INTERNATIONAL JOURNAL OF INSTRUCTIONAL TECHNOLOGY AND DISTANCE LEARNING

September 2005
Volume 2 Number 9

ISSN 1550-6908

PUBLISHER'S DECLARATION

The International Journal of Instructional Technology and Distance Learning is refereed, global in scope, and focused on research and innovation in teaching and learning.

The Journal was established to facilitate collaboration and communication among researchers, innovators, practitioners, and administrators of education and training programs involving instructional technologies and distance learning. The editors and peer reviewers are committed to publish significant writings of high academic stature.

The initial year of publication was funded by the TEIR Center, Duquesne University. The Executive Director of the Center, Lawrence Tomei, served as Publisher. Additional support was provided by DonEl Learning Inc. and freely donated time of the editors and peer reviewers.

Donald G. Perrin
Executive Editor

International Journal of
Instructional Technology & Distance Learning

Vol. 2. No. 9.

ISSN 1550-6908

Table of Contents – September 2005

Editorial

Content and Curriculum

When a friend wants to put up a web page, I ask questions that relate to the business plan. What is its purpose and intended audience? What will attract people to *this* site compared to millions of others? How can you hold attention to get your message across? How do you build a cadre of regular visitors? Who will guide marketing? Who will provide content? Who will lay-out and author the web page? Who will keep content up to date? And how much are you willing to spend?

Many novices think of a web page as a low-rent store with a web address. If the store attracts few visitors, it is a gravestone site, a monument to a dream not realized.

Despite the extraordinary demand for online learning, the same phenomenon may one day apply.

There is explosive growth of courses and programs which means the learner has access to a multitude of options. If a degree or certificate is a commodity – a ticket to apply for a particular job, union, or profession – the easiest, lowest cost, most-accessible program may suffice. If the ultimate goal is a higher degree, upward mobility, or a management position, criteria will include accreditation, reputation and performance of the program, and its ability to place graduates in well paying jobs. Such programs cost more and have strict entrance requirements. They offer better opportunities but with no guarantee of success. Persons seeking first-time employment should request detailed statistics on placement of graduates with no prior work experience.

Reputable institutions of higher learning have links to business, industry, government, health care, and other potential employers. They may even share expertise so that professional courses are taught by leading practitioners and academic personnel have experience in the workplace. Learners may benefit from apprenticeships and workplace experience as part of their professional training. Such experiences may be valuable in securing employment on graduation. Online programs can likewise benefit from employer relationships and internships for students.

Reputable institutions do regular surveys of graduates and their employers to determine the relevance of education and training and ways in which learners can be better prepared. Extensive data is sought from all stakeholders to build *learning organizations* and *communities of practice.* In addition to monitoring programs and curriculum, these groups should inform leadership of social, political, economic and technological changes and innovations that impact curriculum, methodology, recruitment, enrollment, retention, graduation, and placement of graduates.

The traditional process of curriculum assessment, design, production and dissemination requires a cycle of several years. It is not future oriented and is not responsive to disciplines that are rapidly changing. Drucker's *Theory of the Business* looks for congruence between needs of the workplace (environment), programs of the education or training institution (mission), and performance (relevance, quality and effectiveness of curriculum and instruction.) To the extent that any component of this model is mismatched, there is a decrement in performance.

Responsiveness to change is especially important. A Paradigm Shift can invalidate entire areas of knowledge and skill. Educational leaders must be aware of research and innovations that impact their discipline and programs to prepare the next generation of practitioners.

Even a simple web page requires incessant planning. Likewise, education and training must be responsive to changing needs at the speed of the Internet.

Drucker, Peter F. Theory of the Business, Harvard Business Review, September 1994.

Editor's Note: Katrina Meyer confronts us with serious questions about differences between face-to-face and online communications. The logistical advantages of online may be offset by unintended consequences that affect reading habits, analytical skills, vocabulary, how we communicate, and what is learned. Many issues are opened for discussion and provide significant questions for further study.

Exploring the Potential for Unintended Consequences in Online Learning

Katrina A. Meyer

Abstract

The literature is rife with predictions about the potential impact of online learning. What do we know about predicting unintended consequences that might result from using the Internet for educational purposes? This paper reviews several conceptual frameworks that guide those who believe that technology influences who-we-are as humans and what we can become. It then reviews various predictions of unintended consequences that could result from using the Internet for students and their learning, language acquisition and emotional health, their sense of community, control, and self. Another section discusses predictions for the impact of the Internet and online learning on higher education institutions. Several lines of research are described that could provide important "canaries" to warn us of unintended consequences prior to their becoming a reality and a danger.

Introduction

Predictions about the future of higher education run the gamut from disaster to transformation. At one end, Peter Drucker (in Lenzer & Johnson, 1997) wrote that "thirty years from now the big university campuses will be relics. Universities won't survive." At the other extreme are those who declare that technology "changes everything" (Barone & Hagner, 2001; Hughes, 2001). What does such a divergence of opinion tell us? Surely, there seems to be something uniquely human about making predictions, projecting oneself into a dimly seen future. And the divergence of opinions about that future is also the norm, because people have predicted doom as well as transformation for such innovations as electricity, trains, and television. So it should not surprise us if the predictions about the future of online learning in higher education would be similarly diverse.

One purpose for predictions is to warn of dangers and prepare for anticipated changes. Humans seem happier if they think they know what is coming in the future, even if expectations turn out not to be so. The need to predict is also grounded in knowledge that actions often lead to consequences that were not intended. These unintended consequences litter histories with outcomes that no one wanted or expected, but happened as a result of purposeful action. Boudon (1977) called these "perverse effects," which include effects that are negative or positive but which were unintended by the original actors. Further action may neutralize one perverse effect but also eliminate desirable effects as well as cause new perverse effects. The point is that while perverse effects happen even though they are unintended, such consequences can and should be anticipated or foreseen if time and attention are paid. In fact, Karl Popper once claimed that the "main task of the theoretical human sciences . . . consists in identifying the non-intentional social repercussions of intentional human actions" (Boudon, 1977, p. 1).

An Approach

The goal of this work is to identify consequences of the movement toward online learning, but to go beyond facile fears or boisterous boosterism to an evaluation of emerging research results or theoretical propositions. It will ask questions about what these results may mean for higher education and student learning. If this work has value, higher education may be able to craft its own "canary in the mines," which refers to the canaries miners would take into the shafts to warn them of the presence of poisonous gases and alert them to exit before their own lives were in danger. Higher education's canaries could include measures devised to provide early detection of unwanted consequences as well as research programs that will identify positive consequences that can be nursed and expanded.

The issue is not whether online learning is a good idea or not; it is here and there is every indication that it provides worthwhile benefits and opportunities for learning. The issue is whether thoughtful individuals can project beyond the obvious changes it brings to those secondary or even tertiary changes that might occur as a result of its use. It may be that these unintended consequences are both positive and negative. And the positive gains may certainly outweigh the negative. In either case, it would be wise to find ways to identify, eliminate, or mitigate the negatives to ensure that the miners survive. But the first step is finding the right canary.

Definitions

Two definitions will provide a direction for this work. First, "unintended consequences" may be either positive or negative, although the popular usage tends to focus on negative or "perverse" effects. The crucial characteristic of the consequence is its unanticipated or unintended quality. Second, "online learning" will be used to mean uses of the Internet or the web to deliver or enhance learning, be it entirely at a distance or partially on campus.

Conceptual Framework

Six important concepts ground this work. First, the Internet has been called a "disruptive innovation" (Christenson, 1997; Duin et al., 2001; Meyer, 2005), a technology that has already changed definitions, roles, and even institutions. And because online learning uses the Internet, it may be implicated in the same types of disruptions attributed to the Internet (see Archer, Garrison & Anderson, 1999). What makes the Internet or online learning "disruptive?" It is disruptive because former rules or skills may not be helpful in managing the innovation and may even result in counterintuitive outcomes. When former assumptions or rules do not work as intended, the result could well be an unintended consequence.

Second, Tenner (1996) calls an unintended consequence a "revenge effect," which is particularly endemic to technologies. This is because complex systems cannot be completely mapped and it is impossible to test all possible occurrences (p. 16). Flaws will occur. Tenner also proposes that technology alone "usually doesn't produce a revenge effect. Only when we anchor it in laws, regulations, customs, and habits" (p. 9) is a revenge effect likely to occur. From Tenner (1996), we can know that complex systems and the application of inappropriate regulations or practices to technologies may be more likely to lead to unintended consequences.

Third, a related point about complexity has been made by Burbules and Callister (2000), but it focuses on the point-of-view of the evaluator. In an assessment of means and ends and what is good and bad, the "inseparability and interdependence of many consequences should begin to shake the faith that such determinations can be so readily made . . . the very same effects can be regarded as 'good' or 'bad,' depending on other considerations, or when evaluated by different people" (p. 12). In other words, complex systems are both difficult to unravel but even more difficult to evaluate consistently. This is a cautionary note to any analysis of unintended

consequences, because judgments about the value and impact of the consequence can be inconsistent and contentious.

Fourth, Postman (1993), never a fan of technology, expressed a fear that people will become "tools of our tools" (p. 3). In this view, which owes much to Marshall McLuhan, he worries that an important unintended consequence may be how technology changes our selves and our relationship to our creations. In this sense, humans are products of media (Levinson, 2001, p. 183). Gurak (2001) goes further: "How we view the world and how we live in it are being shaped by the features of these new technologies" (p. 10). However, it is also important to realize that technology is programmable and malleable: "We build our biases into technology, and we bring our social conditions into online space" (Gurak, 2001, p. 64). In other words, what is attributable to the tool or to the software built into the tool may be difficult, but necessary, to unravel.

Fifth, what makes unintended consequences of technology frightening to some is that we are blind to its effects (Levinson, 2001). Something is happening to us and our relationship to technology without our knowledge or approval; some people feel like victims, helpless to control changes they can't identify. This is one of the reasons why work on unintended consequences is important, to allay fears and to help individuals feel they have control over their tools.

Sixth, let us finish on a more positive note. "New tools cause people to imagine new purposes" and change "people's understanding of what they can do, what they want to do, what they think they need to do" (Burbules & Callister, 2000, p. 10, 13). New tools allow us to imagine new forms of success and new definitions for success as well. Thus, it is legitimate to look for positive unintended consequences to online learning, especially those that free individuals from the past and that allow new, never-before-imagined futures to become possible.

The sections that follow will explore possible unintended consequences from the use of online learning on students and their learning, and on higher education generally. (Additional topics that are not included in this paper could address consequences for faculty, the impact on student services and administrative functions, or society as a whole). It is important to consider these projections to be tentative and legitimate only to the extent that they generate a need to design an appropriate canary to warn us if danger is nearby. In fact, as further research is done, these projections ought to be reevaluated and modified, made less urgent or more so. This is clearly a work in progress, one that will require additional work before we can sleep soundly that possible negative consequences are adequately and fairly identified and all canaries are in their appropriate places.

Effects on Students and Learning

Writing, Reading, Literature and Language

Much has already been written about the effects of the Internet on students' writing and reading skills. With email, chat rooms, discussion threads, and web authoring, students are writing a great deal and some research supports that this experience is improving their writing. That in itself may be thought a good outcome, but what is not clear is whether the writing done on or for the web is different in some fashion. For example, Weinberger (2002) has said that email is both like mail (it is typed, then sent) and like a conversation (p. 13). Perhaps online learning's uses of writing are more like a conversation than a sustained argument or college paper. In that case, there is a straightforward solution. College courses offered online may need to make expository writing a requirement of the course and provide instruction on this type of writing so that college students can write both for the chat room and the term paper. In other words, perhaps the impact online learning will have on students' writing skills has more to do with how the course and learning objectives are designed than the web in and of itself.

Birkerts (1994) has argued passionately that reading is in danger as a result of the ascendance of the web. Technology will "render the book antiquated" (p. 17) and students already cannot read dense prose, archaic diction, allusions, irony, or "pretentious" vocabulary (p. 19). This is a concern because how we receive information "bears vitally on the ways we experience and interpret reality" (p. 72). Thus, the issue is not only reading *per se*, but how such a loss might affect college students' ability to understand reality. These are serious charges and worthy of exploration and more formal research and study.

The more pertinent issues for online learning is whether reading online is different and how. Perhaps hypertext (the linking of information on one web page to another) and hypermedia (adding sound and visuals to online text) do make the reading experience different. Perhaps hyperlinks make nonlinear and nonsequential thinking more easy to do. Perhaps the lack of permanence of online text creates a different experience than would a paper text; perhaps a text that moves as you scroll is different than text that stays put on a page while your eyes move; perhaps "deep reading" (another Birkerts term) isn't possible or perhaps it is. Perhaps the word on a page is actual and permanent and fixed and perhaps the word on a screen is provisional and floating (Birkerts, 1994, p. 155-157), and perhaps this makes a difference to students' perceptions of the world. These are good examples of Kipling's "technology in repose" (in Postman, 1993, p. 138), which effects changes without our awareness. In any case, these are good questions to resolve and canaries are needed to alert us if reading is becoming different or more nonlinear and what impact these changes have on students.

