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A Development Research Agenda for Online Collaborative Learning

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Abstract

Traditional "basic to applied" research methods have provided an insufficient basis for advancing the design and implementation of innovative collaborative learning environments. What little progress has been made has been accomplished through "development research," "design experiments," or "formative research." Development research protocols require intensive and long-term collaboration among researchers and practitioners. This paper summarizes a development research success story in collaborative learning at an Australian university. The paper continues with guidelines for implementing development research models more widely, and concludes with a prescription for identifying a collaborative learning research agenda for the next five to ten years.

The Vision

The vision of online collaborative learning is compelling. Learners, enrolled in a common unit of study for training, continuing professional development, or the pursuit of an academic degree, will work together online to solve complex problems and complete authentic tasks (Herrington, Oliver, Reeves, 2003). Although they may never meet face-to-face, these highly motivated learners will form strong bonds that encompass productive teamwork, in-depth collaboration, and even lasting friendships. Through intensive engagement in the collaborative solution of authentic problems, the learning outcomes accomplished by these learners will be of the highest order, including improved problem-solving abilities, enhanced communications skills, continuing intellectual curiosity, and robust mental models of complex processes inherent to the performance contexts in which their new learning will be applied.

Another interpretation of this powerful vision can be found at the extensive Online Collaborative learning website (http://musgrave.cqu.edu.au/clp/clpsite/index.htm) maintained by academic staff and students at Central Queensland University in Australia:

> By ***online***, we mean that most learners are likely be geographically isolated, studying perhaps from home, but with full access to all of the necessary resources via their Internet connection. Materials (such as lecture notes) and processes (such as assignment submission) will be electronic, and interaction will be either synchronous (e.g., via chat-rooms or videoconferencing facilities) or asynchronous (e.g., via email or discussion lists). By ***collaborative***, we mean that despite their differing locations, most learners will conduct most of their learning in groups. Such groups are likely to be wholly virtual, in the sense that their component members may never meet face-to-face. They are, however, in all other respects very real, and group members will be highly reliant on others in the group for the quality of their learning. Depending upon circumstances, such groups may be formal or informal, small or large, homogeneous or heterogeneous. In such an environment where most learning takes place via group interaction, the instructor is likely to act more as a facilitator than as an active deliverer of knowledge. By ***learning***, we mean that in group learning environments, less emphasis is likely to be placed on memorization, rote learning, and cramming for examinations, and more on real-world abilities such as communication, problem-solving, and articulation of solutions. This is in line with the requirements of employers, who constantly express the view via surveys that when looking at graduates, they regard real-world skills as being at least as important as content expertise. It is also in line with the desire of instructors and educators, who often correctly form the view that for many students, the priority is to "pass the exam", rather than to learn the necessary skills.

The Reality

Unfortunately, the reality of online collaborative learning is discouraging. There is little evidence that the developers of most online collaborative learning environments have even tried to reach, much less attained, the vision described above (Kearsley, 2000). While proponents of new technologies argue that we need “to break what has been called the credit-for-contact model” (Twigg, 2003, p. 125) of higher education in the USA, most online courses still seek to ensure that students will spend the 45 – 50 hours of academic contact time required in traditional three credit hour semester long courses. A graduate program at my own institution recently graduated its first cohort of students enrolled in its completely online Masters program (http://www.coe.uga.edu/adulted/onlinemasters.html). According to the program's published description, the online curriculum does not differ in any substantive way from the on-campus version. Rather than perceiving the development of an online degree program as an opportunity for innovation, the faculty members involved in this program appear to take pride in simply replicating their pre-existing instructional methods as nearly as possible.

