Streaming Media Delivery in Higher Education:

Methods and Outcomes

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Published in the United States of America by
Information Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com

Library of Congress Cataloging-in-Publication Data
Streaming media delivery in higher education: methods and outcomes / Charles Wankel and J. Sibley Law, editors.
p. cm.
Includes bibliographical references and index.
Summary: “This book is both a snapshot of streaming media in higher education as it is today and a window into the many developments already underway, forecasting of areas yet to be developed”-- Provided by publisher.
ISBN 978-1-60960-800-2 (hardcover) -- ISBN 978-1-60960-801-9 (ebook) -- ISBN 978-1-60960-802-6 (print & perpetual access) 1. Internet in higher education. 2. Streaming technology (Telecommunications) I. Wankel, Charles. II. Law, J. Sibley, 1969-
LB2395.7.S77 2012
378.1’7344678--dc23
2011016796

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

Chapter 5
Using Video Streaming in an Online, Rich-Media Class to Promote Deep Learning While Educating for Social Change

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ABSTRACT

This chapter shows how the authors have used video streaming as a central component of a rich-media, online learning environment incorporating podcasting and advanced Internet technologies to promote deep learning while educating for social change. In the first part of the chapter we discuss the design and pedagogy of our award-winning course. Various aspects of our technological and teaching innovations are highlighted: first, we have developed a highly flexible and customizable learning environment that addresses different learning styles, and which includes choice of mode of delivery, choice of amount of skills practice, and choice to effect changes to the course-in-progress. Second, we use design and teaching practices that facilitate deep learning through cognitive apprenticeship, such as modeling, coaching, and scaffolding (Weigel, 2002). Third, our design and pedagogy works against fundamental and prevalent values underlying the culture of higher education that desperately need changing, such as aggressive competitiveness, scholarly isolation, lack of mentoring, and valuing of product over process (Damrosch, 1995). These points are illustrated in the online course description that follows.

In the latter part of this chapter, we outline the theory behind our practice. We discuss the factors that impelled us to rethink ways of creating online, rich-media learning environments, and move toward innovation. We explain the principles, ideas, and concepts that have grounded our approach and inspired us to embrace video streaming, podcasting, and advanced Internet technologies. We unpack a fundamental assumption: deep learning and educating for social change are made possible by an acceptance and understanding of the radical intertwining of learner, educator, technologist, and technology. In sum, we draw on our course to illustrate enactive, online teaching-and-learning.

DOI: 10.4018/978-1-60960-800-2.ch005

BACKGROUND AND OVERVIEW

The authors co-designed a rich-media, online learning course for which Zorn developed the pedagogy and course material and which she leads as the course instructor, at York University in Toronto, Canada. She grades students' work with the assistance of a teaching assistant. Parke chose the technologies, designed the technology interface, and adapted the technologies to meet the needs of the course, the students and Zorn. Parke teaches innovation at the Schulich School of Business at York University, and along with a team of people at York's Faculty Support Centre oversees the use of the technology used in teaching-and-learning.

The course is called Reasoning About Morality and Values. It is a full-year, first-year undergraduate course, and was first offered in summer 2005. The most recent version of this course, offered in 2009/2010, comprises an in-class section with 60 enrolled students and a corresponding, fully online section with 150 enrolled students. The online section has one teaching assistant; the in-class section has none. It is one of many general-education, modes-of-reasoning courses offered at York University. However, it is York's only fully online, rich-media course and has the distinction of being the second course in Canada to provide lectures in video podcast format. It was awarded the United States Distance Learning Association 2008 Silver Award for Excellence in Distance Learning Teaching ("York Recognized as a Leader in Distance Education," 2008). It was also nominated for both the 2006 Council of Ontario Universities Award for Excellence in Teaching with Technology, and the 2007 Commonwealth of Learning Excellence in Distance Education Teaching Award for Distance Education Materials.

An interdisciplinary course, it aims to produce effective students and citizens by teaching skills most needed by first-year university students (namely, critical thinking, essay-writing, and reading comprehension) and skills required to participate fully as a citizen of a liberal democracy (namely, critically evaluating what is read or heard, clearly and cogently expressing and supporting one's views, and rational decision-making). The course design, pedagogy, and choice of course materials takes an antidomination approach. The issues, topics, cases, examples, and course content focus on morality and values.

The course is cumulative, skills-based, and multimodular. Module 1 begins by studying argument and argumentation. Module 2 emphasizes informal fallacies in everyday logic. Module 3 focuses on conceptual analysis, Module 4 on passages and issues analysis, and Module 5 on argument analysis. Weekly homework, two fully online tests, and an assignment consisting of analysis of a passage and an article assess the students' ability to analyze and criticize arguments. Since this is a skills-based, not a content-based course, the weekly homework plays the important role of providing the opportunity to practice the skills learned in class.

Classes are three hours in length. The first hour and 50 minutes consists of minilectures (Young, 2008, 2009), punctuated by collaborative learning exercises, with corresponding worksheets that students need to complete. In-class and online students complete the same worksheets. In-class students are divided into learning teams to complete the collaborative learning exercises. Examples of collaborative learning exercises are: viewing a video (DVD or YouTube), discussing, answering questions about it, and collaboratively filling out individual worksheets; listening to pieces of music and applying skills taught in class; completing tasks using skills taught in class and reporting findings as learning teams to the entire class. Zorn moves around the room and brings the microphone to each student, so that all dialogue and discussion is properly video streamed for the online students. The remaining 50 minutes is a workshop session.

The content, technology, and pedagogy have met objectives for essay-writing, critical thinking, and reading comprehension in a fully online,

skills-based, student-centered, and reciprocally adaptive learning environment. The design uses student collaboration, video, audio, text, and exercises, which, together with the weekly homework, promote deep learning. The choice of video streaming, rich-media-capture technology has addressed the problem of how to teach skills and practices fully online while enabling modeling, coaching, and mentoring of behaviors and practices (e.g., argument and conceptual analysis). These enabling objectives are met by capturing and synchronizing images of Zorn lecturing with: (a) PowerPoint slides containing examples, steps, strategies, techniques, and concepts involved with the skills; (b) document camera projector images depicting the practice of work in progress; and (c) the Internet as a resource (e.g., databases, video clips).

The choice of video-streamed lectures, video and audio podcast format, and a WebCT platform (Blackboard) has addressed the challenges of York University as a commuter campus and the students' need for mobile learning. The WebCT (Blackboard) course management system has met the need for a fully online learning environment, delivering the course in an enactive and student-centered format, including real-time chat rooms, a virtual office, discussion rooms, nonlinear, user-friendly interface, video welcome messages, Ombuds Buddies, private learning teams, and coaching/mentoring videos. The course also has an accompanying Facebook User Group site (Facebook). Students' avatars (graphic representations of persons) also have the option to meet Zorn's avatar in Second Life (Second Life), a 3D virtual world, for virtual office hours.

A systematic design and multimedia product development process has been followed. The first step in the process is to digitally record the lecture material using Sonic Foundry's Mediasite technology (Mediasite). The in-class lecture is video recorded. The rich-media lecture material is also converted to Adobe Systems' Flash media by MediaLandscape software (MediaLandscape) to ensure playback compatibility for the Mac platform. The rich-media capture technology has facilitated the creation of searchable, self-paced learning modules that are critical for this online environment. The user controls empower the students to stop, rewind, search, and print notes—all from the same interface. The course design has taken advantage of these player features to promote interactivity and allow the opportunity for discovery.

Rich media was an important choice for the technologist as well. Statistics are kept on how many times and when modules have been accessed. Information is also available on the country of origin from which the user accesses the system. This origination information has given us a global picture of our online community. The access information has also been critical for instructor feedback as the course is in progress. For example, if one learning module has been accessed more than other modules, it is clear what material has to be emphasized during the exam preparation.

Mobile learning capability is a reality for most of our students. Many students have access to MP3 players or portable video players such as the Apple video iPod. To add another dimension to the course, enhanced audio and video podcasts have thus been created. Creating this possibility has allowed even more integration with a student's lifestyle. We have chosen the unique approach of having referenced PDF files for each module. PDF referencing is done by time stamps on the individual pages that refer to the v-cast. RSS feeds contain both the v-cast and referenced PDF file.