There is more about the evolving nature of text that is intriguing. Lanham (2001) has written about the changing nature of text online, how it is increasingly multimodal (textual and aural and graphic) and moves text into a three-dimensional world where text can fade or move. He claims that digital text puts text back into space and time (p. 33), increasing the need for students to develop a spatial awareness. How do these different methods of presenting text (e.g., the web versus paper) affect the reader and the reader's understanding of what has been read?

Birkerts (1994) has argued that technology may spell the end of reading, literature, and language use He is worried about losing an elite level of reading, books, and language, which might create a larger rift – a language and education rift – between individuals whose reading and language use are more mundane and those whose declining numbers spell the end of a particular type of literature. This rift – if caused by online learning – may have class implications and ought to be seriously evaluated.

So we find several writers who disagree on the impact of online learning on students writing, reading, and language use. This is an area that needs research to evaluate these predictions. Is there evidence that experiences change when we go online and that such changes impact students in some fundamental way? Possible canaries might include assessments of how reading text online changes students, their reading, and/or their comprehension, or whether and to what extent reading text online changes the readers' perception of reality.

Emotions and Connections

Locke (1998) also focused on a perceived loss of emotion in the online world. Talking is the sharing of personal information, the person's character, personality, emotionality, and attitudes (p. 60), but email provides no way to show how we feel, increases ambiguity, and doesn't allow us to intimately engage in friendship (p. 163-169). Talking alters mood and provides cathartic relief, which may occur online or not. Birkerts (1994) adds that while the screen is ideal for relaying data, it is not a good avenue for subjectivity or art, and in fact is "antithetical to inwardness" (p. 193). These are serious charges and they could be evaluated by assessing regular online learners' ability to share and comprehend one's own and other's emotions as well as whether online "talking" had the same or different effects on their moods. But perhaps there is a

mitigating factor for most students, since the majority will have other friends and emotional ties with friends and family members that are conducted face-to-face. In other words, their online relationships in a course or program may be a small percentage of their emotional lives. In any case, it is a charge worth investigating.

Research on "social presence" in online courses captures the ability of online learners to enhance "closeness" to each other and to use the technology to increase personal connections (see Rourke & Anderson, 2002; Rourke, Anderson, Garrison & Archer, 1999). This presence may be the same or different than that gained in face-to-face interactions, which may have its own implications for students' ability to exchange emotions by talking online and/or in other conversations.

The development of community is another concern. Wheatley and Kellner-Rogers (1998) stress that community requires the co-evolution of the self and other, where boundaries between persons comprise a meeting place and not a wall, a place to exchange and grow. They note that the web can be used to create stronger boundaries between persons or forge growth across individual boundaries and this certainly ought to be tested. Therefore, the role of online learning would be to support the latter use and not the former, but this may be a function of instructional design rather than a necessary consequence of using the web to deliver or enhance a class. Palloff and Pratt (1999) would certainly argue that community is achievable in online courses, but it is not clear if it is the same as face-to-face versions of community or if it has different characteristics. And yet communicating one's essence is key to providing others' with a sense of who is on the other end of an online conversation, and this may be tied more to writing skill than the medium. In any case, as was noted earlier, "social presence" is a hot topic among those who evaluate online discussions, and it is tied to the personal side of talking valued by Locke (1998). Social presence may turn out to be talking's best online analogue.

Lastly, O'Donnell (1998) has pointed out that communication skills are essential for student learning, because it is through communication that students create truth collectively (p. 149). Whether online forms of communication – be they email, chats, or threaded discussions – are effective at fueling this communication and giving rise to joint construction, testing, and evaluation of truths is a question well worth asking. Certainly, enough research has been done to support that learning does occur online, but the question should be more narrowly cast and focused on how and to what extent online communication tools actually contribute to learning. An appropriate canary might entail the design of measures or assessments that regularly indicate the level or kind of community online students achieve.

Control and Self

There are several ways that control may be pertinent as a consequence of learning online. First, Turkle suggested that computers could offer companionship "without the mutuality and complexity of a human relationship" (in Locke, 1998, p. 181) because, in part, the individual was in control of the relationship: he or she could log off, close the screen, and delete the message. The gain in control was attractive to many individuals but might not portend well for forging deeper relationships. Second, Postman (1993) voiced a fear that has been common among technophobes that humans will become "tools of our tools" (p. 3). In this view, control is ceded away from the individual, and the usual relationship between tool and tool user is subtly reversed. If this were a true consequence of online learning, it would be serious indeed and is worthy of a flock of canaries.

The issue of control may be related to the phenomenon of individuals who present themselves as someone other than who they are in chat rooms. In addition to the masks people can wear in online settings, this falsity is compounded by our inability to discern truth from lies on the web (Locke, 1998). And yet it is common for individuals to try on different selves in new settings or fantasize about new lives or present themselves as happier or wealthier than they truly are. And

frankly, false information has been around for a while, too. We need to know if these instances of falsity on the web are different in degree and/or kind from the past or whether online learners are more (or less) prone to creating a false self in an online educational setting.

Several writers are concerned about the effects of the online experience on the emerging self of youngsters or more impressionable college students. Weinberger (2002) claims that the web is a new world and will "create new people" (p. 9). He then refers to two research studies that arrive at diametrically opposed conclusions: that the web caused less social engagement AND more contact with others (p. 10-11). In other words, we need canaries that can help us identify and study these "new people," or whether indeed they are new people at all.

Birkerts (1994) has several consequences for the self that worry him. Will the steady user of online learning be changed by its altered relationship to time, space, and others (p. 31)? Will the way they receive information change the way they experience and interpret reality (p. 72)? Will they know more bits of information but not with depth or context (p. 72)? Will they be able to reflect and understand themselves and their worlds because they read online versus from a book (p. 83)? Will the way they think be different because the order of print was linear and the order of the web page is visual, impressionistic, rapid, and associative (p. 122)? These are serious concerns, and online learning may need to address them with well-designed and long-term studies.

This issue is not solely a concern that the next generation will be different from our own. Given your personal values, such difference may be a sign of progress or degeneration. The real issue is whether these changes are being wrought by students' involvement with online learning or not. It may be that online courses are only a small part of students' web-influenced lives. Or these courses may be construed as only a tool to get an education and the content of the education plays the greater role in forming the students' self than the means of receiving it. Time, and canaries, may tell.

Effects on Institutions

It is unclear when reading the prophets of change for higher education whether the change is the result of online learning or a variety of forces. These forces are often entangled, and thus difficult to unravel. Yet the Internet and online learning are credited with causing some of the prophesied changes, so they will be included in this discussion. Typical of such statements is Barone and Hagner's (2001) "information technology changes the very nature of what we do" (p. xi), including concepts, definitions, roles, and structures. The following material on consequences is grouped into three large categories focusing on major conceptual shifts and changes in the structure of higher education.

Among the conceptual issues are three possible but important shifts. The first of these shifts is the loss among higher education institutions of the knowledge of what business they are in. O'Donnell (1998) argues that how a business defines itself will constrain the future of that business; he uses the well-known example of the railroads, which saw their business as railroads rather than transportation. He thinks that higher education operates as if it were in the "fifty-minute lecture business" (p. 148). Such assumptions about a core business are often unspoken and unexamined. Feenberg (2002) makes a similar point about online learning: is its business to achieve greater efficiencies or greater freedom for students? Will higher education someday be in the "student learning business" (be it online or on campus) and what types of changes would result from such a designation?

A second shift results from the institution's relationship to what the Internet does best: that is, to provide data. Postman (1993) captured this idea thus: "to a man with a computer, everything looks like data" (p. 14). Indeed, the need for more information and data is perhaps both a cause and result of the Internet. And yet, Postman comments that there are "few political, social, and

especially personal problems that arise because of insufficient information" (p. 60). This does not devalue the usefulness of information for making better-informed decisions, but it does put into perspective the role of information while making serious decisions that depend on personal values or social ethics. In fact, the larger problem of having so much information is that it is disconnected from theory, meaning, or purpose (Postman, 1993, p. 70). We don't discover truth anymore; we manage information. This explosion has overwhelmed traditional gatekeepers of information like universities, who evaluated and passed on some information but not others. This shift in function could change how society values the university.

The larger problem this issue causes for higher education is whether it is in the information transfer business – which the Internet can also do well and more cheaply – or whether it will focus on developing context, depth, and wisdom or the business of student learning. Wisdom, for Birkerts, "has nothing to do with the gathering or organizing of facts . . . wisdom is a seeing *through* facts, a penetration to the underlying law and patterns" (p. 75). If online learning subscribes to the business of information transfer, then it could be eliminated by its competition; if it is in the business of building wisdom, it has a nobler aim and is more closely aligned with the traditional role of higher education. Which model online learning subscribes to will be influenced by the predominant model of the institution that offers it, the philosophy of its faculty, and the demands of students. In any case, the consequences of which model is chosen will not only affect online learning, but it could affect online learning's impact on students.

The third major shift is the transformation of pedagogy made possible by the web. Privateer (1999) complained that many uses made of technology duplicate an old model of pedagogy that retains elements of hierarchy, efficiency, mass production, faculty control, an information transfer model of education, and the "reproductive theory of knowledge" (p. 5). For example, faculty lectures are videostreamed or given over interactive video and the one-to-many broadcast model of faculty dictating content to students is retained. This is not real change. What is needed is a new pedagogy that uses technology to stimulate intelligent problem-solving among students. If online learning replicates an older pedagogy, perhaps the consequences for student learning will be more of the same. If it breaks free and develops new pedagogies, perhaps students will have a better – or different -- education. In any case, this shift (or lack thereof) deserves a canary.

Lastly, what is happening to higher education organizations more generally? Some emerging organizational structures are being implemented in new virtual universities, including distributed organizations, network organizations, and hybrid organizations (Carchidi & Peterson, 2000; Hanna, 1998). In fact, if there is guidance for higher education from the e-business realm, Kanter (2001) has noted that these emerging organizations focus on creative destruction, emergent strategies "made up as you go along" (p. 7), and they require a tolerance for paradox such as the pursuit of centralization and decentralization at the same time. These organizations need to "manage complexity" (Suter, 2001, p. 25), working with it and eschewing attempts to control or eliminate it. Organizations need to be able to manage change as well, both living within a culture of change, and successfully adopting changes that support the institution's business and avoiding changes that do not. Higher education institutions are likely evolving their own e-culture to survive in a future where online learning is ubiquitous. Canaries might be needed to identify these new structures and evaluate their effects on higher education.

The final issue is one of the larger environment for higher education, an environment that has become increasingly fraught with competition, including new types of competitors as well as traditional competitors with more online learning offerings (Katz, 1999). Does this competition mean that higher education's monopoly is truly broken or only bent? Will it mean that residential colleges decrease in size or number or that there will be an increase in the variety of institutions and learning opportunities? Will competition result in improved performance and better offerings or poorer performance? Meyer (2004) has argued that the answer to that question is complicated

by individual attitudes and responses to competition and change, but it is an important question to ask an institution. Will competition bring out the institution's best or worst? Will it affect peripheral services (such as continuing education) but not its core, or will it affect only institutions that are less-selective or specialize in convenience services (Marchese, 1998)? From the point-of-view of identifying and understanding unintended consequences, it will be important to ask what other changes might logically happen as a result of such transformations. The issue is not whether we may personally like the changes or not, but whether the changes are happening as predicted and what the consequence of such changes may be.

Conclusions

There are more questions than answers in the above material, but that is perhaps a good sign, because the questions are being asked in advance of the consequences. Therefore, there is time to craft some very useful canaries to put in place to help us identify what is happening as a result of the influx of online learning and its technological partners, the Internet and information technology.

This is largely a hopeful situation. First of all, we can learn from our failures as Tenner (1996) has stressed, and learn from the consequences of our choices. As Gurak (2001) has suggested, the Internet is the product of certain design choices and choices made about how to use it. What may seem "given" in the current day was once a choice, and it is helpful to remember the importance of choices as we evaluate online learning and learn how to better project consequences.

Second, McLuhan proposed that it is the way a thing is used that defines what the thing really is (in Locke, 1998, p. 55), and that is especially true of the Internet, which is used by predators looking for victims and individuals researching the latest medical information to assess different treatment options. It is also true for online learning, which may be used to duplicate a mundane educational model of information transfer or an exciting model that stresses students' collective construction of knowledge as they interact with other students, the content, and faculty. In other words, consequences for using online learning may derive as much or more from its context, the intent of the user as well as the designer, and the values of student, faculty, and educational system.