What is at fault for the general failure to design and implement "break the mould" interactive collaborative learning environments in postsecondary education? At least part of the blame can be attributed to the software currently being used to put courses online. Most online courses, including those in the online Masters program noted above, are delivered using commercial course management systems such as Blackboard and WebCT. The "affordances" (Norman, 1988) of these systems tend to promote thinking of online course design as a process of replicating traditional classroom instructional practices such as lecture notes, readings, quizzes, term papers, exams, and the like. When Britto (2002) investigated faculty intentions and student perceptions of the pedagogical dimensions of WebCT, he found that faculty perceived the primary benefits of teaching a course using WebCT were the convenience and efficiency of course administration and management whereas students expressed frustration that the online tools were not employed to support their learning more directly.

In addition, faculty members are not given insufficient time to create completely different designs for online courses, and so they fall back on using the technology to replicate as faithfully as possible the instructional dimensions of traditional courses (Reeves & Reeves, 1997). The time demands of online teaching are hotly debated (DiBiase, 2000; Palloff and Pratt, 1999), but developing an innovative online course surely takes more time than the one semester course release that faculty may be given for such a task.

The Problem

The primary problem seems to be an inability of faculty and instructional designers to think “out of the box” when it comes to developing online courses. Rather than attempting “to make online courses even better than traditional classes” (Twigg, 2003, p. 116), many of the people involved in online course development seem to be content with converting traditional courses into an online format. Moving a course from one medium to another, e.g., from the physical classroom to online, can take different instructional design paths, ranging from attempts to replicate the previous version in the new medium as faithfully as possible to radical changes in the design that take advantage of the unique features by of the new medium. As noted above, the more common approach used in higher education today is replicating the instructional design of traditional face-to-face courses in the online medium (Kearsley, 2000). For example, lectures delivered in a traditional classroom are delivered online via PowerPoint with audio or streaming video, the identical textbook is used both classroom and online versions of a course, and the same multiple-choice exams are used as the primary means of assessment.

A more radical approach would involve moving away from traditional university course activities (lectures, demonstrations, discussions, textbook readings, exams, etc.) to a large scale online simulation in which a single authentic task or project becomes the focus of the learning environment. Herrington et al. (2003) have defined ten design principles for developing and evaluating this type of authentic activity-based collaborative learning environment:

1. Authentic activities must have real-world relevance.

2. Authentic activities must be ill-defined, requiring students to define the tasks and sub-tasks needed to complete the activity.
3. Authentic activities must comprise complex tasks to be investigated by students over a sustained period of time.
4. Authentic activities must provide the opportunity for students to examine the task from different perspectives, using a variety of resources.
5. Authentic activities must provide the opportunity to collaborate.
6. Authentic activities must provide the opportunity to reflect and involve students' beliefs and values.
7. Authentic activities must be integrated and applied across different subject areas and extend beyond domain-specific outcomes.
8. Authentic activities must be seamlessly integrated with assessment.
9. Authentic activities must yield polished products valuable in their own right rather than as preparation for something else.
10. Authentic activities must allow competing solutions and diversity of outcomes.

Weigel (2002) describes another innovative model for online courses that takes advantage of the pedagogical affordances of online learning and advances in situated learning theory (Brown, Collins, & Duguid, 1989). He recommends the construction of virtual, collaborative spaces, called "knowledge rooms" where learners can engage in deep learning, i.e., "learning that promotes the development of conditionalized knowledge and metacognition through communities of inquiry" (p. 5).

In short, good online learning requires more than a mere shift from one medium to another. Instructional methods must be enhanced to take advantage of the affordances of technology. Obviously, this is not an easy transition. Cuban (2001), after analyzing the application of technology in instruction at Stanford University, an elite institution that has had strong technological support for two decades, concluded:

> Dominant teaching practices remained largely constant in the years of greatest penetration of new technologies. Lecturing still absorbs more than half to two thirds of various departments' teaching practices, especially for undergraduates. Seminars, an innovation that was introduced at the turn of the last century, have become integral to graduate instruction and have penetrated the last two years of undergraduate coursework. These traditional forms of teaching seem to have been relatively untouched by the enormous investment in technologies that the university has made since the 1960s. That individual professors of various departments and schools turned to the case-study method, project-based teaching, problem-based learning, and other innovative approaches, using computer simulations and applications, goes without saying. That such faculty constituted a tiny minority of the entire faculty is just as clear. (p. 129)