Impacts on student learning have been variously assessed. Survey data have been collected anonymously at the end of the summer 2006 course offering, again at the end of the 2007/2008 version, and during the 2009/2010 running of the course. A summary of the survey data is available. Mediasite metrics have been collected and Ombuds Buddies have been used throughout all versions the course. (Ombuds Buddies are discussed in "Highly Flexible and Customizable E-Learning

Environment," below.) The survey data have shown the following:

- 10 percent of the class view the lectures on a video iPod about half of the time, frequently, or almost always;
- 54 percent of the class appreciate having the option to listen to the lectures on an MP3 player;
- 93 percent of the class say that the online format is a good way for them to learn; and
- 78 percent prefer online learning to an in-class format.

The Mediasite metrics have shown that students rewatch the lectures before the midterm test, and that more coaching has been needed for the conceptual analysis steps.

DESIGN AND PEDAGOGY

Highly Flexible and Customizable E-Learning Environment

In this section, we discuss the ways we have used video streaming, podcasting, and advanced Internet technologies to allow for a highly flexible and customizable enactive online learning environment. Students have several options from which to choose:

- when, where, and how the course is delivered;
- learning options that address their individual learning styles;
- how much practice they need at the skills they are learning; and
- to make changes to the course while it is in progress.

Choice of Mode of Delivery

Students in both the in-class and the fully online section have the choice of where, how, and when they would like to attend class. Students enrolled in the in-class section can attend in person one night of the week for a 3-hour class. Students in the fully online section have the option to tune in to the live webcast during the in-class session, including the workshop session, or watch the class on their PC or Mac, download the class from iTunes as an audio (MP3) file or a video (MP4) file to be viewed on a video iPod or any other hand-held device that will play MP4 files, including the Sony PlayStation Portable.

Students can also customize the mode of delivery individually; for example, Mediasite allows students to play the lectures at double speed and maintain the same audio pitch. This is used for review purposes as a way to speed-watch sections. This option meets the needs of ESL (English as a Second Language) students who may need to view and listen to the lecture at a slower pace. This option also meets the needs of digital learners who are multitaskers (Tapscott, 2009, pp. 106–110) and choose to speed the lecture up with the aim of watching it in less time.

Our learning environment has also allowed students to interact with and customize software components. For example, the WebCT (Blackboard) calendar function is not static. It can be altered for personal use, allowing it to act as a place to keep more than basic date information.

Addressing Different Learning Styles

Another aspect of a highly flexible, enactive learning environment is how different learning styles can be addressed. There is neither a common definition nor a unified theory of *learning style* (Cassidy, 2004; Desmedt & Valcke, 2004; Hall & Moseley, 2005; Merriam, Caffarella, & Baumgartner, 2007). Toye (1989) has defined learning styles as "attempts to explain learning

variation between individuals in the way they approach learning tasks" (quoted in Merriam et al., 2007, p. 407), while Cranton's (2005) definition is "preferences for certain conditions or ways of learning, where learning means the development of meaning, values, skills, and strategies" (quoted in Merriam et al., 2007, p. 407). Merriam et al. (2007) note that although scholars are not in agreement about which elements constitute a learning style, learning-style inventories seem to be "useful in helping learners and instructors alike become aware of their personal learning styles and their strengths and weaknesses as learners and teachers" (p. 409).

Bonk and Zhang's (2008) R2D2 Model illustrates the ways that our online teaching-and-learning environment addresses different learning styles. Their model consists of four phases, corresponding to four types of learners: Read, Reflect, Display, and Do (Bonk and Zhang, p. 5). Sample technology resources and tools for each type of learner accompany each phase (Bonk & Zhang, p. 5). The R2D2 Model adapts and extends the work of several scholars of learning styles for online teaching-and-learning (Fleming & Mills, 1992; Kolb, 1984; McCarthy, 1987). For example, Fleming and Mill's (1992) VARK (visual, aural, read/write, and kinesthetic) approach to learning styles plays a central role in the R2D2 Model.

Read. The "Read" phase represents people with a dominant auditory and verbal learning style—those who prefer words, sounds, and spoken or written explanations. Examples of sample technology resources suited for the auditory and verbal learner are podcasts, online PDF documents, audio files, PowerPoint presentations, online portals, course announcements, help systems, FAQs, Webquests, online newsletters, e-books, and online journals (Bonk & Zhang, 2008, p. 5).

Our course addresses the learning style of auditory and verbal learners in the following ways. Students can download all class sessions (including workshop sessions) as audio podcasts, using Apple's iTunes digital music and video player. Audio presentations are also provided from the authors of the students' textbooks. Every class session has corresponding PowerPoint presentations that are downloadable from either the WebCT course platform (Blackboard) or through iTunes. Links to downloadable PDF documents are available throughout the course. Such documents may include: the weekly handouts and worksheets; samples of graded assignments that are accompanied by audio podcasts explaining grading criteria and assignment expectations; graded homework accompanied by audio podcasts taking up the homework; and workshop session worksheets accompanied by audio podcasts of the session. The WebCT course platform (Blackboard) is itself a kind of portal for the students. Its features include: an email system; synchronous and asynchronous, text-based discussion rooms (including announcements discussion room, coaching messages discussion room, and "Prof and TA never enter here"); interactive calendar, showing all homework and assignment due dates and other significant, university-wide academic dates; and a virtual office in which to meet with the professor and discuss with her, using real-time, text-based chatting. (For screen prints, see Appendix 1: Discussion Rooms, Appendix 2: Interactive Calendar, and Appendix 3: Real-Time Student Lounges and professor's Virtual Office.)

The course's web site home page consists of 15 graphic icons, each with a text heading beneath. Eight of the 15 icons have expanded textual explanation beneath the main text heading. The site addresses the navigation needs of verbal learners by including a text-based, at-a-glance, drop-down menu of all the lobbies, halls, and rooms on the site. For students who choose not to use the drop-down menu, every graphic icon on the site is accompanied by written text. Students can choose to click on the graphic image or on the written text to move about the site. When a student clicks on the written text that accompanies a home page graphic icon, the written text is repeated in the

banners of the corresponding lobbies, rooms, or halls, often with more detailed textual explanation.

The choice of wording for the text is designed to be language-comfortable to the digital generation (Tapscott, 1996, 2009). Here are three examples, quoted directly from the home page:

- Main heading beneath graphic icon: "Technology Training Hall." Text beneath main heading: "How to use the course site. Well, do you want to ace the course or not? So, don't ignore this!"
- Main heading beneath graphic icon: "Lecture Halls." Text beneath main heading: "If you are allergic to work, do not enter these rooms. If you plan to fail this course, avoid this room like the plague."
- Main heading beneath graphic icon: "Coaching and Mentoring Hall." Text beneath main heading: "Come on in and take a long drink of water! Everyone needs some extra help once in a while. People with photographic memories or geniuses need not enter."

For a screen print of the drop-down menu and home page, see Appendix 4: Pull Down Menu, and Appendix 5: Home Page.)

Reflect. Our online teaching-and-learning environment also addresses Bonk and Zhang's (2008) "Reflect" phase. This phase refers to people with a dominant reflective and observational learning style—those who prefer to reflect, observe, view, and watch learning (p. 5). Reflective and observational learners make careful judgments and view things from different perspectives; they enjoy reflection, self-testing, review, and reflective summary writing. Examples of sample technologies suited for reflective and observational learners are blogs, synchronous chats, online exams, writing aids, electronic portfolios, asynchronous discussion, reflective writing tools, online review and self-testing aids, and expert videos or performances. The course includes synchronous chats, two online tests, and a portfolio assignment. Online review and self-testing aids are included as required, as well as optional online weekly homework and online practice tests and exercises.