And third, human agency cannot be ignored. We are not passive and weak or powerless and incapacitated when presented with changes wrought by technology. Our responses to it are under our control and are as creative as we choose to make them.

> *These are positive reasons to believe the future of online learning could bring better results than the pessimists suppose. Such a positive future may be limited only by our ability to choose wisely. Of course, our choices can go inadvertently awry, but we can recover quickly once we are in the habit of anticipating unintended consequences and once we have our canaries in the appropriate places.*

References

Archer, W., Garrison, D.R., & Anderson, T. (1999). Adopting disruptive technologies in traditional universities: Continuing education as an incubator for innovation. *Canadian Journal for University Continuing Education, 25*(1), 13-30. [http://www.extension.usask.ca/cjuce/articles/v25jpdf/2511.pdf]

Barone, C. A., & Hagner, P. R. (Eds.) (2001). *Technology-enhanced teaching and learning*. EDUCAUSE Leadership Strategies No. 5. San Francisco, CA: Jossey-Bass.

Birkerts, S. (1994). *The Gutenberg elegies*. Boston, MA: Faber and Faber.

Boudon, R. (1977). *The unintended consequences of social action*. New York: St. Martin's Press.

Burbules, N. C., & Callister, T. A., Jr. (2000). *Watch IT: The risks and promises of information technologies for education.* Boulder, CO: Westview Press.

Carchidi, D. M., & Peterson, M. W. (2000). Emerging organizational structures. *Planning for Higher Education, 28*(3), 1-15.

Christenson, C. (1997). *The innovator's dilemma: When new technologies cause great firms to fail.* Boston: Harvard University Press.

Duin, A. H., Baer, L. L., & Starke-Meyerring, D. (2001). *Partnering in the learning marketspace*. EDUCAUSE Leadership Strategies No. 4. San Francisco: Jossey-Bass.

Feenberg, A. (2002). *Transforming technology: A critical theory revisited.* New York: Oxford University Press.

Gurak, L. J. (2001). *Cyberliteracy: Navigating the Internet with awareness*. New Haven, CT: Yale University Press.

Hanna, D. E. (1998). Higher education in an era of digital competition: Emerging organizational models. *JALN, 2*(1). [http://www.aln.org/alnweb/journal/vol2_issue1/hanna.htm]

Hughes, T. P. (2001). Through a glass, darkly: Anticipating the future of technology-enabled education. *Educause Review, 36*(4), 16-26.

Kanter, R. M. (2001). *E-volve*. Boston, MA: Harvard Business School.

Katz, R. N., & Associates. (1999). *Dancing with the devil*. San Francisco: Jossey-Bass.

Lanham, R. A. (2001). What's next for text? *Education, Communication & Information, 1*(1) 15-36.

Lenzer, R., & Johnson, S. S. (March 10, 1997). Seeing things as they really are. Forbes Magazine [http://www.forbes.com].

Levinson, P. (2001). *Digital McLuhan*. New York: Routledge.

Locke, J. L. (1998). *Why we don't talk to each other anymore*. New York: Simon & Schuster.

Marchese, T. (1998). Not-so-distance competitors. *AAHE Bulletin*. [http://www.aahe.bulletin.com/public/archive]

Meyer, K.A. (2005). Critical decisions affecting the development of Western Governors

University. *Innovative Higher Education, 30*(2), __.

Meyer, K. A. (June-August 2004). The impact of competition on program quality. *Planning for Higher Education, 32*(4), 5-13. [http://www.scup.org]

O'Donnell, J. J. (1998). *Avatars of the word*. Cambridge, MA: Harvard University Press.

Palloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom*. San Francisco, CA: Jossey-Bass.

Postman, N. (1993). *Technopoly*. New York: Vintage Books.

Privateer, P. M. (1999). Academic technology and the future of higher education: Strategic paths taken and not taken. *Journal of Higher Education, 70*(1), 60+.

Rourke, L., & Anderson, T. (2002). Exploring social interaction in computer conferencing. *Journal of Interactive Learning Research, 13*(3), 257-273.

Rourke, L., Anderson, T. Garrison, D. R., & Archer, W. (1999). Assessing social presence in asynchronous, text-based computer conferencing. *Journal of Distance Education, 14*(3), 51-70. [http://cade.athabascau.ca/vol14.2/rourke_et_al.html]

Suter, V. N. (2001). Managing complexity in a transforming environment. In Barone, C. A., & Hagner, P. R. (Eds.), *Technology-enhanced teaching and learning* (pp.25-34). EDUCAUSE Leadership Strategies No. 5. San Francisco, CA: Jossey-Bass.

Tenner, E. (1996). *Why things bite back*. New York: Vintage Books.

Weinberger, D. (2002). *Small pieces loosely joined*. Cambridge, MA: Perseus Publishing.

Wheatley, M. J., & Kellner-Rogers, M. (1998). The paradox and promise of community. In Hesselbein, F., Goldsmith, M., Beckhard, R., & Schubert, R. F. (Eds.), *The community of the future* (pp. 9-18). San Francisco, CA: Jossey-Bass.

About the Author

Katrina A. Meyer is Associate Professor, Higher and Adult Education at The University of Memphis,
308 Browning Hall, Memphis, TN 38152-3340.

Phone: (901) 678-2466. Email: kmeyer@memphis.edu

Editor's Note: For instructional designers and administrators, it is important to know which products and services are most used and most valued by students. This study provides definitive data for the School of Distance Education at University of Malaysia.

The Learners' Support System in Distance Education: A Study of the Satisfaction of Quality

Helen Khoo Chooi Sim, Hanafi Atan and Rozhan M. Idrus

Abstract

This article reports on the study undertaken to determine the satisfaction of quality related to the 16 dimensions of the support system provided to the learners enrolled at the School of Distance Education (SDE), Universiti Sains Malaysia (USM). The three main aspects of this study were the frequency of usage, the degree of the usefulness in their learning and the critical dimension contributing towards the overall satisfaction of quality of the support system. The findings revealed that the learner support system consisting of the annual residential intensive course, modular printed learning materials, academic planner, the university library, the academic guide book and video conferencing were among the dimensions perceived to be useful by the students in providing the necessary support in the learning processes. The correlation analysis showed that all the 16 dimensions studied were significantly ($p<0.01$) and positively correlated with the overall satisfaction of quality. The modular printed materials recorded the highest positive correlation, followed by video conferencing, the annual residential course, regional centres and assignments. The Multinomial Logistic Regression analysis indicated that the modular printed learning materials emerged as a critical dimension for the overall satisfaction of quality with 77.9 percent predictability. The role of the modular printed materials towards the overall satisfaction of the quality of the support system is highlighted and discussed.

KeyWords: distance education, adult learner, support system, quality, learner satisfaction, academic support system, non-academic support system, learner's needs, critical dimension of support system, video conferencing, printed module, regional center.

Introduction

Distance education has created enormous opportunities for the expansion of the educational opportunities especially at the higher educational level. This should be of great benefit to developed nations as well as developing countries in their human resource development and provision of a skilled labour workforce to drive the economic growth of their countries. Malaysia is a developing country with only about 16 percent of its population aged 20 and above possessing any form of post-secondary, college or university education (Malaysia, 2002). The Malaysian government hopes to raise this figure to 25 percent by the year 2020 by increasing access to higher education for its population (Gan, 2001). Distance education is thus becoming one of the important strategies that could be deployed to achieve this vision.

As the government strives to increase access to higher education, more and more distance education institutions are being established with various types of programmes being offered to cater to the increasing demand. With a growing number of distance education learners, the issue of quality becomes increasingly important. In this study, we focus on the quality of the support system that the institution provides to the learners and attempts to identify aspects of the learners' support system that contribute most to the student's learning process. This study subsequently

tries to elucidate critical dimensions in the support system that contribute significantly to the overall quality of the support system. The results of this study are vital for the institution to identify the vital areas of the support system that should be given greater emphasis and improvement to ensure a high level of satisfaction among learners regarding the quality of the support system provided to them.

The Learners' Support System in Distance Education

The learners' support system in distance education may be defined as all activities beyond the production and the delivery of course materials that assist in the progress of students in their studies (Simpson, 2000). These can be in the form of facilities, administrative assistance, supplementary reading materials and references, human interaction, advice and moral support. Generally, it may be classified into two broad areas. The first is academic support which deals with supporting students with the cognitive, intellectual and knowledge issues of specific courses or sets of courses (Simpson, 2000). They include, for example, the development of learning skills, knowledge and literacy.

Besides the more traditional technologies such as print, broadcast television and radio, distance education providers add new technologies as they strive to enhance the quality of teaching and learning. These include use of audiotapes, videotapes, computer-based learning packages, interactive videos, interactive multimedia (IMM), audio-teleconferencing, audio-graphic communication systems, video conferencing, and videos on demand (VOD). The advancement of the information and communication technology (ICT) provides the opportunities for interactivity and access to instructional resources provided by computer communications networks popularly referred to as the Internet, the World Wide Web (WWW) or the Information Super Highway (Taylor, 1997).

The second category of the learners' support system is non-academic – the support of students in the effective and organizational aspects of their studies (Simpson, 2000). Examples of the services contained within this support system are counselling services, orientation programme, course registration, news bulletin, and the student's association. The learners' support system is an important service that needs to be provided by the institution to the learners because of the characteristics of distance learners themselves. They are isolated and come from diverse backgrounds – economic, social, educational and occupational. The provision of such an educational support system ensures the facilitation of communication between students, the academic staff as well as the administrator to cater for administrative needs of the students (Kember & Dekkers, 1987; Sewart, 1992; Hillman et al., 1994).

The provision of learners' support is now widely and increasingly recognized as an essential component of any open and distance learning system. As learners are the most important stakeholders in any educational system, distance education providers should provide the highest possible quality learner support services possible to all of them as without their presence, a distance education programme will not succeed (Ravisankar & Murthy, 2000).

As the responsibility of learning is in the hands of the learners, it is important that learners' support from providers should also be learner-focused and meets the learners' expectations and needs. Learners themselves are in the best position to know what kinds of support systems are pertinent in order to achieve their educational and personal goals. Moreover, distance education learners are adults and they are able to determine quality according to their individual needs (McIlroy & Walker, 1993).

Quality of the Learners' Support System

Crosby (1979) defines quality as conformance to customer needs. Juran (1989) emphasized the importance of satisfying client needs. Quality is "fitness for use" which includes the identification of customer needs and attempt to meet these needs. This, when translated into educational terms, can be equated with the learner-centered approach (McIlroy & Walker, 1993). A key concept in current approaches to manage quality is putting the student first (Nunan & Calvert, 1991; Mills & Paul, 1993; Robinson, 1994) and designing procedures and courses which match the learners' needs as closely as possible.

Quality in distance education has primarily been based on performance indicators of input and outcome measures and little attention has been paid to customer satisfaction as a measure of quality or through a "fitness for purpose/use" definition. The quality-satisfaction relationship is seldom examined explicitly. One reason for this is that both concepts are often used synonymously (Abrami, 1989; D'Apollonia & Cohen, 1990). In the quest of quality for the learners' support system, attention should be paid to what quality means to the distance education learners. It is important that distance education providers should meet or exceed the expectation of their learners. Adult learners would demand quality in the products and services offered by the distance education providers and value for their money. Therefore, adult learners in the distance education systems are in the best position to assess the quality of the learners' support that is provided.

Aims of Study and Methodology

The aims of this study are to identify 1) aspects of the learners' support system that contributes significantly to the learning process of distance education learners, 2)frequency of use of these learner support services provided by the School of Distance Education (SDE), Universiti Sains Malaysia (USM), and 3) critical dimensions that contribute most to the overall quality of the learners' support system.

The questionnaire developed for this study is the type that elicits the student's expectation and perception regarding the sixteen dimensions of learners' support currently provided by the SDE, USM. The dimensions were pre-registration, registration as a student, the academic planner, the academic guide book, the orientation programme, printed learning materials, supplementary materials (multimedia), video conferencing, counselling services, the intensive course, regional centres, the student's bulletin, the main library, the students' association, assignments and examination. The questionnaire consisted of 171 items and each item was accompanied by two five-point Likert scales one for the expectation of quality and the other for the perception of quality. A pilot test was conducted prior to the actual study to test the reliability of the questionnaire. The overall Cronbach's Alpha coefficient of 0.9839 was recorded for the expectation of quality and 0.9755 for the perception of quality. The coefficient indicated that the questionnaire was reliable. The measurement of quality was based on the Expectancy Disconfirmation Theory which proposed that if the mean of perception exceeds the mean of expectation (a positive disconfirmation), a student is very satisfied with the quality. If the mean of perception equals the mean of expectation (zero disconfirmation), a student is only satisfied with the quality. However, the student is not satisfied about the quality if the mean of perception falls short of her or his expectation (negative disconfirmation).