The Solution

Research is the solution, but not the type of research that has dominated education technology for the past fifty years. Instead, there is an urgent need for development research (van den Akker, 1999) to provide design guidelines for enhancing collaborative online teaching and learning. Unfortunately, most of the existing research continues to compare online courses with traditional classroom courses. The weaknesses of these media comparison studies have been well-documented by Clark (2001) among others.

Recently, Bernard, Lou, Abrami, Wozney, Borokhovski, Wallet, Wade, and Fiset (2003) reported a large-scale meta-analysis of 157 empirical comparisons of distance education courses with face-to-face instruction courses between 1985 and 2003. Although they had found over 1,000 such comparisons in the research literature, the majority of the studies did not meet their criteria for inclusion in the meta-analysis. Earlier reviews have found that such media comparison studies are often flawed by problems such as specification error, lack of linkage to theoretical foundations, inadequate literature reviews, poor treatment implementation, major measurement flaws, inconsequential learning outcomes for research participants, inadequate sample sizes, inaccurate statistical analyses, and meaningless discussions of results (Reeves, 1993). Bernard et al. (2003) did report a very small, but statistically “significant positive mean effect size for interactive distance education over traditional classroom instruction on student achievement” as well as small, but statistically significant, “negative effect for retention rate” (p. 2). They surmised that synchronous communication and two-way audio and video were among the conditions that contributed to effective distance education. These findings obviously do little to specify guidelines regarding the design features needed for online collaborative learning.

Instead of more media comparison studies, we need the type of research that others have labeled “development research” (van den Akker, 1999), “design experiments” (Brown, 1992; Collins, 1992), or “formative research” (Newman, 1990). The critical characteristics of “design experiments,” as described by Brown (1992) and Collins (1992) are:

- addressing complex problems in real contexts in collaboration with practitioners;
- integrating known and hypothetical design principles with technological affordances to render plausible solutions to these complex problems; and
- conducting rigorous and reflective inquiry to test and refine innovative learning environments as well as to define new design principles.

Van den Akker (1999) states that, “Methods of development research are not necessarily different from those in other research approaches” (p. 9). Although this is usually the case, there are major differences between the philosophical framework and goals of these different approaches. Figure 1 illustrates the differences between research conducted with predictive goals and that inspired by development goals.

Van den Akker clarifies the differences illustrated in Figure 1:

More than most other research approaches, development research aims at making both practical and scientific contributions. In the search for innovative 'solutions' for educational problems, interaction with practitioners…is essential. The ultimate aim is not to test whether theory, when applied to practice, is a good predictor of events. The interrelation between theory and practice is more complex and dynamic: is it possible to create a practical and effective intervention for an existing problem or intended change in the real world? The innovative challenge is usually quite substantial, otherwise the research would not be initiated at all. Interaction with practitioners is needed to gradually clarify both the problem at stake and the characteristics of its potential solution. An iterative process of 'successive approximation' or 'evolutionary prototyping' of the 'ideal' intervention is desirable. Direct application of theory is not sufficient to solve those complicated problems. (pp. 8-9)