Display. The course also addresses Bonk and Zhang's (2008) "Display" phase, which refers to people who are predominantly visual learners—those who prefer diagrams, concept maps, flowcharts, timelines, pictures, films, and demonstrations. Examples of sample technologies suited for visual learners are concept mapping and timeline tools, interactive news, video streamed content, online videos, virtual field trips and tours, animations, whiteboards, videoconferencing, online charts, graphs and visualization tools, video blogs (vblogs), and vodcasts.

All class and workshop sessions are provided as video streamed presentations synchronized with PowerPoint slides when viewed on a PC or Mac, without the slides when viewed on a hand-held device. Video streamed welcome messages from the professor and authors of the students' textbooks are provided on the home page. Also, video streamed coaching and mentoring presentations can be found throughout the site. For example, each Module of the course in the site's Lecture Halls has a welcome/coaching from the professor. (For screen prints, see Appendix 6: Video streamed Presentation, Appendix 7: Video streamed Author Presentation, and Appendix 8: Video streamed Welcome Message from Professor.) Links to online videos are provided with almost every class session. (For a screen print of a class session with links to videos, see Appendix 9: Class Videos.) All videos include text worksheets as PDF and Word docs for verbal learners and include a "doing" component. Concept and learning objective maps are also provided. As well, students are given the option in homework to learn to depict arguments in linear diagram form, arrow diagram form, or concept form.

Do. The "Do" phase refers to people who are dominantly tactile and kinesthetic learners—those who prefer role play, dramatization, cooperative

games, simulations, scenarios, creative movement and dance, multisensory activities, manipulatives, and hands-on projects. Examples of technologies suited for tactile and kinesthetic learners are simulations, online games, wikis, digital storytelling and movie making, real-time cases, video scenarios, survey research, continuous stories, groupware and other collaborative tools, role play, and debate tools. Real-time cases, role playing, and debate format are used in the in-class and workshop session and then video streamed for those students in the fully online session.

A pilot-project, role-playing game will be introduced in the final module of the most recent version of the course (March–April, 2010). This will be the first online role-playing game we have attempted. The game is based on Professor David Wiley's open-source model used at Brigham Young University, Utah, in which students choose a character (an artisan, a bard, a merchant, or a monk), go on learning quests together, and gain experience points ("Introduction to Open Education 2009," 2009; Young, 2009). A 1-hour phone conversion with Professor Wiley convinced Zorn that the model he used for a sample group of less than 10 master's-level students could work even better with a class of 60 in-class and 150 online students.

Finally, consider the following example that illustrates a way in which our course addresses all four types of learners, in one room on the home page of the course web site. In the Coaching and Mentoring Hall, students can click on a Module of the course to get coaching. Information about assignment grading criteria and requirements are provided in this room, along with other helpful coaching and mentoring. When they enter an assignment information room for a specific assignment, the page provides them with written information and requirements for the assignment. Within the text are links to PDFs of actual, previously graded assignments with comments and grading bubbles, used with the permission of the student and all references to the student's identity removed. Accompanying the PDFs are links to audio or video streamed presentations of the professor explaining the grading criteria and assignment information.

Choice of Amount of Skills to Practice

The course enables students to customize their learning experience by allowing them to choose how much practice they need to learn the skills taught in the course. Students can choose between two streams of homework, required and optional. Required homework is completed online in the Submit Homework Room. Answers to required homework are posted in the Coaching and Mentoring Hall after the due date. Also, video streamed presentations of the professor taking up the homework, including a student question-and-answer period, are provided as downloadable audio and video podcasts through iTunes, or webcasts that can be viewed on a PC or Mac. Extra, optional homework is provided in the Coaching and Mentoring Hall, with all the answers also available. (For print screens, see Appendix10: Submit Homework Room, Appendix 11: Sample Homework from Submit Homework Room, and Appendix 12: Required and Optional Homework from Coaching and Mentoring Hall.)

Choice to Effect Changes to the Course-in-Progress

The course uses Ombuds Buddies as a central way to allow students to effect changes to the course while it is in progress. Zorn's aim is to do whatever she can to ensure that students have a voice in the course, and, when possible, to make changes to the course before it is over. (Students are informed that there are some aspects of the course that simply cannot be changed 2 weeks after the course begins without violating Senate Policies.) It is Zorn's hope that students will feel comfortable enough to contact her directly with

concerns, complaints or suggestions for change. If, however, students would like to remain anonymous, they can use one of the course's Ombuds Buddies. These are students who pass messages anonymously from other students to Zorn. To ensure that the student learning experience is enjoyable and the best that she can offer, Zorn asks for volunteers in the class to be Ombuds Buddies. Students are informed that Ombuds Buddies are not Teaching Assistants, and that they will not answer questions about course material, but rather only handle concerns, complaints, or suggestions. Within the Basic Information Centre is a Contact an Ombuds Buddy Room. Also, the web site includes a dedicated discussion room that both Zorn and the TA have promised not to enter, called Post Questions & Comments for Students—Prof NEVER Looks Here. There may be issues and concerns being discussed in this room that Zorn can respond to. An Ombuds Buddy will anonymously forward such concerns.

Here are three concrete examples of issues forwarded by Ombuds Buddies that resulted in changes to the course. In one case, students found that one question on a test was too hard, simply pitched at a higher skill level than had been addressed before the test. Many students emailed Ombuds Buddies who in turn informed Zorn of the concern. Zorn then consulted with the TA, course instructors of other sections of the same course, and the Area Coordinator. The general view was that this one question had been too difficult. Zorn dropped the question from the test. In a second example, students emailed the Ombuds Buddy because they felt that during one part of one Module the course material was being covered too quickly, moving too fast. Zorn was able to provide video streamed presentations reviewing material in the Coaching and Mentoring Hall, and she extended the due date of the corresponding assignment that tested these skills. A last example concerns the choice of how much practice, in the form of homework, students wanted in doing the skills they were learning. In the most recent version of this course, students emailed the Ombuds Buddies, distressed that there was far too much homework. Zorn addressed this concern by adding two streams of homework, required and optional. Students were then able to customize their learning experience and make choices about how much practice they preferred.

PROMOTING DEEP LEARNING IN AN ONLINE TEACHING-AND-LEARNING COURSE

Our course addresses the problem of how to connect deep learning and e-learning. It shows how deep and durable learning can be achieved in a fully online, rich-media learning environment that uses WebCT (Blackboard), video streaming or webcasting, and video and audio podcasting. We do not advocate the use of technology for its own sake, a view in keeping with the conclusions of a study that answered the question "what do faculty want?" (Chizmar & Williams, 2001): "Faculty want instructional technology driven by pedagogical goals" (p. 19).

The biggest pedagogical challenge in creating this course has been to ensure the deep learning of skills. The course is almost entirely skills-based, rather than content-based. When the course was being designed, many faculty members expressed concerns about two common myths that needed to be debunked: first, that only content, not skills, could be taught online; and, second, that certain subjects could not be taught online, such as critical thinking, conceptual analysis, and argument analysis.

One faculty member had twice previously attempted online versions of this course. He had then thrown his hands up and the air and said, "These skills cannot be taught online." His attempts, however, were made before video streaming, podcasting, and advanced Internet technologies.

The courses he had developed were two versions of an online Modes of Reasoning course. The

first was offered five times: 2000/2001, 2001/2002, 2002/2003, summer 2003, and 2003/2004. Each online section had an enrollment of between 60 and 80 students and each was offered in conjunction with a separate in-class section offering the same course material. Students enrolled in the in-class version had access to all online materials. Demographically—in terms of number of years in their program, grade point average, age, and how far along they were in university—there was no difference between the students in his online and in-class sections. The course was delivered in Lotus' Learning Space without the added advantage of recently developed rich-media approaches. The faculty member wrote all of the lectures and provided them to the students as PDFs. No audio or video elements were used. The course, designed without interactive elements, involved some asynchronous discussion and a lot of reading of documents that the faculty member had spent many months writing. The faculty member stated that this early online version fell short of meeting the learning objectives.

The same faculty member later developed a hybrid version of his original design to address problems with the course. The hybrid section was offered once in the summer 2004. In this version, students attended two classes a week for 12 weeks; each class was 3 hours in length, one in-class and one online. They met once a week rather than twice a week. Students also attended an in-person, 3-hour, inaugural workshop at the beginning of the course. Less than half of the students enrolled in the class attended this workshop. The faculty member stated that the hybrid section worked slightly better, but not well enough.