The sample for this study was students of SDE, USM, from the academic session 2002/2003. The questionnaires were distributed randomly to 558 students during the three-week annual residential intensive course held at the main campus of USM. The questionnaires were distributed in person by the researcher and completed questionnaires were collected at a specific time agreed to by both parties. Data analysis was conducted using the SPSS version 10.0.

Results and Discussion

Frequency of Use

Table 1 shows the frequency of use of the learners' support system provided by SDE, USM. As can be seen, the most frequently used learners' support system is the intensive course held annually at the main campus (mean=4.15). The high mean recorded is expected as the annual residential course is made compulsory among learners and failure to attend without valid and acceptable reasons will result in the students being barred from sitting the final examination. The next highest recorded frequency is the printed learning materials (mean=4.10). The printed learning materials are the specially designed self-instructional learning materials which are the main source of learning materials. Again, this high frequency recorded is expected as the printed learning materials form the main mode of the course delivery mechanism and is being used regularly by the students to keep pace with their study schedule. The next highest support system that is being used by the students is the academic planner (mean=3.88). The academic planner is the academic self-organizer which highlights the important academic activities throughout the academic session. This planner enables the students to systematically organize their study schedule and it thus is of great assistance to the learners. The use of library facilities also recorded a high mean (mean=3.78), followed closely by video conferencing (mean=3.65) and the academic guide book (mean=3.53).

Table 1

Frequency of use of the learners' support system

	Very Seldom (%)	Seldom (%)	Neither Often nor Seldom (%)	Often (%)	Very Often (%)	Mean (SD) n=340
1. Academic Planner	4 (1.2)	36 (10.6)	26 (7.6)	205 (60.3)	69 (20.3)	3.88 (0.89)
2. Academic Guide Book	6 (1.8)	64 (18.8)	49 (14.4)	187 (55.0)	34 (10.0)	3.53 (0.97)
3. Printed Learning Materials	2 (0.60)	13 (3.8)	29 (8.5)	20 (58.8)	96 (28.8)	4.10 (0.75)
4. Supplementary Materials (Multimedia)	27 (79)	83 (24.4)	103 (30.3)	104 (30.6)	23 (6.8)	3.04 (1.07)
5. Video Conferencing	28 (8.2)	30 (8.8)	48 (14.1)	162 (47.6)	72 (21.2)	3.65 (1.15)
6. Counselling Services	88 (25.9)	88 (25.9)	90 (26.5)	60 (17.6)	14 (4.1)	2.48 (1.17)
7. Intensive Course	7 (2.1)	20 (5.9)	16 (4.7)	168 (49.4)	129 (37.9)	4.15 (0.91)
8. Regional Centres	28 (8.2)	49 (14.4)	60 (17.6)	162 (47.6)	41 (12.1)	3.41 (1.13)
9. Students' Bulletin	45 (13.2)	83 (24.4)	90 (26.5)	106 (31.2)	16 (4.7)	2.90 (1.13)
10. Main Library	10 (2.9)	35 (10.3)	33 (9.7)	204 (60.0)	58 (17.1)	3.78 (0.95)
11. Students' Association	126 (37.1)	83 (24.4)	75 (22.1)	52 (15.3)	4 (1.2)	2.19 (1.13)

Degree of Usefulness

Table 2 shows the results on the degree of usefulness of various dimensions of the learners' support system towards their learning process. The dimensions that recorded the highest mean and perceived to be useful in helping the respondents in their studies were the intensive course (mean=4.42) followed by the printed learning materials (mean=4.34), the academic planner (mean=4.20), the main library (mean= 4.16), the academic guide book (mean=4.09) and video conferencing (mean=3.98). As expected, the dimensions that recorded the highest means were those that supported the students with cognitive, intellectual and knowledge through the mediation and facilitation of the standard and uniform elements of course materials and learning resources. The annual intensive course (a three-week on-campus residential school) was perceived to be the most useful in assisting them in their learning process relative to other dimensions. The intensive course consists mainly of face-to-face tutorial sessions with lecturers for course content facilitation. The tutorial services have been known to have positive effects on the students' learning outcomes (Morgan & Morris, 1994; Stevenson & Sander, 1998). Similarly, the facilitation by the lecturer and the student-peer collaboration during the video conferencing sessions which helped students to clarify issues pertaining to the course contents were found to improve and enhance students' understanding (Knox, 1997; Daud et al., 2000).

Table 2

The Degree of Usefulness of the Learners' Support System

	Not Very Helpful (%)	Not Helpful (%)	Uncertain (%)	Helpful (%)	Very Helpful (%)	Mean (SD) n=340
1. Academic Planner	1 (0.3)	5 (1.5)	22 (6.5)	209 (61.5)	103 (30.3)	4.20 (0.64)
2. Academic Guide Book	-	12 (3.5)	34 (10.0)	205 (60.3)	89 (26.2)	4.09 (0.70)
3. Printed Learning Materials	-	2 (0.6)	24 (7.1)	170 (50.0)	144 (42.4)	4.34 (0.63)
4. Supplementary Materials (Multimedia)	7 (2.1)	32 (9.4)	122 (35.9)	133 (39.1)	46 (13.5)	3.53 (0.91)
5. Video Conferencing	14 (4.1)	10 (2.9)	47 (13.8)	169 (49.7)	100 (29.4)	3.98 (0.96)
6. Counselling	33 (9.7)	55 (16.2)	142 (41.8)	87 (25.6)	23 (6.8)	3.04 (1.04)
7. Intensive Course	-	2 (0.6)	19 (5.6)	153 (45.0)	166 (48.8)	4.42 (0.63)
8. Regional Centres	15 (4.4)	30 (8.8)	79 (23.2)	166 (48.8)	50 (14.7)	3.61 (0.99)
9. Students' Bulletin	27 (7.9)	60 (17.6)	113 (33.2)	118 (34.7)	22 (6.5)	3.14 (1.04)
10. Main Library USM	3 (0.9)	15 (4.4)	25 (7.4)	180 (52.9)	117 (34.4)	4.16 (0.81)
11. Students' Association	89 (26.2)	82 (24.1)	100 (29.4)	57 (16.8)	12 (3.5)	2.47 (1.15)

Critical Dimensions

Before undertaking an analysis to elucidate the critical dimensions contributing to the overall satisfaction of quality, the frequency analysis of the degree of satisfaction was carried out. Based on the Expectancy Disconfirmation Theory, three different satisfaction groups were established, namely the very satisfied, satisfied and not satisfied. The analysis revealed that 59.7 percent of the respondents were very satisfied, 7.9 percent satisfied and 32.4 percent not satisfied. The distribution of the means of these three groups in relation to the sixteen dimensions is depicted in Figure 1. As expected, the group that was very satisfied recorded the highest means compared to the other two groups across each of the dimensions. The profile distribution of the means for each group is parallel indicating that the relative perception of each group in terms of the given dimensions is similar, the difference being only on the level of satisfaction of quality.

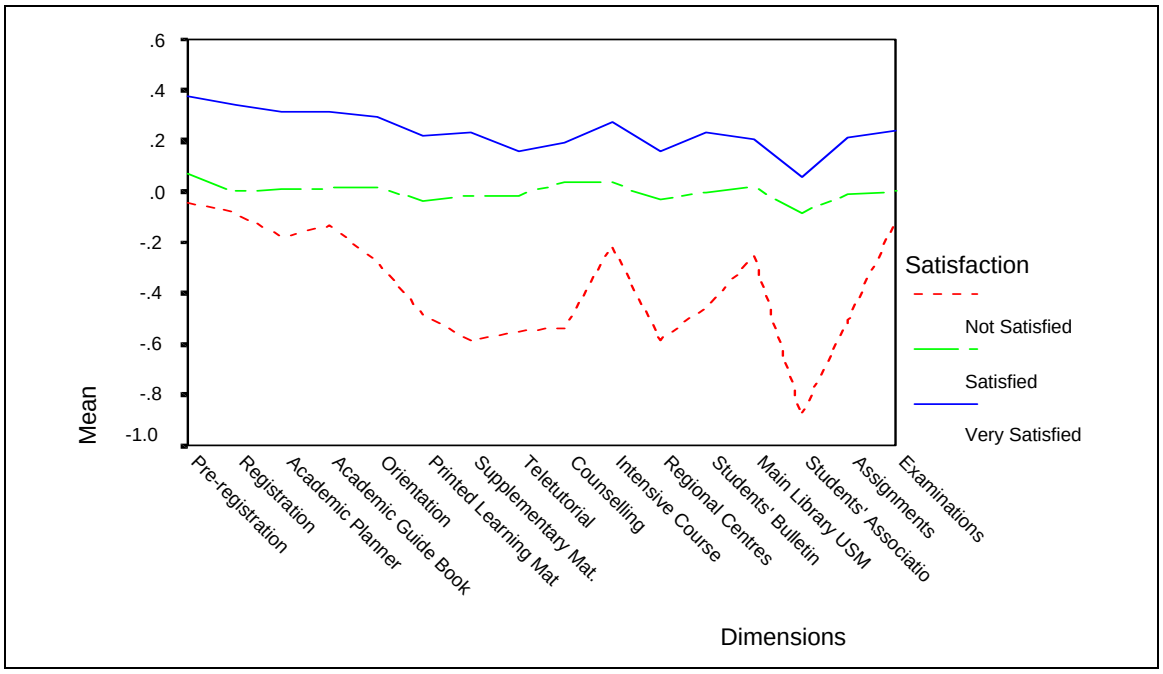


Figure 1. Means distribution across sixteen dimensions of the support system for three different satisfaction levels.

A correlation analysis was conducted to determine the extent of correlation of each of the dimensions towards the satisfaction of quality. The result of the correlation analysis is depicted in Table 3. As shown in Table 3, printed learning materials (0.850) recorded the highest positive correlation with satisfaction of quality. It was followed by video conferencing (0.835), the intensive course (0.811), regional centres (0.809) and assignments (0.808). The results indicated that printed learning materials are an important factor in determining the overall quality of the learners' support system.

Table 3

Correlation of dimensions of the learners' support system with overall satisfaction of quality

Dimension of the Learners' Support System	Correlation with the Overall Satisfaction of Quality
1. Pre-registration	0.463*
2. Registration as a Student	0.561*
3. Academic Planner	0.670*
4. Academic Guide Book	0.672*
5 Orientation Programme	0.740*
6 Printed Learning Materials	0.850*
7. Supplementary Materials (Multimedia)	0.789*
8. Video Conferencing	0.835*
9. Counselling	0.762*
10. Intensive Course	0.811*
11. Regional Centres	0.809*
12. Students' Bulletin	0.792*
13. Main Library	0.736*
14. Students' Association	0.699*
15. Assignments	0.808*
16. Examinations	0.631*

*Significant at $p<0.01$

To determine the degree of the contribution of the three highest positively correlated dimensions towards the overall satisfaction of quality, namely, the printed learning materials, video conferencing and the intensive course, a Multinomial Logistic Regression was conducted towards the three different groups of satisfaction i.e., the very satisfied, satisfied and not satisfied groups. Table 4 (i) shows the results for the printed learning materials. The results revealed the contribution of the printed learning materials towards the overall quality was significant. Nagelkerke Pseudo R-Square (Table 4 (ii)) recorded a value of 0.522 and the Likelihood Ratio Test (Table 4 (iii)) indicated that the variable printed learning materials are significant and should be included in the model for the overall quality of satisfaction. The overall predictability (Table 4 (v)) was 77.9 percent and this implied that the printed learning material is a good predictor for learners in the very satisfied group (96.6% correct).

When the dimension of video conferencing, which recorded the second highest correlation with the overall satisfaction of quality, was modelled together with printed learning materials, the model was also significant. The Nagelkerke Pseudo R-Square now recorded a value of 0.590 and the Likelihood Ratio Test indicated that the variable printed learning materials and video conferencing were both significant and should be in the model for the overall satisfaction of quality. The overall predictability now increased to 80.9 percent, an increase of 3.0 percent. However, predictability of those in the very satisfied group now decreased by 0.5 percent to 96.1 percent. The predictability of those in the not satisfied group increased from 62.7 to 72.7 percent.