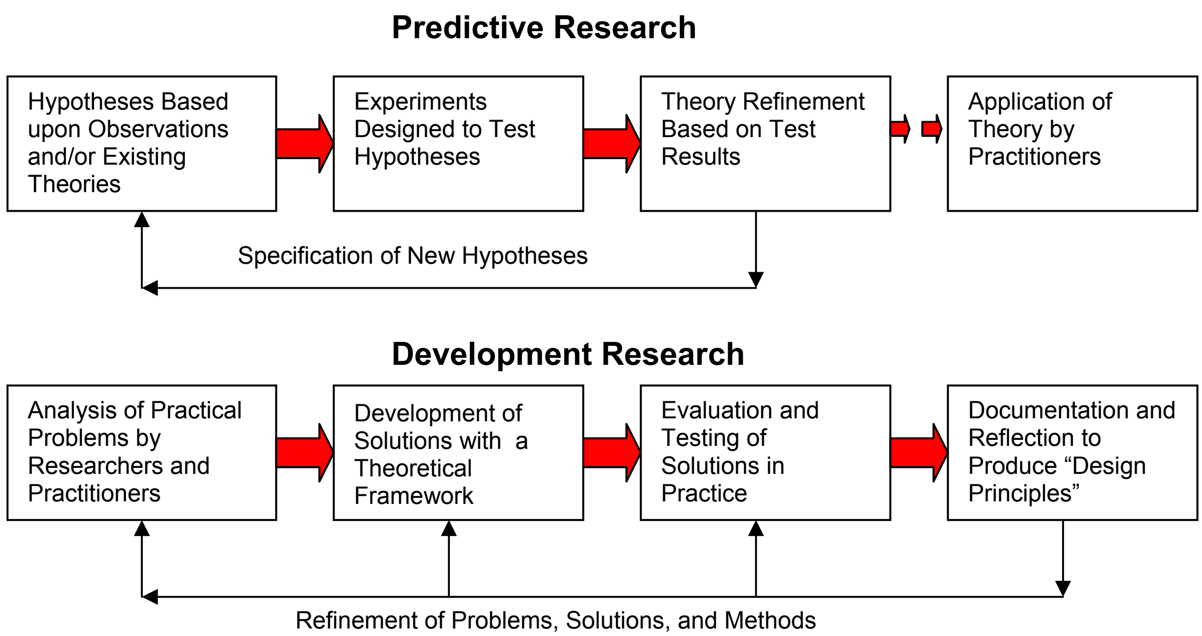

Figure 1. Predictive and development research approaches in online collaborative learning.

Development research:

- Focuses on broad-based, complex problems critical to education,
- Involves intensive collaboration among researchers and practitioners,
- Requires long-term engagement that allows for continual refinement of protocols and questions, and

- Maintains a commitment to theory construction and explanation while solving local problems.

Good examples of development research in the context of online collaborative learning environments are difficult to find. The development activities of Jan Herrington and her colleagues at Edith Cowan University in Australia (Herrington & Knibb, 1999; Herrington & Oliver, 1999) are rare exemplars. The roots of Herrington's development research agenda go back over ten years when she began a doctoral dissertation study that eventually won her the 1999 Young Researcher of the Year Award from the Association for Educational Communications and Technology (AECT). In her dissertation research, Herrington employed a range of innovative investigative strategies, including video analysis of the dialogue between pairs of students engaged in multimedia learning. Her collaborators in this long-term effort to develop and apply a model of situated learning theory included other educational technologists, math educators, and teachers. She not only developed a model of the critical factors of situated learning and instantiated these factors in multimedia learning environments, but also she tested the model and the technological products in multiple contexts, including pre-service teacher education courses and K-12 schools. This line of research had value within the immediate context of its implementation, but it also has yielded generalizable design principles that are being applied in many other contexts.

Herrington's development research agenda is still thriving, most recently focusing on the effectiveness of authentic activities in Web-based learning environments (Herrington, 2002). Working with a team at Edith Cowan University in Western Australia, she developed a *Graduate Certificate in Online Teaching and Learning* that adheres to the guidelines of authentic activity described above. The aim of the program is to assist teachers to have the confidence to design and plan effective online learning environments. The program consists of four courses: *Online Teaching and Learning, Resources for Teaching and Learning Online, Designing Effective Online Learning Environments,* and an *Online Learning Project Unit*. The design of the courses is characterized by strongly student-centered environments, with authentic and contextualized learning tasks in collaborative settings, using integrated assessment strategies and learning scaffolded by teacher support. The courses are designed to be delivered online and to embody a variety of authentic interactive teaching and learning strategies. Recent studies (Herrington et al., 2003; Herrington, Reeves, Oliver, & Woo, in press) have yielded additional insights into the design of online collaborative learning environments.