Video streaming, podcasting, and advanced Internet technologies solved the problems faced by this faculty member in the two earlier versions of his course. In the remainder of this section, we discuss the ways in which these technologies enabled deep learning of skills.

A Definition of Deep Learning

Weigel's (2002) model of depth education outlines the clear differences between deep and surface learning. His explanation, adapted from Noel Entwistle's (2001) research on assessment to promote deep learning, states that deep learners:

... relate ideas to previous knowledge and experience... look for patterns and underlying principles... check evidence and relate it to conclusions... examine logic and argument cautiously and critically... are aware of the understanding that develops while learning... become actively interested in the course content. (Weigel, p. 6)

On the other hand, surface learners:

... treat the course as unrelated bits of knowledge... memorize facts and carry out procedures routinely... find difficulty in making sense of new ideas presented... see little value or meaning in either courses or tasks... study without reflecting on either purpose or strategy... feel undue pressure and worry about work. (Weigel, p. 6)

Deep learning is rooted in conditionalized knowledge that specifies use contexts, metacognition that involves monitoring and reflecting on one's level of knowledge, and communities of inquiry or practice.

Cognitive Apprenticeship Learning

Cognitive apprenticeship (i.e., traditional apprenticeship learning applied to thinking or cognitive skills) is the learning methodology best suited to achieve the aims of deep learning (Weigel, 2002). Van Weigel (2002) has set out six teaching practices and course design strategies that facilitate cognitive apprenticeship (Collins, 1991; Collins, Brown, & Newman, 1989) in online learning environments: modeling, coaching, scaffolding, articulating, reflecting, and exploring (Weigel,

2002, pp. 10–11). Below we discuss the ways in which our course design and pedagogy illustrate the first three methods.

Modeling. When it comes to teaching cognitive skills, modeling—showing someone how something is done—is necessary for deep learning. Consider the skill of playing golf, for example. One cannot teach golf without showing learners how to position their hands on the golf club, how to take a proper swinging stance, how to plant their feet on the ground, and so on. Modeling cognitive skills such as concept and argument analysis involves "the externalization of internal cognitive processes" in which "the teacher puts her mind on display, walking her students through her approach to a problem making explicit the internal steps she took and strategies she used along the way" (Weigel, 2002, p. 10).

Video streaming technology makes this possible. It is thus a central way to achieve modeling in online learning environments. In our course, the rich-media capture technology, Mediasite, facilitates the creation of searchable, self-paced webcast presentations that are synchronized with PowerPoint slides, live Internet, or a doc-cam projector (a projector with a built-in document camera). Using this video streaming technology, Zorn has been able to demonstrate a step-by-step process of concept or argument analysis captured as a live and video podcast or presentation.

Coaching. In coaching, an instructor observes students in the classroom and gives feedback for improvement. Van Weigel (2002) notes that:

... whereas modeling emphasizes the student's role as observer, coaching requires teachers to observe students in the performance of some task or skill (usually in the context of problem solving) and to ask questions or to offer feedback on the student's performance. (p. 10)

Video streaming technology has enabled Zorn to coach students in several ways. For example, she sometimes provides students PDFs of graded homework with comment bubbles and an accompanying webcast of her taking up the homework on a doc-cam projector. Rich-media capture technology, Mediasite, has allowed Zorn's image and voice to be synchronized with a doc-cam projector of the homework. Mediasite's seek-and-search capability has made it easy for students to review only the sections that need attention, thus maximizing their study time.

Scaffolding. Scaffolding refers to the various ways that a teacher and a learning community help in the construction of knowledge; for example, hints and aids built into the curriculum designed to help students complete a task. The WebCT platform (Blackboard) has allowed Zorn to provide her students with a Coaching and Mentoring Hall on the course website's home page, containing video streamed presentations and podcasts of assignment information, grading criteria, and much more. Also, in order to avoid any "creepy treehouse effect" (flexknowlogy, 2008), Zorn set up a Facebook user group for students of the course to use as an alternative meeting place.[1]

The course also provides scaffolding with a Technology Training Hall. The following text on the home page describes this area:

Welcome! You have entered the lobby of the course Technology Training Hall. As the course instructor, I realize that I cannot erase social, political, and economic inequities among the students in this course. I also realize that despite my most democratic intentions, not everyone will feel comfortable in this course. Given these two provisos, there is something that I can do. I can make sure that everyone in the course knows how to use the technology. That is what this room is all about. Click on the icons below to learn how to view and use the lecture and site technology fully and to your advantage.

The Technology Training Hall includes video streamed presentations—including classes, workshop sessions, coaching and mentoring messag-

es—on how to view and use the video streaming technology in the most beneficial ways. Students learn how to slow down or speed up the viewing speed. Slowing down video streamed presentations is advantageous for ESL students. Speeding up the video streamed presentations is helpful for digital learners who wish to multitask by viewing the presentations in less time. Students also learn how to use the Slide View function of the Mediasite video streaming technology for review purposes. To view the instructor talking about a specific slide or captured image, they can select a particular PowerPoint Slide, doc-cam projection, or live Internet capture.

The Technology Training Hall also includes an online code of conduct, information about how to subscribe to the course RSS feed through iTunes, how to join the Facebook user group, and how to use Second Life, 3D virtual technology (to meet with Zorn's avatar), a graphic representation of a person, or another student's avatar, in the Modes of Reasoning Building in Second Life. Once in this building, students can discuss course material and issues while sitting in comfortable chairs in a glass building with a view of water.

The Hall also includes a Troubleshooting Problems with Technology video streamed presentation that discusses possible problems that students may encounter using the technology and how to avoid these problems. The Hall also provides a video streamed presentation of Zorn explaining how to use basic WebCT (Blackboard) course features. Free plug-ins are also provided in the Hall, such as Adobe Acrobat, Media Player, and PowerPoint Viewer.

Teaching Against Prevalent Values and Educating for Social Change

The features of our enactive online learning environment discussed in the above sections point to the ways in which an enactive approach can educate for social change. These features in combination educate against the fundamental and prevalent values underlying the culture of higher education that desperately need changing: aggressive competitiveness, scholarly isolation, lack of mentoring, and valuing product over process (Damrosch, 1995).

Our customizable learning environment includes the following features:

- choice of mode of delivery;
- addressing of different learning styles;
- choice of amount of skills practice;
- choice to effect change to the course in progress;
- promotion of deep learning through cognitive apprenticeship learning, via coaching, modeling, scaffolding, articulating, reflecting and exploring; and
- foundational mentoring, including a Coaching and Mentoring Hall, video streamed welcome, coaching and mentoring messages throughout the site, coupled with dedicated asynchronous and synchronous discussion rooms and a Facebook user group.

Our use of video streaming, podcasting, WebCT (Blackboard), and advanced Internet technologies encourages behaviors and teaches values that promote social change by demonizing scholarly isolation, exiling aggressive competitiveness, valuing the learning process over the learning product, and embracing mentoring.

We are most proud of the mentoring and reciprocally adaptive course features that create comfort, collaboration, and community. Foundational mentoring features include video welcome messages on the home page, coaching messages throughout the site, modeling of expectations, skills, and practices in the form of sample assignments and homework, grading criteria videos, and a private discussion room dedicated to students only. The reciprocally adaptive features of the course include Ombuds Buddies and the ability to respond to information (metrics) gathered by

Mediasite technology. For example, Mediasite enables the instructor and technologist to see which lectures have been viewed more often, enabling us to change the course in response to students' needs. The organic fluidity and adaptability of this course structure has necessarily encouraged and strengthened the experience for student, technologist, and instructor alike, allowing the course to evolve in progress.

As well as contributing to the improvement of the culture of higher education, our innovative course improves the quality of education by going far beyond what is possible in a conventional classroom, through mobile learning and the students' ability to customize their learning environment and learning style.

THEORY BEHIND THE DESIGN AND PEDAGOGY

In the latter part of this chapter, we outline the theory behind our practice, drawing on our course to illustrate enactive online teaching-and-learning.