Table 4 (i)
Model fitting information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	313.509			
Final	121.523	191.986	2	0.000

Table 4 (ii)
Psuedo R-Square

Cox and Snell	0.431
Nagelkerke	0.522
McFadden	0.323

Table 4 (iii)
Likelihood Ratio Tests

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	211.571	90.048	2	0.000
Printed Learning Materials	313.509	191.986	2	0.000

Table 4 (iv)
Parameter Estimates of Multinomial Logistic Regression

Satisfaction of quality		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Not Satisfied	Intercept	-0.956	0.167	32.606	1	0.000			
	PLM	-7.079	0.936	57.150	1	0.000	8.430E-04	1.345E-04	5.282E-03
Satisfied	Intercept	-1.722	0.215	64.053	1	0.000			
	PLM	-3.929	1.008	15.199	1	0.000	1.966E-02	2.728E-03	0.142

Table 4 (v)
Classification

	Predicted			
Observed	Not Satisfied	Satisfied	Very Satisfied	% Correct
Not Satisfied	69	0	41	62.7%
Satisfied	3	0	24	0.0%
Very Satisfied	7	0	196	96.6%
Overall Percentage	23.2%	.0%	76.8%	77.9%

The analysis of the contribution of the intensive course that recorded the third highest correlation coupled together with the printed learning materials and video conferencing to the overall quality was conducted. When the dimension of the intensive course was modelled together with printed learning materials and video conferencing, the model was also found to be significant. The Nagelkerke Pseudo R-Square then increased and recorded a value of 0.604. The Likelihood Ratio Test indicated that the three variables of the printed learning materials, video conferencing and intensive course were all significant and should be in the model for the overall satisfaction of quality. However, the overall predictability now remained at 80.9 percent. The predictability of those in the "very satisfied" and "not satisfied" groups remained at 96.1 percent and 72.7 percent respectively.

This study indicated that the printed learning material dimension recorded the highest positive correlation towards the overall satisfaction of quality with the highest contribution towards the usefulness to the learners in terms of their learning process (mean=4.34). This dimension was also one of the dimensions that was often used by the learners (mean=4.10). The Multinomial Logistic Regression conducted indicated that the dimension printed learning materials was a good indicator for the overall satisfaction of quality especially by the very satisfied group.

This finding implies that the printed learning materials is the most important dimension and imperative in the determination of the satisfaction of quality of the learners' support system. In order to increase the satisfaction of learners towards the learners' support system, it is therefore vital for the SDE, USM to increase the satisfaction of learners in the dimension of the printed learning materials. As noted by Mann (1998), the modular printed learning materials are the concrete frontier of quality assurance. This finding is also consistent with the study of Ibrahim & Silong (1997) which pointed out that the academic module (printed learning materials) is an important aspect in the learners' support system. McIIroy (1997) also revealed that the printed course materials are extremely effective in enhancing the quality of the courses offered. Printed learning materials is the main source of learning as far as the open and distance learners are concerned because of their characteristics of being self-instructional, self-explanatory, self-contained, self-directed, self-evaluated, self-learning and self-motivating (Partovi, 1997). To achieve the highest standards of quality in the provision of services for the learners' support system, it is therefore imperative that the printed learning materials are suitably designed with the intended characteristics to fulfil the learning objectives and be constantly reviewed to keep up to date with current issues and the latest knowledge of the course contents.

Summary

This study revealed that the printed learning materials is the most important dimension in the learners' support system and contributed the most to the overall satisfaction of quality. The quest towards quality in the learners' support system provided to the student should be viewed as a never-ending process. Determining the critical dimensions that contribute to the satisfaction of quality of support is imperative to enhance the quality of the distance education offered to students. This study provides an insight for the distance education providers to focus on the support system that contributes positively to the learners' overall satisfaction of the quality. Appropriate steps should continuously be taken to maintain the highest level of satisfaction of quality among the learners in order to remain and to excel in an increasingly competitive industry.

References

Abrami, P. C. (1989). How should we use student ratings to evaluate teaching? *Research in Higher Education, 30*(2), 221-27.

Crosby, P. B. (1979). *Quality is Free*. New York: McGraw-Hill.

Daud, S.M., Hashim, Y., & Saleh, M.N. (2000). Factors influencing the effectiveness of teaching and learning through the video conferencing in distance education (in Malay). Malaysian Journal of Distance Education, 2(1), 67-90.

D'Apollonia, S. & Cohen, P. (1990). Validity of student ratings of instruction: what we know and what we do not? *Journal of Educational Psychology, 82*, 219-231.

Gan, Siowck-Lee. (2001). Malaysia. In O. Jegede & G. Shive (Eds.), *Open and Distance Education in Asia Pacific Region.* Hong Kong: Open University of Hong Kong Press.

Hillman, D. C. A., Willis, D. J. & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: an extension of contemporary models and strategies for practitioners. *American Journal of Distance Education, 8*(2), 30-34.

Ibrahim, D. Z. & Silong, A. D. (1997). Assuring quality learning support for teachers' distance education program. In P.C. Chew, (Ed.). *Quality Assurance in Distance and Open Learning. Conference Proceedings, Vol. 2.* 11th Annual Conference and Exhibition. Asian Association of Open Universities, 11-14 November, Kuala Lumpur, Malaysia.

Juran, J.M. (1989). Juran on Leadership for Quality: An Executive Handbook. New York: The Free Press.

Kember, D. & Dekkers, J. (1987). The role of study centres for academic support in distance education. *Distance Education, 8*(2), 30-42.

Knox, D.M. (1997). A review of the use of video conferencing for actuarial education – a three-year case study. *Distance Education, 18*(2), 225-235.

Malaysia. (2002). Laporan Ciri-Ciri Pendidikan Dan Sosial Penduduk, Banci Penduduk Dan Perumahan 2000. Retrieved 20.8.2002 from http://www.statistics.gov.my/Bahasa/presspendidikan.htm.

Mann, C. C. (1998). Quality assurance in distance education: the Surrey MA (TESOL) experience. *Distance Education, 19*(1), 7-22.

McIlroy, A. & Walker, R. (1993). Total quality management: some implications for the management of distance education. *Distance Education, 14*(1), 40-54.

McIlroy, A. (1997). Quality in business education: perceptions of staff and students in an undergraduate program. In P.C. Chew, (Ed.). *Quality Assurance in Distance and Open Learning. Conference Proceedings, Vol. 1.* 11th Annual Conference and Exhibition. Asian Association of Open Universities, 11-14 November, Kuala Lumpur, Malaysia.

Mills, R. & Paul, R. (1993). Putting the student first: management for quality in distance education. In T. Evans, & D. Nation (Eds.). *Reforming Open and Distance Education Critical Reflections form Pacific.* London: Kogan Page.

Morgan, C., & Morris, G. (1994). The student view of tutorial support: report of a survey of Open University Education students. *Open Learning, 9*(1), 22-33.

Nunan, T. & Calvert, J. (1991). Investigating quality and standards in distance education - an interpretation of issues. Paper presented at the 10th Biennial Forum, Australian and South Pacific External Studies Association, NSW, Australia, 15-19 July, 1991.

Partovi, T. (1997). Revolution in learner-centered education in the 21st century. In P.C. Chew, (Ed.). *Quality Assurance in Distance and Open Learning. Conference Proceedings, Vol. 1.* 11th Annual Conference and Exhibition. Asian Association of Open Universities, 11-14 November, Kuala Lumpur, Malaysia.

Ravisankar, K & Murthy, C. R. K. (2000). Student participation circles: an approach to learner participation in quality improvement. *Indian Journal of Open Learning*, *9*(1), 73-85.

Robinson, B. (1994). Ensuring quality in the planning and development of distance learning courses. Paper presented at the 20th Anniversary International Conference on Distance Learning, Colombia, September 20-22.

Sewart, D. (1992). Student support systems in distance education. Paper presented at the 16th Conference of the International Council for Distance Education, Thailand, 8 - 13 November, 1992.

Simpson, O. (2000). Supporting Students in Open and Distance Learning. London: Kogan Page.

Stevenson, K., & Sander, P. (1998). How do Open University students expect to be taught at tutorials? *Open Learning*, *13*(2), 42-46.

Taylor, J. C. (1997). Flexible learning systems: opportunities and strategies for staff development in industry. In P. C. Chew (Ed.). *Quality Assurance in Distance and Open Learning. Conference Proceedings, Vol. 1.* 11th Annual Conference and Exhibition. Asian Association of Open Universities, 11-14 November, Kuala Lumpur, Malaysia.

About the Authors

Helen Khoo Chooi Sim, Hanafi Atan & Rozhan M. Idrus
School of Distance Education
Universiti Sains Malaysia
11800 Pulau Pinang
Malaysia

Editor's Note: Instructional design provides many techniques to assist learning. Brain-Based Learning looks at research on neural mechanisms that facilitate the learning process. as a way to optimize performance. Some approaches are already used under other names; others provide leverage to optimize learning.

Brain-Based Learning: Possible Implications for Online Instruction

Stephanie A. Clemons

Abstract

As higher education institutions push for more online courses instructors are faced with issues and challenges related to teaching in the online learning environment. Regardless, of whether higher education's impetus is fueled by cost-saving measures, or the belief that online courses answer the challenge of rapid tuition increases or changing student body, one issue that continues to resurface, concerning online courses is to how best to deliver the information and facilitate learning for the student.

Issues concerning student learning involve how they accept, retain and process information delivered in a course. This paper briefly defines and describes brain-based learning, a theory that is under investigation in higher education, and offers suggestions on how that theory may be implemented in the delivery of information and facilitation of online classes in higher education. Implications for online educators are also presented.

The brain is "not only the control center of the entire human body, organizing our behaviors and biological functions, but it also is the seat of our humanity. It defines who we are, how we act, and the very nature of our species." (Slavkin 2004, 38).

KeyWords: Learning models, learners, modalities, online learning and instruction, brain-based learning, higher education.

Introduction

As higher education institutions in the United States push for more online courses, instructors are faced with new issues and challenges related to teaching in the online learning environment. Regardless, of whether higher education's impetus is fueled by cost-saving measures (Jaffee, 1998) or the belief that online courses answer the challenge of rapid tuition increased or changing student body (Feenberg, 1999; Hara & Kling, 2000), one issue that continues to resurface, concerning online courses is to how best to deliver the information and facilitate learning for the student (Bolliger & Martindale, 2004). Student learning is impacted by how the human brain accepts and processes information delivered in the course.

The 1990's were recognized by the President of the United States and the Congress as the Decade of the Brain. They predicted findings from the neurosciences would result in significant benefits for society (Lucas, 2004). As the twentieth century waned, an explosion of information about the human brain and how it learns appeared in educational journals, popular magazines, and television documentaries (Stevens & Goldberg, 2001). Thousands of research projects, books, magazine covers, and television specials regaled the public with new facts and figures, and at times, suspiciously simple ways to improve our memories and make babies geniuses (Wolfe & Brandt, 1998).

As skeptical as some have been, findings from the neurosciences, a relatively new field with over 90% of all neuroscientists still alive and practicing today (Lackney, 2004), linked with educational needs, offers information for improving teaching and learning. Again, neuroscience is a field of study, separate form the field of education. Can findings about the brain that involve learning, assist in the development and facilitation of online courses? Although brain-based learning has been extensively explored as it relates to elementary and secondary education, could this research apply to learning in higher education? This paper briefly defines and describes brain-based learning, and offers suggestions for the delivery of information and facilitation of online classes in higher education. Implications for online educators are presented.

The review of literature involves the exploration of brain-based learning, brain-based instruction, and online instructional design. Although the review is brief in nature, websites are referenced to provde more information if desired.

Review of Literature

The Brain: A Synopsis

At birth, a child's brain has all the brain cells, or neurons, that it will ever have (Wolfe & Brandt 1998). The brain weighs about one pound and reaches about three pounds by adulthood (Sprenger, 2002). The human brain differs from other species in that 1) it has a larger cognitive area with the ability to use it for higher-order thinking, and 2) it requires nurturing for 18 to 20 years in comparison to other species whose offspring are born with almost fully developed brains (Sylwester, 1997). It wasn't too long ago that scientists thought the brain was fixed at birth (Wolfe & Brandt, 1998).

A simplistic way of looking at the brain is to divide it into three areas as outlined by Dr. Paul Maclean in his "triune brain theory" (Hermann, 1994). The lowest area of the brain, where information enters, is called the brain stem. This regulates such functions as breathing, heart rate, and waking/sleeping cycles. The second area, above the brain stem, is the limbic area, which controls emotions and, when encountering stimuli, the decision-making process. The third area is the cerebrum which is divided into the right and left hemispheres. The cerebrum is a collection of connections that send messages from the brain to the body and has a thin covering about $1/8^{th}$ inches thick called the neocortex or "new bark" The neocortex is sometimes called the cerebral cortex, commonly referred to as "gray matter." The cerebrum invents, creates, writes, and calculates; its characteristics define our individual attributes.

The brain has two hemispheres. The left hemisphere, within the cerebral cortex, is in charge of speech, logic, sequence, time, details, and math. The right hemisphere is related to music, art, strong emotional responses, intuition, images, and summarizing (Sprenger, 2002). The hemispheres are divided into lobes that 1) process visual and auditory information, 2) take charge of feeling and touch, 3) deal with decisions and planning, creativity, and problem solving, and 4) involve emotions, personality, working memory, attention, and learning (Sprenger, 2002).