Is development research the only viable approach to research related to online collaborative learning environments? Probably not, but unfortunately, there is little evidence that the increasing popularity of qualitative methods is improving the impact of the research in this area on practice. Perhaps this can be excused given that the proponents of qualitative approaches make few claims to generalizability. Nevertheless, in light of the poor history of media comparisons studies and lack of transfer of qualitative investigation, it seems clear that if educational technologists wish to advance the design of online collaborative learning, we should pursue development research agendas.

That said, development research is not just for educational technologists, instructional designers, computer scientists, and others in fields most heavily engaged in the development of online collaborative learning. Faculty members in all disciplines can contribute by engaging in the “scholarship of teaching” intended to optimize the roles of human teachers and digital technologies in higher education (Shulman, 2001). Not enough is known about the demands of online teaching on faculty and learners, nor do we understand the most effective alignments of educational objectives, content, subject matter expertise, instructional methods, technological affordances, and assessment strategies for online collaborative learning. Despite a rosy future predicted by some (Duderstadt, Atkins, & Van Houweling, 2002; Pittinsky, 2003), the current state of knowledge in this area is woefully inadequate**,** and research findings to date are often contradictory. We should encourage the active participation in development research and the scholarship of teaching across the entire academic spectrum.

The Agenda

What questions should be pursued over the next five – ten years to advance the state-of-the-art of online collaborative learning. Since 1990, the Campus Computing Project (Green, 2001) has conducted an annual survey of more than 600 colleges and universities in the United States concerning the role of information technology in teaching, learning, and scholarship. According to the summary of the 2001 survey results, respondents across all sectors of higher education identified "assisting faculty integrate technology into instruction" as the single most important IT issue confronting their campuses "over the next two or three years." A recent survey of college administrators (Allen & Seaman, 2003) indicates that a majority of administrators at institutes of higher education "say online learning is just as good as traditional, face-to-face classroom instruction," and "nearly three out of four academic leaders say learning online may be better within three years." Similarly optimistic predictions can be found in recent books authored by a former university president (Duderstadt et al., 2002) and the CEO of a popular course management system (Pittinsky, 2003). But while these and other academic and corporate leaders may see a rosy future for online learning in higher education, professors and their students seem much less certain of this brave new world of the virtual university (Duderstadt, 1999).

Academic staff members are under increasing pressure to design online courses in ways that help students to achieve higher order outcomes such as thinking like experts and developing robust mental models of complex processes. But most of them are unable to accomplish this without substantial instructional design support. Instead of long term support, the best many of them get is a workshop or two on their institution's particular course management system. As noted above, most of the technological features of Blackboard, WebCT, and other course management systems support the presentation of material rather than the engagement of students in solving complex problems or undertaking authentic tasks. This mismatch relates to learning "from" and learning "with" technology (Jonassen & Reeves, 1996).

The foundation for the "learning from" approach is "educational communications," i.e., the deliberate and intentional act of communicating content to students with the assumption that they will learn something "from" these communications. The instructional processes inherent in the "from" approach to using media and technology in higher education can be reduced to a series of simple steps:

1. exposing students to messages encoded in media and delivered by technology,
2. assuming that students perceive and encode these messages,
3. requiring a response to indicate that messages have been received, and
4. providing feedback as to the adequacy of the response.

In contrast, the theoretical foundation for the "learning with" approach is "cognitive tools" that have been intentionally adapted or developed to function as intellectual partners to enable and facilitate critical thinking and higher-order learning (Lajoie, 2000). Examples of cognitive tools include: databases, spreadsheets, semantic networks, expert systems, communications software such as teleconferencing programs, on-line collaborative knowledge construction environments, multimedia/hypermedia construction software, modeling tools, and computer programming languages. In the cognitive tools approach, media and technology are given directly to learners to use for representing and expressing what they know. Learners themselves function as designers using media and technology as tools for analyzing the world, accessing and interpreting information, organizing their personal knowledge, and representing what they know to others.