Teaching and Design Values and Behaviors That Need Changing

A starting point in our discussion was the following headline that appeared in the *Toronto Star*'*s* online news source on April 6, 2009: "Profs blast lazy first-year students: Wikipedia generation is lazy and unprepared for university's rigors, survey of faculty says" (Rushowy, 2009). The headline suggests that facing current and future challenges may be like climbing a greased pole, to borrow Donna Haraway's phrase (1991, p. 188). Rushowy's key points are that college and university professors feel their students are less mature, rely too much on Wikipedia, and "expect success without the requisite effort." In their view, a decline in student preparedness began years ago but has more recently accelerated. Rushowy (2009) quotes several instructors who all agree that wider social issues, possibly the fault of the students, underlie these themes. One instructor said: "We are basically trying to deliver a quality education on our campuses for a cohort of students who need extra attention to succeed." A fourth-year undergraduate student who worked at a library at the University of Toronto reports that "many students can't even ask for help. Partly, it's generational, the attitude and sense of entitlement they have." A faculty member said: "What the questionnaire reveals is a serious challenge that we are facing in the system. We are teaching students from what is basically an under-resourced secondary school system."

In presenting views about limited educational resources or a decline in student preparedness, Rushowy (2009) offers one defensible interpretation of the results of the questionnaire. We offer an alternative view. Rather than attributing the problem to lazy students and an under-resourced secondary school system, we would like to shine a light on the following fundamental and prevalent values underlying the culture of higher education that desperately need changing: aggressive competitiveness, scholarly isolation, lack of mentoring, and valuing product over process (Damrosch, 1995). Damrosch (1995) traces these shared learned values and behaviors to the birth of the university in the Middle Ages. He argues that

> *... much of this stability results from the university's ability to change constantly at a local level while varying little in many basic ways, so that contemporary concerns can coexist with very archaic procedures and values. Sedimented levels of history overlay one another, punctuated by igneous extrusions from the deep past. (p. 18)*

Limited resources and budget cuts are seasonal: they come and go, depending on the health of the economy. But the shared values and collaboratively learned behaviors that are most relevant to the problems identified in the star.com article, and that have the most significant impact on teaching, learning, and creativity in North America, are the ones Damrosch (1995) mentions.

Confronting Habits of Inattention

These "holdover" (Damrosch, 1995, p. 18) values from the Middle Ages currently contribute to what Megan Boler (1999, 2004) calls " inscribed habits of inattention" (Boler, 1999, p. 180) in online teaching-and-learning. Course design and teaching practices in online learning environments reflect these taken-for-granted, shared, and collaboratively formed values and behaviors. Habits of inattention are learned ways of seeing and acting that can prevent one from seeing differently. They direct one's perceptions and actions, and limit one's ability to respond to students' needs in online learning environments. These are fundamentally emotional habits, driven by the avoidance of feelings of discomfort, feelings that most North Americans are simply not skilled at staying with, such as fear, disappointment, and uncertainty (Chödrön, 1997, 2001; Epstein, 1995, 1998; Hanh, 2005; Watts, 2000). Unfortunately, for the most part, North Americans are trained to run and hide from these unfamiliar feelings of discomfort when designing online learning environments. The authors had to use practices of mindfulness awareness to notice our habits of inattention in design and teaching and to stay with our discomfort in order to enable student-centered, highly participatory, engaging e-learning environments that would promote deep learning while educating for social change.[2]

Our enactive approach to online teaching-and-learning began by practicing unlearning emotional habits of inattention, through: befriending the fear of the unfamiliar, and living the assumption that rich media (i.e., online learning environments using advanced Internet technologies) can take us far beyond what is possible in a conventional classroom; staying with the uneasiness of not being the expert, to enable collective learning and to let a space for power to emerge from deep and durable learning methods that blur the lines between learner, instructor, technologist, and technology; and staying with and noticing the fear of losing control and of uncertainty, in favor of what is happening: emergent, collective teaching-and-learning.

For example, we have had to notice and practice unlearning certain ways of seeing and acting concerning online learning environments that had become obstacles. Three such habits of inattention are the association of high-quality learning with the in-class experience; the disassociation of teaching and research; and the tendency to see online learning environments as *created* or *constructed*. We discuss these emotional habits below.

Habit of associating high-quality learning with in-class courses. First we had to learn to let go of associating high-quality learning and the in-class experience. This habit can be expressed in the idea that "good" online learning environments are ones that replicate the in-class experience (Twigg, 2001), for example. We found that the emotional element of this habit was located in fear of the unfamiliar, and the profound need to feel that we are on safe ground as teachers. Twigg (2001) observes that "the problem with applying old solutions to new problems in the world of online learning is that these applications tend to produce results that are 'as good as' what we have done before" (p. 4). Only by letting go of this expectation were we able to practice new approaches that went beyond producing *no significant difference* between online teaching-and-learning and teaching-and-learning that takes place in a physical classroom. To paraphrase Twigg (2001), our focus shifted to what we could do with technology that we could not do without it (p. 9). We have needed to broaden our idea of a "high-quality" learning experience to mean greater individualization of learning experiences for students. The best e-learning environments would no longer begin with the thought "all students need..." We have learned that video streaming, podcasting, and advanced Internet technologies such as social networking sites, wikis, and blogs, can meet the needs of diverse students when, where, and how they want to learn. Living this habit of inattention

could have prevented us from seeing that advanced Internet technologies could take online learning environments far beyond what is possible in a conventional classroom.

Habit of disassociating teaching and research. A second habit of inattention we have confronted is the disassociation of teaching and research. The emotional core of this habit, we have found, is an unhealthy attachment to power and the fear of being found out as an impostor—the fear that we don't know what we are talking about. The habit of bifurcating research and teaching leads to favoring a "banking" model of education, which views instructors as exclusive experts who deposit information in students' heads (Freire, 2003, pp. 71–86). The banking model, ineffective at promoting deep, durable learning, works even less effectively in e-learning environments. High-quality online learning environments call for instructors to employ cognitive apprenticeship models of education that require instructors to coach, mentor, facilitate, and model learning (Weigel, 2002, pp. 9–11). This tendency towards a false dilemma between research and teaching is an obstacle to creating e-learning environments that are highly participatory and that promote deep rather than surface learning (Weigel, 2002, pp. 5–6)

Habit of seeing online courses as constructed. A third habit of inattention is the tendency to see online learning and community as created or constructed. The emotions associated with this habit, we have discovered, are uncertainty and the fear of losing control. The habit is grounded in the idea of the "clockmaker hypothesis," the notion of a godlike instructor who must directly intervene to create the online learning environment because the complexity of e-learning and online communities requires it. Afterwards, according to this hypothesis, the creator steps aside, only acting to maintain the universe he created, perhaps repairing various mechanisms and replacing parts. This habit of inattention perpetuates the false idea that e-learning environments are mechanistic, rather than the complex, dynamic, and self-organizing systems they are—a view that is founded in a misconception of the activities of teaching and learning.

REPLACING SELF-ACTION AND INTERACTION WITH ENACTION

In the remainder of this chapter we discuss the ways that our innovations in online teaching and course design have been enactive, rather than self-active or interactive.

The enactive approach is a form of collective, emergent teaching-and-learning and a technology innovation and design that redefines our concept of learner, educator, technologist, and technology. No longer are these roles we can occupy only one at a time. In fact, we are all these things simultaneously, and only by allowing all the relationships to exist simultaneously do we foster a truly enactive learning environment that can promote deep learning and social change.

Traditional lines that demarcate these roles are blurring, opening up the possibility to experience something new and genuine. Letting go of the model of interactive education and embracing an enactive approach can create an unsettling feeling as the ground constantly shifts; but the possibilities are boundless, as we position ourselves to engage simultaneously from all perspectives. This synergistic growth can be empowering. More importantly, staying with the discomfort and uncertainly of this shifting ground allows the roles of learner, educator, technologist, and technology to dynamically, reciprocally, evolve.

