spreadsheets, today's educators are divided by their ability to create and update their online course materials. Solutions to this problem are rapidly becoming available, e.g., the online "blogging" methods that allow individuals to update educational materials without programming ability (Baggaley, 2003). The online LMS software programs now available have also reduced this gulf of understanding and ability, and are allowing more teachers to explore and experiment with online methods. Morgan (2003) found that faculty members' use of an LMS increased their instructional effectiveness, enhanced their communication with students, and allowed them to restructure their learning activities, thereby improving the pedagogy of their courses. Why then if they enhance learning environments so greatly, do some educators lag far behind in their uses of educational technology?

A major reason for the relatively slow adoption of LMS systems in education is the increasing cost of the software (see Technical Report 24). The current "digital divide" separates not only teachers (and their students), but also higher education institutions. If institutional infrastructures and support for online learning are not available, instructors may be unable to use online methods despite their personal readiness to do so. Many higher education institutions are using proprietary LMS products such as WebCT and BlackBoard, although these may be cost-prohibitive for other institutions. An alternative solution is to be found in the wide and rapidly emerging range of non-proprietary open source (OS) and free software (FS) LMS packages. The Centre for Curriculum, Transfer and Technology's website (www.c2t2.ca/) lists over 40 such packages; and the Edutools website (www.edutools.info/index.jsp) lists others.

The current report reviews two products, *Bazaar* and *Moodle*, both available at no cost under the GNU General Public License. The report also describes *Plone*, an OSS/ FS content management system (CMS) that uses a browser-based principle similar to the increasingly popular "blogging" method. All three products facilitate the creation, submission, and publication of educational content directly to a website, without the need for further development tools nor Hyper Text Markup Language (HTML) skills.

Open Source Learning and Content Management Systems

1) *Bazaar* is an LMS developed at Athabasca University - Canada's Open University. It requires an Apache Web-server and a MySQL database, and uses CPAN Perl modules. Although it has also been tested successfully on other operating systems, it runs in a Linux (Unix) environment. Version 7.05 of the product includes the following resources: a calendar, drop-box for student uploads, file uploads, discussion forum, grade sheet, guest book, HTML page, Internet Relay Chat (IRC) client, journal discussion, poll, quiz, RSS feed, references, search, sign-up sheet, URL, and a user list. Each option is selected from a drop-down menu and added to a "Category" (e.g., a course). Multiple categories can be created, each containing different resources that, in turn, can include other categories. Access to the resources is managed by the instructor, and can be restricted by individual users and user groups, or can be made publicly available.

Each resource presents its own degree of ease of use. Adding a calendar, discussion forum, or drop-box is straightforward. Creating a quiz is time-consuming, and results of completed quizzes are reported in a numeric form that may confuse users. Navigation for learners is straightforward, with a site map providing a global display of all the site's resources. If users forget their passwords, they can obtain replacements via an automated response to an email request. The system requires a site administrator to set up the initial category for each instructor. The site administrator assigns various levels of access and control to the course instructors based on pre-defined roles, and creates groupings of students at the request of instructors. Creating an HTML page presents some difficulty for instructors, especially if images are used. These must be sent to the site administrator for uploading to the Web-server. User documentation is available from the *Bazaar* website. A Frequently Asked Questions (FAQ) site provides user support. There is no help function available within the system itself.

2) *Moodle* is an LMS developed by Martin Dougiamas as a PhD in Education project. It runs in a Linux (Unix) environment supporting the PHP scripting language, and requires a MySQL or PostgreSQL database. Course home pages can be formatted in three ways: weekly, social, or by topic. The weekly format was used for this review of v1.1.1 of the product. Within each week, the course instructor can add activities including: assignments, attendance, chats, choices, dialogues, glossary, journals, quizzes, resources, and a workshop. Course content can be prepared in the form of files uploaded to the server, pages edited directly within the LMS, and external webpages that can be made to appear as part of the course materials. The instructor manages access to the course. Activities are easily created for each week, can be hidden from students until needed, and is supported by help dialogue boxes. Documents created in word-processing software can be pasted into the activity option as HTML text, maintaining their formatted features. Activities requiring text use a Rich Text HTML editor to provide a word-processor interface that includes formatting, insertion of images, tables, links, and emoticons. Chat, quizzes, and survey activities are also easily created.

Moodle is based on the philosophy of maximum instructor control and minimal administrator control. After the initial setup and creation of the course area, the instructor manages its materials with minimal (if any) assistance by the administrator. Course pages and other files

can be published directly from within the system, giving the instructor greater control. The *Moodle* website contains administrative documentation, a teacher's manual, and documentation created by other users. Other resources include a vibrant user's group FAQ. For the benefit of users and institutions that lack the server and support infrastructure to host their own online materials, a *Moodle* hosting service is available at a reasonable price.

3) *Plone* is a content management system (CMS) dedicated to browser-based document publishing and updating functions. It utilizes the OSS application server Zope and its accompanying Content Management Framework, which its developers describe as delivering "a powerful, tailored CMS in a fraction of the time of big vendors." *Plone's* potential in online education is that this tool allows instructors to format and publish their course materials without the need for Web programming skills. It has an easy-to-use interface, and utilizes style sheets to unify the "look and feel" of course websites with minimal effort on the teacher's part. Once a course account has been created (usually by a site administrator), teachers can use the software without further assistance. Although focusing on document management rather than the more varied activities of LMS systems such as *Bazaar* and *Moodle, Plone* can also serve as a useful collaborative tool between remote project partners.

Conclusion

Proprietary software is not the only available option for quality online course management. A healthy OSS/ FS movement has emerged, providing no-cost products that are as good as or even better than proprietary, commercial products. The open availability of an OSS/ FS product's source code makes it more flexible and customizable than typical proprietary software. Based on the current evaluation, the author is recommending the use of *Moodle* within his College campus. Its appealing visual design, the ease and intuitive feel with which online activities can be added, the online help and support provided by the documentation and user groups make this a superior and user-friendly LMS. It is hoped that this recommendation will assist in the development of a structured, supportive, and relatively cost-free environment at the College, in which instructors can experiment with learning technology, and can enhance their teaching activities for the student's benefit. A tool such as *Plone*, serving restricted CMS needs, may also be useful in this context in that it can be used by novice website builders for the major functions of online publishing, without the potential distractions of more elaborate LMS systems.

References

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N.B. Owing to the speed with which Web addresses are changed, the online references cited in this report may be outdated. They can be checked at the Athabasca University software evaluation site: http://cde.athabascau.ca/softeval/. Italicised product names in this report are assumed to be registered trademarks.

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