Brain-Based Learning

To understand brain-based learning, a study of brain cells is needed. The brain consists of many cells; one type, which is basic to learning, is the neuron. Learning takes place when two neurons communicate. When the neuron gathers information, it grows appendages called dendrites (http://www.funderstanding.com/brain_based_learning.cfm.) More than 30,000 dendrites can fit onto the head of a pin (Sylwester, 1995). Dendrites constantly scan for information because the brain continually wants to learn. (It is sometimes hard to see the strong desire of the brain to learn in classrooms or online; however, the brain is always searching for meaning from gathered information and stimuli.) A synapse transmits messages between neurons via the axon (Sprenger, 2002). A synapse is a gap between the cells, an invisible bridge (Stevens & Goldberg, 2001) that

allows the neurons to communicate as information travels through the brain. When neurons repetitively communicate with each other, a neural network is formed (Sprenger, 2002) and a pattern is repeated. See Figure 2.

Following are some of the findings from brain research (Stevens and Goldberg, 2001)

- Brains are specialized and are not equally good at everything.
- Brains are designed for fluctuations rather than constant attention
- Emotions are critical to successful learning.
- Brains are poorly designed for rote learning.
- Multi-sensory input is desired by our brains.
- Learning involves the whole body.
- Each brain is unique.
- Threat, high anxiety, and a sense of helplessness impairs learning.
- Brains process both parts and wholes simultaneously
- Brains are considered "plastic" and continue to develop throughout our lives.

Figure 1. Findings from Brain Research.

Following are some of the core principles of brain-based learning.

1. The brain can perform several activities at once (e.g. tasting and smelling).
2. Learning engages the whole body.
3. The search for meaning is innate and comes through patterning.
4. Emotions are critical to patterning.
5. The brain processes wholes and parts simultaneously.
6. Learning involves focused attention and peripheral perception.
7. Learning involves both conscious and unconscious processes.
8. We have two types of memory – spatial and rote.
9. Learning and understanding are enhanced if facts are embedded in natural, spatial memory.
10. Challenge and threat inhibits learning.

Excerpts from "Brain-Based Learning" written by On Purpose Associates, 2004.

Figure 2. Core Principles of Brain-Based Learning.

See following websites for additional information on brain-based learning.

www.thebrainstore.com
http://www.designshare.com/Research/BrainBasedLearn98.htm
http://www.loloville.com/brain_based_learning.htm
http://www.brainconnection.com/

Physiologically, the genetic structure of the brain seeks for meaning, pattern interconnectedness, relevance and useful applications (Greenleaf, 2003) from its surroundings. This was supported in the 1960's with research revealing that brain structures are modified by the environment (Diamond and Hopson 1998). It established the concept of neural plasticity; the brain's ability to constantly change its structure and function in response to external experiences (Wolfe & Brandt, 1998). As information and skills are collected, they are organized according to meaning related to the information. As a result, students learn in different ways due to their previous experiences, perceptions, and prior knowledge about the subject (Slavkin, 2002). See Figures 1-3 to gather more information about brain based learning and enriched environments.

Enriched environments unmistakable influence the brain's growth and learning. These suggestions are adapted from "Enriching the Environment" by Diamond and Hopson, 1998).

- Include a steady source of positive emotional support.
- Encourage them to eat nutritious meals while learning.
- Provide an atmosphere free from undue stress but filled with pleasurable intensity.
- Encourage social interaction for a significant percentage of activities.
- Promote development of a broad range of skills that are mental, physical, aesthetic, social, and emotional.
- Promote exploration and fun of learning.
- Allow student to be active participant rather than passive observer.

Figure 3. Concrete Strategies for Enriching the Environment.

Previous studies have related the human brain and learning to computers by comparing the ability o each to store, retrieve, and organize files of information. However, that simile is limiting as the human brain constantly updates how it stores and networks information based on individual experiences (Slavkin, 2004). See the following website to locate articles concerning this topic. (http://www.findarticles.com/p/articles/mi_m4467/is_7_54/ai_64059320).

Understanding how the brain learns and relating it to the educational field resulted in the concept known as brain-based learning. It is defined as any teaching technique or strategy that utilizes information about the human brain to organize how lessons are constructed and facilitated with emphasis placed on how the brain learns naturally (Slavkin, 2004). Brain-based learning offers a framework to enhance student learning.

Brain-Based Instruction

Brain-based or brain-compatible instruction requires instructors to understand how the brain works and thus, design instruction with that information in mind (Stevens & Goldberg, 2001).Teachers have been encouraged to combine knowledge about their profession with findings from brain research to create learner-centered environments – whether online or in physical classrooms. Applying brain research to instructional design can result in the practice of brain-compatible instruction instead of brain-antagonistic instruction (Stevens & Goldberg, 2001).

Instructional Design – Online Classes

Instructional design is measured by how well the design supports and facilitates the achievement of the instructional objectives (Koohang & Du Plessis, 2004). It relies on learning models and theories that encourage learning and is considered by some an art and science that "brings the

learner from the state of not being able to accomplish certain tasks to the state of being able to accomplish those tasks" (Broderick, 2001). Attention is shifting to concept of active learning that involves constructing new knowledge based on prior knowledge, real-world observation with real problems in real situations, and constructing interpretations of observations (Adler, 1998; Gagne et al, 1992).

Instructional design for online classes must include learning principles and conditions that meet the learner's needs (Egbert & Thomas, 2001). Key elements of instructional models for online classes include: learner consideration, learning task, learning content, content organization, instructional strategies, media, learning environment, assessment of instruction, materials for delivery and evaluation/feedback (Sherry & Morse, 1995; Moore & Kearsley, 1996; Simonson, et al., 2000). Recently, Koohang and Du Plessis (2004) developed an online model that demonstrates the interconnectedness of the instructional design (content), learning (user) and usability (system). Instructional design for online classes is constantly being assessed and reassessed to determine quality learning outcomes.

Implications for Development/Facilitation of Online Classes

There are many suggestions for integrating brain-based learning into the educational environment that are applicable to online courses. Following are four suggestions based on findings from neuroscience research: memory/retrieval, learning styles, increasing attentiveness, and the role of emotion in learning. In addition, other suggestions are briefly mentioned in bullet format to encourage personal reflection concerning existing online courses.

Memory and Retrieval

The first suggestion involves the physiology of the brain as it relates to memory and retrieval. There are three types of memory: sensory, short-term (or working) and long term. Sensory memory sifts all incoming stimuli through the five senses, recognizes it, passes it along to working memory or discards it. Short-term memory refers to the ability to retain limited amounts of information for brief periods. Long-term memory refers to the storage of large amounts of information, procedures, and events. Scientists typically group retrieval into two categories: implicit and explicit memory. Implicit memory refers to subconscious retrieval of information; for example, searching for a word rarely used that pops into the mind. Explicit memory relates to the intentional recall of information and events. There are two types of memory tests for explicit memory: recognition and recall (Lucas, 2004).

Tips for online classes. Students will remember content more if it is moved from short-term memory to long term memory through a technique called "elaborate rehearsal." Class content, or a concept to be learned, can be contained in role plays, debates, video clips, art or music (Stevens & Goldberg, 2001). Some of these teaching strategies are easier to put into place in online classes. However, technology is making it easier every day.

Another technique to help students retain information via online classes is "chunking." This is effective if students are required to recall lists of information. Chunking is a strategy of grouping items into smaller chucks of seven, plus or minus two "chunks." Examples of seven used every day include telephone numbers with area codes, social security numbers, license plate numbers, postal zip codes in the United States, or the "Seven Habits of Highly Effective People. Other techniques include the use of acronyms and rhymes (Lucas, 2004). Chunking can be easily implemented into online classes through such areas as discussion points, downloadable handouts, and PowerPoint lecture notes.

Learning Styles

The brain uses its hundred billion plus cells to process information and images in many ways and on different levels. Most students have a preferred and a secondary modality for learning commonly called learning styles. These preferences involve receiving information through auditory, visual or kinesthetic means (Clemons, 2004). Ninety percent of learning is visual with eighty-five percent of the brain wired for visual processing. Rhythm/music allows us to encode information effortlessly. Music at 60 beats per minute may maximize retention (Lucas, 2004).

Tips for online classes. It is understandable that an instructor of any course delivers the information in a way that is easy for them, personally, to learn. However, it is important to develop and deliver the course with several learning modalities in mind. Auditory learners enjoy talking to themselves when reviewing information (Lucas, 2004). Therefore, encourage group discussions with someone at their site (even if not enrolled in the class) and have them report the results. In addition, use audio/video/animation clips, voice-overs of "lecture" materials, or send students to websites with audio components. Visual learners gain understanding from stimuli through their eyes. Use of PowerPoint software slides and images, video clips, or animation will be appealing to this learner. In addition, use of color, diagrams, charts, bold lettering, pictures, extra white space, and symbols will impact a visual learner. The kinesthetic/tactile learner will gather maximum information via an activity or task. They learn best through exploring, manipulating, and assembling or disassembling ideas or objects. Online courses can be developed with assignments that involve model building, sketching/drawing, and field trips or scavenger hunts (Clemons, 2004). Digital images of models or designs can be uploaded for grading. Encourage the upload of five to seven images per model for effective grading results.

Increasing Attentiveness

The average learner attention span is 15-20 minutes -- depending on age, gender, and background. Learners, especially traditional-aged college students, have been conditioned to speed and quick sound bytes rather than prolonged learning tasks. The average student packs more into his/her workday than can effectively be managed. Technology offers an additional distraction including cell phones, I-Pods, DVD players, microwave ovens, satellite television and computerized toys. Online techniques can be used to minimize distractions and maximize attention.

Tips for online classes. The opening and closing of your online session are the last bits of information remembered. Gain attention by using quotes by famous people that relate to content, humorous video clips (e.g. Muppets), post tests in the form of crossword or words search puzzles that contain key content terms and concepts. Incorporate originality into the design of your materials. Stimulate emotions with such techniques as excitement, fun, curiosity, anticipation, or surprise to enhance learning (Lucas, 2004).

Interaction will enhance attentiveness in online courses. Distance learning theory and subsequent research studies advocate that interaction is an essential characteristic of successful distance learning courses (Roblyer & Wiencke, 2003). Increased interaction is associated with higher achievement and student satisfaction (Zirkin & Sumler, 1995). Distance courses must use different, often more intensive means than traditional courses do to infuse instruction with interactive qualities (Rheingold, 2001) but with worthwhile success.

Role of Emotion

Learning is strongly influenced by emotion. Strong emotion connected with an experience causes chemicals in the brain to send a message to the rest of the brain such as, "This information is more important. Retain it for future use." However, if the emotion is too strong (usually dealing with a threat or stress) there is a decrease in efficiency of the rational thinking cortex of the brain

and learning stops (Wolfe & Brandt, 1998). Blood moves away from the frontal lobes, thereby reducing the ability to think clearly or recall information. Peak learning happens when the brain is in high challenge and low stress (Lucas, 2004).

Tips for online classes.

Establish early that the learning environment will be safe and that students are free to challenge ideas, question facts or thoughts, and voice opinions. Outline objectives, the course schedule, and assignments in such a way that it puts control into the students' hands. Alleviate stress of failure in the online course. Maintain contact with each student, offer encouraging, positive feedback and avoid penalizing mistakes that come from the learning curve associated with technology.

Realize that gender differences can impact learning. The male brain is great at hunting (e.g. video games) while the female brain is great for seeing, listening, memorizing, reading, nonverbal cues, and articulating emotion (Lucas, 2004).

Additional Brain-Based Instructional Suggestions

- **Make learning contextual and related to student interests**. The big picture should not be separated from the details. Studies show that, especially with adults, there is a need to understand the big picture to recognize the value of each piece of information encountered (Lucas, 2004; On Purpose Associates, 2004).
- **Structure learning around real problems and in teams** (On Purpose Associates, 2004).
- **Immerse learners in rich, complex interactive experiences** (On Purpose Associates, 2004).
- **Offer personally meaningful challenges to enhance learning**. The student's mind is stimulated to the desired state of alertness. (On Purpose Associates, 2004).
- **Humor aids in learning**. (On Purpose Associates, 2004).
- **Develop educational tools that are artistic to create brain-friendly environments** (On Purpose Associates, 2004)
- **Offer two minutes of time for the students to process the information for every ten minutes of information shared with students** (Stevens & Goldberg, 2001). Present online information in chunks; then offer an activity that incorporates content and gives downtime to process information.
- **Use patterns**. The brain is able to retain the equivalent of 500 encyclopedias. When knowledge is organized as a pattern, it is easier to retrieve. Use mnemonic devises to help students recall difficult subject matter concepts (Stevens & Goldberg, 2001).
- **Suggest periodically the value of good nutrition**. Nutrition is crucial to effective learning (Lucas, 2004). The immune and endocrine systems as well as the brain contain many of the same types of chemicals and chemical receptors (Pert, 1997). In addition, the brain's super fuel is oxygen, with water the next most important. Protein helps boost memory and attention. Carbohydrates promote release of the relaxant serotonin (hence drowsiness after lunch). Fruit is an excellent source of energy that requires minimal digestion (Lucas, 2004). Studies indicate that students who eat nutritious food while studying earn statistically higher test scores, and increase reading speed and accuracy (Dunn & Milgram, 1993).