The broad enactive perspective (as discussed in Bateson, 1979, 1987; Johnson, 1987; Lakoff, 1987; Lakoff & Johnson, 1980, 1999; Maturana, 1975, 1980; Maturana & Varela, 1980, 1987; Varela, 1987; Varela et al., 1991) has helped to put self-organization, emergence, complexity, autopoiesis, non-linearity, dynamical systems theory, and a new conception of embodiment, experience,

and ethics at the forefront of educational theory, research, and pedagogy.

Enactive online education fundamentally rethinks what it means to learn and think. Davis and Sumara (1997) present an enactivist model of cognition and contrast it with popular notions that pervade formal education. They cite the example of a year-long study in a small, inner-city elementary school to illustrate this model of cognition. They argue that cognition does not occur in individual minds or brains, but in the possibility for shared action. They suggest that an enactivist theory of cognition requires teachers and teacher educators to reconceive the practice of teaching, by blurring the lines between knower and known, teacher and student, school and community. They explain that "learning might be better understood as mutually specifying, co-emergent, pervasive, and evolving practices that are at the core of our culture's efforts at self-organization and self-renewal" (Davis & Sumara, p. 123).

Davis and Sumara understand learners as reciprocally intertwined with and emergent from relationships with others and their world or environment. With reference to a question about fractions posed to a group of 12-year-olds, Davis (1995) shows that mathematical knowledge is "simultaneously about the dynamic co-emergence of knowing agent-and-known world, of self-and-collective" (p. 8). He uses the enactive concept of "structural coupling" and complexity theory to argue that mathematical knowledge is neither subjective nor objective, but rather emerges out of shared action. It is neither a process nor a product; rather, the two are inseparable. Davis explains that "mathematical knowledge is like the subject matter of a conversation. It exists only in conversing, and its nature, its structure, and its results can never be anticipated, let alone fixed" (p. 4). Enactive education requires a theory of parthood relations in order to describe and explain "collectivities that arise in the co-specifying activities of diverse, relatively independent, dynamic, and interacting agents" (Davis & Sumara, 2002, p. 425). Davis (1995) draws on an enactive account of selfhood as "tied closely to the co-evolving identities of those around us" (p. 7), and an enactive mereology (theory of the relations of part to whole and the relations of part to part within a whole) in which the whole unfolds from the part and is enfolded in it (p. 7).

The central hypothesis of the broad enactive approach to cognition is that natural cognitive systems are subject to the enaction of a world and mind on the basis of a history of embodied action (Thompson, 1996, p. 128). In this model, the online learning environment and online learning take form as a result of emergent, self-organized processes that span and interconnect students, teachers, technologists, software, hardware, and online resources. The act of knowing involves the complex interplay of brain, body, world, and technology. We do not believe that learning is constructed actively and interactively online, a commonly held constructivist view. We believe that learning, mentorship, discussion, and community emerge over time out of reciprocally evolving relationships between our students, technologies, software, hardware, online resources, the technologist, the course instructor, and the teaching assistants.

The authors see online learning environments as constantly evolving dynamic systems. We view the online course site we created as an open, nonlinear, dynamic system, following dynamic systems theory; it is an area of mathematics used to describe the behavior of complex systems. The course site is "open" in the sense that it is not confined to an interaction between student, teacher, and course materials. It dynamically interacts with its environment; for example, it travels with students on their iPods and MP3 players, and extends from the private learning team/tutorial rooms to students' MSN messaging. Our course constantly reaches beyond the confines of its design and reciprocally evolves via interactions characterized by nonequilibrium, since without

such interaction the course cannot maintain its structure or function.

Our learning environment exhibits self-organization and emergent processes at multiple levels. Emergence involves both upward and downward causation. Instructors and technologists are changed by learners and learners are changed by instructors and technologists. Instructors, learners, and technologists change and are changed by environments. Learning environments are changed by instructors, technologists, and learners. Instructors, learners, learning environments and technologies become inseparably coupled Technologies, software, and hardware evolve through our interactions with them, and so on. The processes crucial for the success of the course cut across technology-student-instructor-technologist divisions.

A central condition for the possibility of online rich-media learning environments that promote deep learning and educate for social change is a new idea of *action*. If we—as technologists, designers, educators, learners, and administrators—are to begin the long, gradual, uncomfortable, and rewarding practice of befriending current challenges, we need to courageously replace the widespread ideas of *self-action* and *interaction* with the notion of *enaction.*

Self-Action, Interaction, and Enaction

Three main ways of understanding the activity of online rich-media teaching-and-learning and the technologies themselves have been *self-action*, *interaction*, and *enaction*. These three main approaches have not all been present from the inception of distance education and the balance of trends in the literature has changed from an exclusive dominance of the self-action approach to a coexistence of all three in contemporary research and practice.

The first concept, *self-action*, underlies the earliest forms of distance education, such as correspondence courses. These were pioneering online courses that employed written lectures and (more recently) audio lectures. The approach saw distance teaching-and-learning as a matter of self-action and correspondingly created distance learning courses that emphasized student self-direction. The assumption was that students learned better when they took control of their own learning. From this standpoint, good distance teaching involved creating an environment and support infrastructure that encouraged student self-action.

Dewey and Bentley (1973) note that the self-action model views "things... as acting under their own powers" (p. 121). The problem with the self-action approach, we now know, is that deep and engaged learning does not happen under one's own powers. As a matter of fact, the most viable cognitive scientific theories about how the human mind operates show that humans learn through sharing and collaboration (Bransford, Brown, & Cocking, 2000; Fischer & Immordino-Yang, 2008). This research supports the view that online teaching-and-learning cannot originate from self-action, but rather must emerge from a reciprocal, mutually codetermining relationship between a brain, a body, and a world; between educators, learners, technologists, and technology.

The second distance education model of action is *interaction*. This view is the most pervasive and well-documented approach in online teaching-and-learning theory and practice. Dewey and Bentley (1973) describe interaction as a system "where thing is balanced against thing in causal interconnection" (p. 121). The interactive model assumes that e-learning has separate constituent parts that "act" on each other to create or construct teaching-and-learning; constituent parts such as learners, educators, technologists, assistants, course materials, and the technologies themselves. Interactivity is seen as leading to learning; therefore, according to this model, the most viable and effective e-learning environments would be the ones that offer the most interactive learning experiences. The main problem with the interactive

model is that teaching-and-learning is not caused or created; rather, it is enacted, and it emerges.

Influences on an Enactive Approach in Education

Dewey and Bentley. *Enaction* sees action as transactive, rather than self-active or interactive.[3] Dewey and Bentley's (1973) concept of transaction has characteristics very similar to the concept of enaction. For these authors, transaction emphasizes the temporal aspect of things in action, where interaction understands things in action as spatial. In transaction, "[a] 'thing' is in action,... [an] 'action' is observable as [a] thing,... [and] all the distinctions between things and actions are taken as marking provisional stages of subject matter to be established through further inquiry" (p. 137). In interaction, on the other hand, things in action are "primarily static" (Dewey & Bentley, p. 137). Thus, in the relationship of organism and environment, interaction presupposes that organism and environment are distinct, "substantially separate existences or forms of existence" (Dewey & Bentley, p. 137).

Concerning the object of knowledge and learning, transaction is a procedure that includes observing the ways that people use language and "other representational activities connected with their thing-perceivings and manipulations" (p. 137). Interaction, on the other hand, assumes that what can be known consists of "little 'reals' interacting with or upon portions of the flesh of an organism to produce all knowings up to and including both the most mechanistic and the most unmechanistic theories of knowledge" (Dewey & Bentley, 1973, p. 137). So, in contrast with self-action and interaction, we could say that transaction sees the activity of online teaching-and-learning as inseparable.

Finally, in terms of inquiry in general, "[t]ransactional observation is the fruit of an insistence upon the right to proceed in freedom to select and view all subject matters in whatever way seems desirable under reasonable hypothesis, and regardless of ancient claims on behalf of either minds or material mechanisms, or any of the surrogates of either" (Dewey & Bentley, 1973, p. 137). By contrast, interactional views are dogmatically asserted, insisting "on establishing its procedure as authoritative to the overthrow of all rivals" (Dewey & Bentley, 1973, p. 137).