The "learning from" approach to using media and technology dominates higher education in both traditional and online classrooms. The "learning with" approach appears to be ideal for online collaborative learning and it is being explored in a few innovative projects (Herrington et al, 2002; Schank, 2002). But it is not in evidence in most university courses at this time, online or otherwise. Clearly, development research is needed that focuses on enabling the "learning with" pedagogy within the context of online collaborative learning environments.

Just as development research should be done in close collaboration with teaching practitioners, it should also engage learners themselves in the process. Crook (2002) reported that a survey of students in the UK indicated that while most of them believed that online universities were inevitable in the future, none of them expressed a desire to study at a virtual university, and "many vigorously dismissed the whole virtualization prospect" (p. 155). Meanwhile, many authorities seem to assume that learners will automatically embrace collaborative learning. For example, Duderstadt et al., (2002) write:

> In these new learning paradigms, the word *student* becomes largely obsolete, because it describes the passive role of absorbing content selected and conveyed by teachers. Instead, we should probably begin to refer to the clients of the twenty-first century university as active *learners*, since they will increasingly demand responsibility for their own learning experiences and outcomes. (p. 64)

Will today's "students" easily transform themselves into tomorrow's "learners?" Will the "communities of inquiry" advocated by Weigel (2002) evolve and thrive? Will authentic tasks become integral to online learning environments? These desirable results are unlikely to occur unless students themselves have played significant roles in the design and refinement of online collaborative learning environments though long term development research. This is an ideal task for graduate students in fields such educational technology and computer science, but students in virtually any discipline can and should participate.

A Call for Action

If the hopeful vision of online collaborative learning with which this paper began is to be realized, then we must fundamentally change our methods of research and development. The kinds of design research described by van den Akker (1999) and others hold great promise. But other things are needed. For starters, we must shift from a position that views learning theory as something that stands apart from and above instructional practice to one that recognizes that learning theory is collaboratively shaped by researchers and practitioners in context. Educational technology is a design field, and thus, our paramount goal of research should be solving teaching, learning, and performance problems, and deriving design principles that can inform future decisions. Our goal should not be to develop theoretical knowledge that can be applied by practitioners whenever we get around to throwing it over the walls of the classroom to them. This has not worked for fifty years, and it will not work in the future.

The reward structure for scholarship must change in higher education. Educational researchers should be rewarded for participation in long-term design research projects rather than for the number of refereed journal articles they can publish. Faculty in all disciplines should be provided time for participation in this type of formative research, reflection, and continuous professional development.

Development research demands that faculty members:

- Define a pedagogical outcome and create learning environments that address it.
- Emphasize content and pedagogy rather than technology.
- Give special attention to supporting human interactions and nurturing learning communities.
- Modify the learning environments until the pedagogical outcome is reached.
- Reflect on the process to reveal design principles that can inform future development projects.

Finally, additional financial support is needed for the types of long term development research initiatives called for in this paper. Private funding agencies such as the Alfred P. Sloan Foundation (http://www.sloan.org/main.shtml) and the Spencer Foundation (http://www.spencer.org/) as well as the National Science Foundation (http://www.nsf.gov) and the Australian Research Council (http://www.arc.gov.au/) have funded a large number of projects designed to advance the prospects for collaborative e-learning in higher education. Unfortunately, few of these initiatives have been sufficiently integrated with long-term development research agendas. A special conference should be held to bring together researchers, faculty, students, and others to define a detailed online learning research agenda for the next five to ten years. Funding proposals submitted during that period should clearly align themselves with the goals of this design research agenda. The time for such an integrated approach to development research focused on online collaborative learning is now.

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