Conclusion

Brain-based or brain-compatible learning theory focuses on concepts that create an opportunity to maximize attainment and retention of information. A key to successful application is for everyone involved in the learning process (online course developers, educators, students) to understand the structure of the brain and consciously focus on learners' needs and styles to evaluate and improve the course format and delivery system. In brain-based learning environments, materials and instruction must be learner-centered and delivered in a manner that is fun, meaningful, and personally enriching (Lucas, 2004). These goals are possible to achieve in online courses – perhaps even more so than in traditional resident instruction.

Brain-based learning and strategies emerging from the neuroscience's body of research are still at a "buzzword stage." Other valid theories concerning intelligence and brain-based learning (Lucas, 2004) are available. Gardner himself has been frustrated by "reductionist thinking" of many educators that "talk the language", but walk using old instructional strategies--dividing up content into distinct learning modalities to the exclusion of other dimensions (Lackney, 2004). Researchers continually caution educators to resist the temptation to use neuroscience as a promotional tool for a pet program; much work needs to be done (Wolfe & Brandt, 1998).

Online educators who seek to base practice on the sciences should assess recommendations stemming from these theories and ideas to determine if they can improve delivery and course content. Keeping cautionary advice in mind, brain-based learning makes some good sense.

> *"The brain is the last and grandest biological frontier, the most complex thing we have yet discovered in our universe. It contains hundreds of billions of cells interlinked through trillions of connections. The brain boggles the mind."*
>
> *James Watson Director,*
> *National Center for Human Genome Research*

References

Adler, D. L. (1998). Understanding: Coming to terms with the u-word of instructional design. Paper presented at the annual meeting of the *Mid-South Educational Research Association*, New Orleans, LA., November.

Bolliger, D. U. & Martindale, T. (2004). Key factors for determining student satisfaction in online courses. *International Journal on E-Learning 3*(1): 61-67, January-March.

Broderick, C. L. (2001). *What is instructional design?* Retrieved November 2, 2004, from http: //www.geocities.com/ok_bcurt/whatisID.htm.

Clemons, S. (2004, November). Developing on-line courses for visual/kinesthetic learners: A case study. *The International Journal of Instructional Technology and Distance Learning, 1*(11), 1-13.

Diamond, M. & Hopson, J. (1998). *Magic trees of the mind: How to nurture your child's intelligence, creativity, and healthy emotions from birth through adolescence.* New York: Dutton.

Dunn, R. & Milgram, R. (1993). Learning styles of gifted students in diverse cultures. In R. M. Milgram, R. Dunn, & G.E. Price (eds). *Teaching and counseling gifted and talented adolescents for learning style: An international perspective.* Westport, CT: Praeger, 3-23.

Egbert, J. & Thomas, M. (2001). The new frontier: A case study in applying instructional design for distance teacher education. *Journal of Technology and Teacher Education 9*(3): 391-405.

Feenberg, A. (1999). *Distance learning: Promise or threat?* Retrieved November 1, 2004, from http://www-rohan.sdsu.edu/faculty/feenberg/TELE3.HTM.

Gagne, R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of instructional design* (4th ed.). Fort Worth: Harcourt, Brace, Jovanovich College Publishers.

Greenleaf, R. K. (2003). Motion and emotion. *Principal Leadership 3*(9): 14-19.

Hara, N. & Kling, R. (2000). Students' distress with web-based distance education course: An ethnographic study of participants' experiences. Bloomington, IN: Center for Social Informatics. Retrieved September 8, 2001, from http://www.slis.indiana.edu/CSIwp00-01.html.

Hermann, N. (1994). *The creative brain.* Lake Lure, NC: The Ned Hermann Group.

Jaffee, D. (1998). Institutionalized resistance to asynchronous learning networks. *Journal of Asynchronous Learning Networks*, 2(2). Retrieved November 22, 2001, from http://www.aln.org/alnweb/journal/vol2_issue2/jaffee.htm.

Koohang, A.& Du Plessis, J. (2004). Architecting usability properties in the e-learning instructional design process. *International Journal on E-Learning, 3*(3): 38-43.

Lackney, J. A. (2004). 12 design principles based on brain-based learning research. DesignShare: The International Forum for Innovative Schools. Retrieved November 4, 2004, from http://www.designshare.com/Research/BrainBasedLearn98.htm

Lucas, R. W. (2004). *The creative training idea book: Inspired tips and techniques for engaging and effective learning.* New York: AMACOM.

Moore, M. & Kearsley, G. (1996). *Distance education: A systems view.* Belmont, CA: Wadsworth.

On Purpose Associates. (2004). Brain-Based Learning. Funderstanding. Retrieved November 2, 2004, from http://www.funderstanding.com/brain_based_learning.cfm.

Pert, C. (1997). *Molecules of emotion: Why you feel the way you feel.* New York: Scribner.

Rheingold, H. (2001). Face-to-face with virtual communities. *Syllabus 14*(12): 8-12.

Roblyer, M. D. & Wiencke, W. R. (2003). Design and use of a rubric to assess and encourage interactive qualities in distance courses. *The American Journal of Distance Education, 17*(2): 77-98.

Sherry, L. & Morse, R. (1995). An assessment of training needs in the use of distance education for instruction. *International Journal of Educational Telecommunications, 1*(1): 5-22.

Simonson, M., Smaldino, S., Albright, M. & Zvacek, S. (2000). *Teaching and learning at a distance: Foundations of distance education.* Upper Saddle River, NJ: Merrill/Prentice Hall.

Sprenger, M. B. (2002). *Becoming a "wiz" at brain-based teaching.* Thousand Oaks, CA.: Corwin Press, Inc.

Slavkin, M. L. (2002). The importance of brain functioning on cognition and teacher practice. *The Journal of Teaching and Learning 6*(1): 21-34.

Slavkin, M. L. (2004). *Authentic learning.* Toronto: ScarecrowEducation.

Stevens, J. & Goldberg, D. (2001). *For the learners' sake.* Tucson: Zephyr Press.

Sylwester, R. (1995). *A celebration of neurons: An educator's guide to the human brain.* Alexandria, VA: Association for Supervision and Curriculum Development.

Wolfe, P. & Brandt, R. (1998). What do we know? *Educational Leadership 56*(3): 8-13, November.

Zirkin, B. G., & Sumler, D. E. (1995). Interactive or non-interactive? That is the question!!! An annotated bibliography. *Journal of Distance Education 10*(1): 95-112.

About the Author

Stephanie A. Clemons, PhD., FIDEC, ASID is an Associate Professor in the Department of Design and Merchandising at Colorado State University. Her doctorate is from the School of Education. She is a Past President and Fellow of the Interior Design Educators Council (IDEC) (www.idec.org) and currently serves on the Educational Training Area Council (ETAC) for the American Society of Interior Designers (ASID) (www.asid.org), the leading professional organization for interior designers with more than 34,000 members. She has received numerous teaching awards, and has published extensively – both refereed and non-refereed articles. Her specialty areas relate to technology and education. Clemons has presented research both nationally and internationally (including in South Korea's World Congress and at the South Africa IFI Conference) and has taught in higher education for over 20 years. Clemons has been teaching online courses for two years. Clemons can be reached at sclemons@cahs.colostate.edu.

Stephanie A. Clemons, Ph.D., Associate Professor
Department of Design & Merchandising
Colorado State University
Fort Collins, Colorado, 80523-1574, USA
clemons@cahs.colostate.edu
970.491.5639 work 970.416.7445 home 970.491-4855 fax

Editor's Note: New technologies must respond to user se4rvice demands. The use of wireless mobile devices for internet is growing rapidly. The transition to digital phones permits Internet Protocols (IP). Various methods of sharing optimize quality and bandwidth.

Open and Distance Education through Wireless Mobile Internet: A Learning Model

Sanjay Jasola and Ramesh Sharma

Abstract

Technology has been the driving force to bring paradigm shifts in education. Big changes are not possible unless tools are available. Technology has great impact on what we can do. The printing press is an example. People had been reading and writing even before the invention of the press but it was not that wide spread. The quality and quantity to accumulate knowledge has been possible with the books accessible and affordable to all. In earlier days, students had to rely on memory to remember everything that teacher delivered but now books are available. More recently, there has been universal use of inventions as radio, television, and, increasingly, computers in distance education. The past few years have produced an explosion of electronic information resources available to students, teachers, library patrons, and anyone with a computer. Millions of pages of graphics and text-based information can be accessed directly on-line through hundreds of public, private, and commercial networks, including the biggest network of all: the Internet. In this paper we propose a learning model for open and distance education through wireless mobile internet.

Key Words: wireless mobile internet, internet protocol, open and distance learning

Introduction

With the advent of Internet Protocol (IP) technology and the tremendous growth in data traffic, the wireless industry is evolving its core network towards IP technology. Enabling wireless Internet access is one of the upcoming challenges for mobile radio network operators. With the rapidly increasing penetration of cell phones, which would be used by mobile users to access Internet services, support of Internet services in a mobile environment has become a growing requirement.

The major shift over from the second-generation (2G) to third-generation (3G) wireless or 4G mobile was the ability to support advanced and wideband multimedia services, including email, file transfers, and distribution services such as radio, TV and software provisioning (software download) which are very important to open and distance learning system. These multimedia services can be asymmetric, symmetric, real time and non real time. External market studies have predicted that in Europe in the year 2010 more than 100 million mobile users will use mobile multimedia services and will generate about 70 percent of traffic in terms of transmitted bits. In Asia, this number will increase to over 200 million. This tremendous success was not anticipated in 1980s, when today's second-generation mobile communication systems were designed.

It is therefore increasingly important that mobile radio networks support these applications in an efficient manner. Thus mobile radio system currently under development includes support for packet data services. The most widely deployed standard for second-generation mobile radio network is Global System for Mobile communication (GSM).

Convergence of Services

User expectations are increasing with regards to a large variety of services and applications with different degrees of quality of services, which is related to delay, data rate and error bit requirements. Therefore, seamless services and applications via different access systems and technologies that maximize the use of available spectrum will be the driving force for the future developments. In addition, many types of objects as well as people will have network functions and will communicate with each other through networks. Therefore, different communications relationships such as person to person, machine to machine and mainly machine to person and vice versa will determine mobile and wireless communication in the future.

Given the increasing demand for flexibility and individuality in society, the means for the end users might be assessed. Potentially, the value would be in diversity of Mobile application, hiding the complexity of underlying communication schemes. This complexity would be absorbed into an intelligent personality management mechanism, which would learn and understand the needs of users and control the behaviors of their configurable terminals accordingly in terms of application behavior and access to future support services.

The trend from a service perspective includes integration of services and convergence of service delivery mechanism. In particular, three pillars (3C) can characterize from a service perspective the trends of integration of services and convergence of service delivery mechanism.

- Connectivity (provision of a pipe, including intelligence in network and terminal)
- Content (information, including push-pull)
- Commerce (Transaction)

These trends will result in new service delivery dynamics and a new paradigm in telecommunication where value added services such as those that are location dependent will provide enormous benefit to both end users and service providers. Convergence of wireless and Internet will be one of the hottest topics in coming years. Wireless Mobile Internet (WMI) and its devices are coming to the market in ever increasing numbers all over the world. The investment in this business will be over $100 billion with in the next several years.

Emerging Business Goals

Due to the dominant role of the IP based data traffic in the future networks, systems have to be designed for the economic data transfer rate. WMI requires the core wireless network infrastructure to change from circuit – to packet switched where voice and data are transported using IP as the common protocol. Wireless mobile users don't just want to access all the information available on the Internet via telephone. It therefore makes better sense if the operator selects an appropriate service portfolio tailored to mobile subscribers. It is also impractical to deliver the contents to a phone in the same manner as supplied to a PC. The graphics and the hyperlinks are to be striped out, but this only represents a Band–Aid approach to the problem. What is needed is a wireless equivalent to the web and it should support following emerging business goals.

Significant Cost reduction

The wireless mobile communication shall help in lowering costs of data communication, Multi vendor procurement, and witnessing a growth in modular and incremental infrastructure.

Accelerated time to market

The end-user services and infrastructure are adequately pushed through.

Variety of services with an Open service creation environment

We can have faster services and applications development, opportunities for new business development, and alignment of data services and the Internet.

Grow Internet services business

It enables to take advantage of wire line investments in Internet, VoIP, and IP-based services and application.