Varela. The term *enaction* was first coined by Varela "in the summer of 1986 in Paris when he and Thompson began writing *The Embodied Mind*" (Thompson, 2007, p. 444). Thompson noted that enaction literally means the

> *... action of enacting a law, but it also connotes the performance of carrying out of an action more generally. Borrowing the words of the poet Antonio Machado, Varela described enaction as the laying down of a path in walking: "Wanderer, the road is your footsteps, nothing else; wanderer, there is no path, you lay down a path in walking." (Varela, 1987, p. 63, quoted in Thompson, 2007, p. 13)*

The three interrelated postulates of the broad enactive approach are:

- *Embodiment*. The mind is not located in the head, but is embodied in the whole organism embedded in its environment.
- *Emergence*. Embodied cognition is constituted by emergent and self-organized processes that span and interconnect the brain, the body, and the environment.
- *Self-other co-determination*. In social creatures, embodied cognition emerges from the dynamic co-determination of self and other. (Thompson, 2001, p. 3; see also Thompson, 2007, p. 13)

The enactive approach is a theory of mind, a specific kind of emergence theory, and a method of examining experience (Zorn, 2010). A broad enactive approach (Torrance, 2006) was espoused by Varela, Thompson, and Rosch (1991) and

Thompson (2007). It has its roots in cognitive science; dynamical, non-linear systems; complexity theory; and two phenomenological traditions of direct experience, continental European philosophy and the Buddhist discipline of mindfulness awareness (Thompson, 2007; Torrance, 2006; Varela et al., 1991).

Enactive education has been flourishing in the decade and a half since the publication of *The Embodied Mind* (Varela et al., 1991).

Davis and Sumara. Zorn's (2010) research shows that the enactive approach in education, beginning in the mid 1990s till the present, consists of two successive major phases,[4] which co-exist in the literature today. The first phase, from the mid 1990s till the present, applies the "broad enactive approach," which examines teaching, learning, and education with a focus on what it is to be an agent with an embodied mind and a lived cognition, including a general account of dynamic co-emergence and self-other co-determination. The second phase, from the early 2000s till the present, uses the "narrow complexity view." This phase studies teaching, learning, and education as dynamic, co-emergent phenomena through the lens of complexity theory or science in general, and adaptive, self-organizing systems theory in particular.

The broad enactive perspective in education has the potential to fundamentally rethink the ideas of teaching, learning, curriculum, leadership, epistemologies, and the purposes of schooling (Zorn, 2010). The broad view, most pronounced in the literature from the late 1990s forward, draws on the work of Maturana (Maturana, 1975, 1980, 1987; Maturana & Varela, 1980), Varela (Varela, 1987; Varela et al., 1991), Bateson (1979, 1987), and Lakoff and Johnson (Johnson, 1987; Lakoff, 1987; Lakoff & Johnson, 1980, 1999).

The clearest formulations and strongest argumentation in a broad enactive approach to education are reflected in the work of Davis and Sumara (Davis, 1993, 1995, 2004, 2005, 2008; Davis & Sumara, 1997, 2002, 2007; Sumara & Davis, 1997). Davis and Sumara, along with other enactive philosophers of education, often distinguish an enactive perspective from a social constructivist framework as a paradigmatic interactive orientation (Davis, 1996; Davis & Sumara, 1997, 2002, 2007; Merriam et al., 2007, pp. 291–294; Sumara & Davis, 1997).

Continental European phenomenology and Buddhist psychology. 2We were also influenced in our enactive approach to online teaching-and-learning in our course by the theory and practice of two kinds of phenomenology: Continental European phenomenology and Buddhist psychology (Varela et al., 1991, pp. 217–260). Phenomenology is both a "style of thinking" and a "special type of reflection or attitude about our capacity for being conscious" (Varela, 1996, p. 335) that involves a disciplined examination of human experience and its direct, lived quality. All phenomenological approaches share a belief in the irreducible, fundamental nature and status of direct experience (Varela, 1996, p. 334). The enactive approach, like phenomenology, believes that the body is something that we live directly and that "all knowledge necessarily emerges from our lived experience" (Varela, 1996, p. 336).

Buddhist psychology uses a method of examining experience it calls mindful awareness (Varela et al., 1991, pp. 21–26, 217–260). In our course we embraced mindfulness awareness as a way of examining the online learning experience with the purpose of "becoming mindful, to experience what one's mind is doing as it does it, to be present with one's mind" (Varela et al., 1991, p. 23). This approach requires a constant and vigilant responding, listening and adapting to the online environment. The condition for the possibility of this sort of dynamic change is a letting-go of the need to have complete control over learning environments.

MOVING TOWARDS ENACTIVE TECHNOLOGIES IN EDUCATION

Current technology trends in education can be seen to be grounded in an enactive approach that draws on the three interrelated enactive postulates of embodiment, emergence, and self-other codetermination. With all of the challenges that the world faces from energy, pollution, social justice and sustaining life on the planet, we need to innovate to survive. Innovation simply defined is finding a way of doing something better. Human-technology relations are evolving away from self-action or interaction and towards enaction. Technologies can be seen to be no longer created or constructed, but rather dynamically coemerging with humans. For example, each of the six technologies indicated in *The 2009 Horizon Report* (Johnson, Levine, & Smith, 2009) that will significantly impact the choices of learning-focused organizations within the next five years are enactive technologies: mobiles, cloud computing, geo-everything, the personal web, semantic-aware applications, and smart objects. Tools such as Twitter, Camtasia, Adobe Captivate, and iPhone, among others, and social networking sites, such as Facebook, MySpace, LinkedIn, and others, are best understood as transactive (Dewey & Bentley, 1973, pp. 120–124) or enactive rather than self-active or interactive. These technologies suggest that e-learning is entering an era of enaction. Self-action and interaction are no longer viable ways of understanding or living with these technologies because they are "emergent processes" (Thompson, 2007, pp. 37–65).

The enactive approach to online teaching-and-learning, like the enactive approach as a cognitive-scientific theory, originates from cognitive science, phenomenology, and dynamic systems theory. In this view, the act of knowing emerges from a reciprocal, causal interaction of brain, body, and environment. Mental or cognitive processes are seen as the result of embodied sensorimotor activity embedded in an environment (Thompson, 1999, p. 7). From this perspective students, instructors, technologists, technologies, software, and hardware are inseparable intertwinings that enact each other; they are not independent realms.

Online teaching-and-learning coemerges transactively across complex dynamic systems. User, technologist, and the technologies themselves are codetermined or structurally coupled (Stiegler, 1994, pp. 157–158): "Structural coupling refers to the history of recurrent interactions between two or more systems that leads to a structural congruence between them" (Thompson, 2007, p. 45; see also Maturana, 1975; Maturana & Varela, 1987, p. 75). These relationships are very much like how the human body functions and evolves to adapt to a new environment (as discussed in Thompson, 2007, pp. 37–65). We and the technologies can be seen to coevolve together, a process profoundly different from how we traditionally understand interacting with technology.

Technology is essentially an extension of the human body.

Here are some examples of enactive technologies.

Mobile computing. Hand-held devices such as phones will dominate the personal computing landscape, with enough computing power to complete most average computing tasks. The designs that are being used are adaptive to the user and are becoming ultimately configurable.

Cloud computing. Virtualized computing resources that adapt to the computing required, cloud computing is also self organizing and takes the computing load off the individual.

Geo-everything. Everything can be spatially identified by location on earth and, in turn, relational to everything else on earth. As you move though space you change the dynamic of that relationship.

The personal web. Customized, personal web-based environments that reflect the individual can be created.

Semantic-aware applications. Applications that can relate and adapt to make the ever-growing

data on the web useful and contextual. The value increases with every action.

Smart objects. Smart objects have self awareness and know where and what they are. These devices are adaptive objects that can self-regulate. They bridge the gap between the real world and the digital world. In the future, many household appliances will be "smart," and adapt to our lives.

*A reciprocally adaptive learning environment***.** The technologies and methodologies for the course were applied by developing an experiential design concept. Experiential design simply takes into consideration the factors that influence how the course is experienced on multiple levels. Some of the variables we took into consideration were language, culture, global location, and learning styles.

The original goal was to allow for access and participation—an interactive model. During the design stage we selected technologies and methodologies that were emergent in nature developing the model further, into an enactive model. We worked in partnership with software companies to make changes in the programs to allow for more feedback, so that the software itself could be reciprocally adaptive to the user. This logic spread through the rest of the course design and created fluidity in the design that not only made it adaptive to the user but also adaptive to the Internet environment. Rapid developments and changes in the technologies used with the Internet also forced this flexible design.

Designing a reciprocally adaptive environment was the key element to enable an enactive approach to online teaching-and-learning. During the development of this project at least one of the software companies involved applied a reciprocally adaptive model to developing new products—thereby transforming the company in the process. This enactive approach is now a key strategy that they use to compete in the marketplace.

Human/technology relations. Enactive technologies can be seen as a new type of experience of technology. Ihde (1974, 1979, 1983, 1993, 1990) argues that there are three fundamental ways of experiencing technology that map onto an existential arc of body, interpretation, and otherness: experience *through*, *with*, and *among* technology. When experiencing the world *through* technology, technologies partially extend my bodily or perceptual experience; for example, when a hammer extends my arm by allowing my fleshy hand to drive a nail into a board. When experiencing *with* technology, humans interpret something about the world with technology (telescopes, microscopes, thermometers), and the technology may be experienced as other than oneself, (e.g., a dialogue box appears on our computer screen asking us to save something). When experiencing *among* technology, we are describing the background texturing of our daily lives (e.g., our air conditioning system).

These ways of experiencing technology correspond with three sets of human-technology relations along a continuum (Ihde, 1974, 1979, 1983, 1993, 1990): embodiment, hermeneutic, and alterity. Embodiment relations in which technologies is experienced as a *quasi-me* are at one end of the continuum. Alterity or *otherness* relations, in which technologies are experienced as a *quasi-other*, are at the other end of the continuum. Between the two sets of relations are hermeneutic relations "that both mediate and yet also fulfill my perceptual and bodily relation with technologies" through a reading process of my own (Ihde, 1990, p. 107). Through phenomenological analysis, Ihde showed that perception is embodied through technologies. The wearer of eyeglasses embodies eyeglass technology, or in Galileo's use of the telescope, he embodies his seeing through telescope technology, that is, "the technology is actually *between* the seer and the seen, in a *position of mediation*. But the referent of the seeing, that towards which sight is directed, is 'on the other side' of the optics" (Ihde, 1990, p. 73).

Enactive technologies join both ends of Ihde's continuum to form a circle in which embodiment and otherness intertwine, since enactive technologies emerge from the coupling of unitary structures

of lived-body environments (Merleau-Ponty, 1962, 1963, 1973; Thompson, 2007; Varela et al., 1991).[5] Human-technology relations are entering an enactive evolutionary phase that can be seen to be "taking the *technē* out of technology" (Zorn, 1994, pp. 100–103).[6]

To understand and manipulate the technology/human interface, technology is developing a transparency layer in its complexity, reflecting the rise of the "prosumer." In his book *The Third Wave*, Alvin Toffler (1984) describes the prosumer as both producer and consumer. Technology companies have targeted this prosumer segment of the marketplace and have redesigned the technologies to satisfy that market segment allowing for the technology to change or be customized by the user. As an example, the consumer camcorder has developed to a level that rivals a professional broadcast camera in only a few short years. By giving prosumers access to high-quality technology, many spin-off applications have been developed. The slogan "broadcast yourself" should sound familiar, with over 100 million videos per month being watched at YouTube alone.

The enactive approach to the design and innovation of technology is indicative of the access and customization to the technology that has created a surge in a culture of participation. Henry Jenkins (n.d.) defined "participatory culture" as a culture:

1. with relatively low barriers to artistic expression and civic engagement;
2. with strong support for creating and sharing one's creations with others;
3. with some type of informal mentorship whereby what is known by the most experienced is passed along to novices;
4. where members believe that their contributions matter; and
5. where members feel some degree of social connection with one another (at the least they care what other people think about what they have created).

Not every member must contribute, but all must believe they are free to contribute when ready and that what they contribute will be appropriately valued.

CONCLUSION

This chapter makes four main points. First, habits of thinking and feeling inherited from the culture of higher education are getting in the way of creating viable, high-quality online learning environments. Second, video streaming, podcasting, and advanced Internet technologies have made obvious something that has been true all along: teaching-and-learning is not created or constructed but rather *enacted*. The focus in online teaching-and-learning therefore needs to be on enaction, rather than interaction. Third, an enactive approach can promote deep learning while educating for social change. Finally, current technology trends in education can be seen to be grounded in an enactive approach point, a new kind of human/technology relation.

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ENDNOTES

1 A creepy treehouse is: "... a place, physical or virtual (e.g., online), built by adults with the intention of luring in kids... [or] any institutionally created, operated, or controlled environment in which participants are lured in either by mimicking preexisting open or naturally formed environments, or by force, through a system of punishments or rewards" (flexknowlogy, 2008).

2 Epstein (1995) has observed that mindfulness is a "distinctive attentional strategy" of Buddhism "in which moment-to-moment awareness of changing objects of perception is cultivated" (pp. 95–96). He distinguishes mindfulness from concentration (p. 132) and one-pointedness (p. 95). Concentration involves the "ability to rest the mind in a single object of awareness," whereas mindfulness involves the "ability to shift attention to a succession of objects of awareness" (p. 132). Mindfulness in Buddhist psychology is "the ability to know one's feelings without having to act on them, or be acted on by them, in an unconscious way" (p. xxi). Gendlin's (1978) concept of *focusing* was a Westernized version of Buddhist mindfulness awareness, in which one makes contact with a special kind of internal bodily awareness called a "felt sense" (Gendlin, p. 10), the "body's physical sense of a problem, or of some concern or situation. It is a physical sense of meaning" (Gendlin, p. 69). Focusing, when done properly, leads to "a distinct physical sensation of change" called a "body shift" (Gendlin, p. 7). Gendlin insisted that focusing is not an emotion (p. 10), not a mere body sensation (p. 69), and not just getting in touch with "gut feelings" (p. 69); it is the:... broader, at first *unclear*, *unrecognizable* discomfort, which *the whole* problem... makes in your body. To let it form, you have to stand back a little from the familiar emotion. The felt sense is wider, less intense [say, than emotions], easier to have, and much more broadly inclusive. It is how your body carries *the whole* problem. (p. 69)

3 "Trans," derived from the Latin, means "across," "beyond," or "over." In such words as "transportation" and "transnational," "trans" suggests a covering or stretching over of an entire area.

4 Zorn's characterization of the two major strands within the enactive approach in education was inspired by Steve Torrance's (2006) discussion of the two major strands within the enactive perspective.

5 Essential to the enactive approach is the view of the lived-body environment as a unitary structure. The lived-body environment includes the world beyond the skin and the biological membrane of the organism (Thompson, 2001, p. 2). The lived body is intertwined with the environment and others in an interpersonal, human world, a unitary structure that emerges through the reciprocal interaction of brain, body and environment. Enactive cognitive science described this process as "structural coupling" (Varela et al., 1991). "The brain is structurally coupled to the body, and the body is structurally coupled to the environment" (Varela et al., p. 13). Merleau-Ponty (1968) used the term "intertwining the chiasm" to describe this kind of structural coupling. Recent neurobiological research has a complementary notion. Chiel and Beer (1997), for example, view adaptive behavior as the result of the continuous interaction between the nervous system, the body, and environment. The mind is seen as a

profoundly interwoven system incorporating complicated and highly dynamic aspects of brain, body, and world.

[6] Gadamer (1979) explains the distinction between *technē*, technical know-how, and *phronēsis*, ethical know-how (p. 118).The former refers to the teachable, skill of the artisan and requires the making and executing of a plan. The latter term refers to concerns the unpredictable nature of actions.