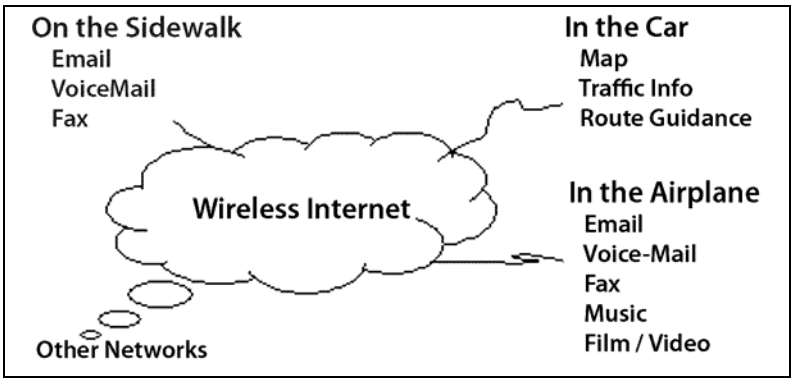


Figure 1. Some Promises of Ubiquitous Networking and Mobile Computing

As shown in Fig. 1, next-generation wireless technologies promise ubiquitous networking and mobile computing on a large scale, with high-bandwidth data services and a wireless Internet (Fasbender & Reichert, 1999; Gibson, 1999; Negus, Stephens & Landford, 2000; and Ojanpera and Prasad, 1998). However, there are still numerous challenges such as reliability and quality of service, infrastructure costs, energy efficiency of mobile devices, among others. Although the commercial impact of wireless technologies has far been limited to cellular telephones, the business and technical communities anticipate rapid growth in wireless data services. Almost daily, some prominent company announces plans for a "wireless e-commerce" enhancement to its business (Pandya, 1999).

Technology advances have made it conceivable to build and deploy dense wireless networks of heterogeneous nodes collecting and disseminating wide ranges of environmental data. Applications of such sensor and monitoring networks include smart warehouses equipped with security, identification, and personalization systems; intelligent assembly systems; warehouse inventory control; interactive learning systems; and disaster mitigation. The opportunities emerging from this technology give rise to new paradigm shift in Open and distance learning. Before proceeding further, let's have a brief idea of how the mobile network works.

Basic Concepts of Cellular Systems

A cellular system is generally characterized as a high-capacity land mobile system in which available frequency spectrum is partitioned into discrete channels assigned in groups to geographic cells covering a cellular Geographic Site Area (GSA). The discrete channels are capable of being reused in different cells within the service area (Pandya, 1999).

The principle of cellular systems is to divide a large geographic service area into cells with diameters from 2 to 50 km, each of which is allocated a number of RF channels (Rappaport, 1996). Transmitters in each adjacent cell operate on different frequencies to avoid interference. However, since transmitted power and antenna height in each cell are relatively low, cells that are sufficiently far apart can reuse the same set of frequencies without co channel interference. The theoretical coverage range and capacity of a cellular system are therefore unlimited.

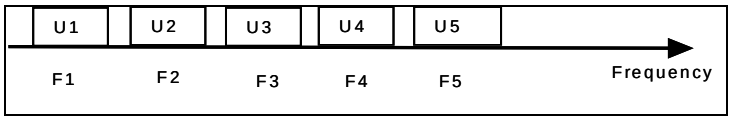


Figure 2. Basic Principles of FDMA

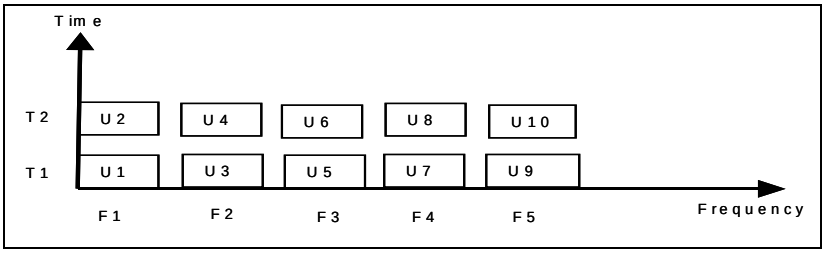


Figure 3. Basic Principles of TDMA

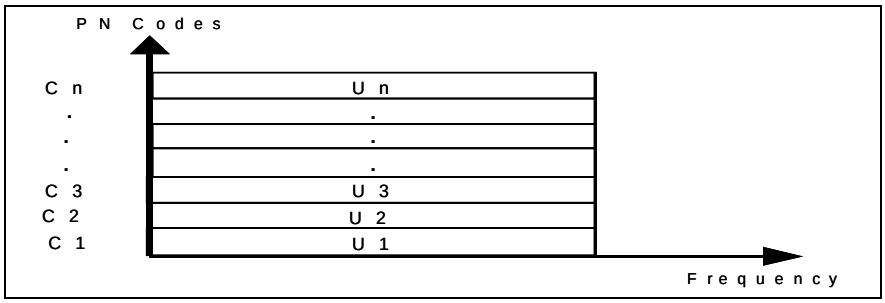


Figure 4 Basic Principle of CDMA

Generally, a fixed amount of frequency spectrum is allocated to a cellular system by the national regulator. Multiple access techniques are then deployed so that many users can share the available spectrum in an efficient manner. The three basic multiple access method currently in use in cellular systems are: Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA). Figs. 2-4 illustrate these multiple access methods, where Fx refers to frequency slot x, Tx to time slot x, Cx to PN code x, and Ux to user number x (Pandya, 1999).

In the case of FDMA, users share the available spectrum in the frequency domain, and a user is allocated a part of the frequency band called the *traffic channel*. The user's signal power is, therefore, concentrated in this relatively narrow band in the frequency domain, such that different users can be assigned different frequency channels on a demand basis (Gibson, 1999). Interference from adjacent channels is limited by the use of guard bands and band pass filters that maintain separation of signals associated with different users.

In TDMA techniques which are widely used in digital cellular systems, the available spectrum is partitioned into narrow frequency bands or frequency channels (as in FDMA), which in turn are divided into a number of time slots (Pandya, 1999). An individual user is assigned a time slot that permits access to the frequency channel for the duration of the time slot. In this context, the traffic channel consists of a time slot in a period train of time slots that make up a frame. In case of the North American digital cellular standard IS-136, each frequency channel (30 Khz) is divided into three time slots, whereas for the European digital standard GSM, each frequency channel (200 Khz) is divided into eight slots (Sollenberger, Seshadri & Cox, 1999). In the case of TDMA systems, guard bands are needed between frequency channels and between time slots.

TDMA is the multiple access technique of choice for several digital cellular and Personal Communication System (PCS) systems. It is usually combined with FDMA, because different carrier frequencies are used in different cells. Frequencies are only reuses in cells sufficiently distant in order to minimize interference (Falconer, Adachi & Gudmundson, 1995).

In the case of CDMA, the spread spectrum technique is used. In fact, a spreading code, also called a PN code, is used to allow multiple users to share a block of frequency spectrum. In CDMA cellular systems that use direct sequence spread spectrum techniques, the digital information from an individual user is modulated by means of a unique PN code assigned to each user. All the PN code modulated signals from different users are then transmitted over to entire CDMA frequency channel. At the receiving end, the desired signal is recovered by dispreading the signal with a copy of the spreading sequence or PN code for the individual user in the receiving correlator. All the other signals (belonging to other users), whose PN codes do not match with that of the desired signals, are not dispread and, as a result, they are considered as a noise by the correlator. As shown in Fig. 4, since the signals in the case of CDMA utilize the entire allocated block of spectrum, no guard bands of any kind are necessary within the allocated block (Pandya, 1999)..

Evolution of Wireless technologies for mobility support

The analog cellular mobile systems fall in the category of first-generation mobile systems, the digital cellular, low-power wireless, and PCS are rather perceived as second-generation systems. The original “first-generation” cellular systems used analog frequency modulation to transmit voice signals. Most of the today’s cellular phone use “second-generation” technology that conveys speech in digital format at bit rates that are around 10 kbps.

The general architecture of next generation wireless networks will include and extend existing infrastructure such as cellular architecture, wireless LAN, fixed networks (LAN, MAN, WAN, Internet, etc) as well as specialized service oriented architecture including radio and satellite services.

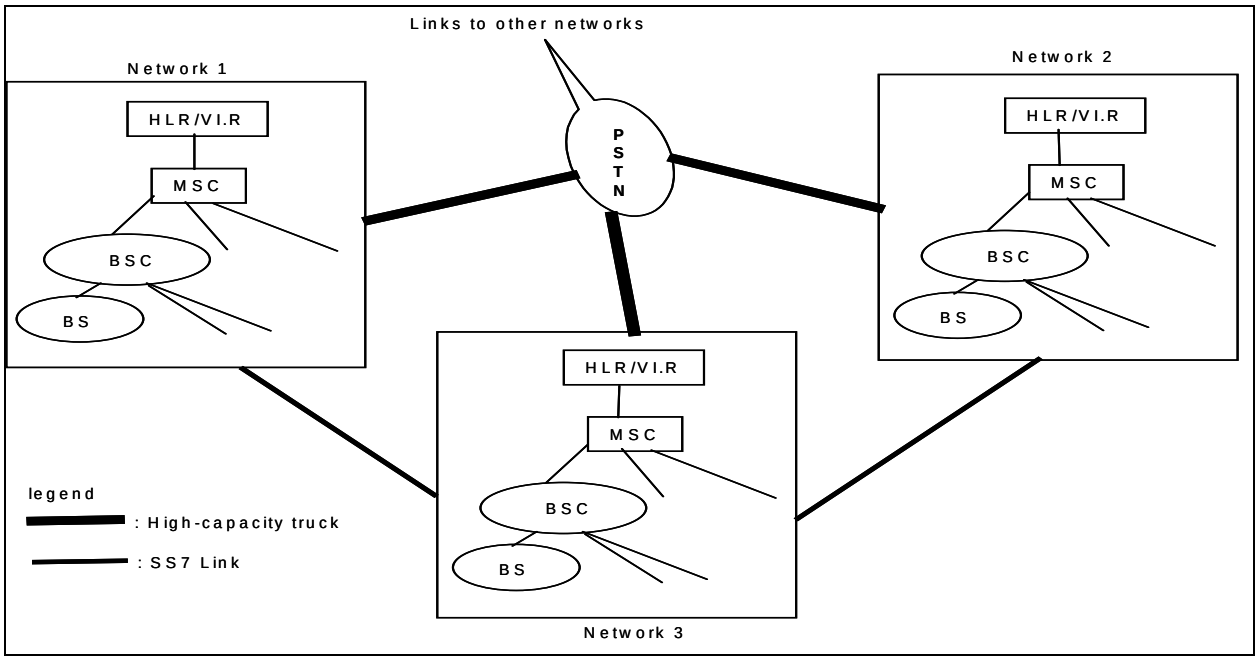


Figure 5. A Typical Wireless Network Infrastructure.

As shown in Fig. 5, a typical cellular wireless network infrastructure consists of a number of components such as :

- A Base Station (BS) which serves hundred of mobile users in a given area (cell) by allocating resources that allow users to make new calls or continue their calls if they move to the cell.
- A Base Switching Circuit (BSC) which provides switching support for several neighboring BS, serving thousands of uses, links between BSC and BS usually have been wireline or fiber line, but they also can be wireless microwave links.
- An Master Switching Circuit (MSC) which is a larger switch that is capable of serving more that 100,000 users; links between MSC and BSC are also increasingly wireless.
- HLR and VLR that keep track of users who are permanently registered or who are just visiting the area, respectively.
- SS7, which performs the call setup between MSC and the PSTN.
- High-capacity trunks (T1 or T3) that carry call between MSC and the PSTN.

Digital cellular service

The first digital cellular system specification was released in 1990 for the GSM system. The GSM, form the basis for mobile and personal communication services, not only in Europe but in many other parts of the world including North America. The number of GSM subscribers worldwide exceeds 100 million and is growing rapidly. The intent of emerging PCS standards in the US is to provide a combination of terminal mobility, personal mobility, and service portability to the end users utilizing a range of wireless technologies and network capabilities.

A digital cellular system called ‘Personal Digital Cellular’ (PDC) was developed in Japan. To a large extent, the specifications for these second-generation cellular systems are being developed to meet business and regulatory requirements in specific countries and/or regions.

All the second-generation digital cellular system designs were optimized for telephone traffic. The initial support of data services on cellular networks was essentially restricted to dial-up modem-based services. The user data rates for these services were further constrained by the interference-prone nature of the radio environment.

If second-generation cellular mobile systems are expected to enhance their data handling capabilities in order to support the emerging high-speed data and multimedia market, the radio access part must be modified. Initial efforts in this direction have been under way for some time in Europe, and the resulting EDGE (Enhanced Data-rate for Global Evaluation) proposal has been developed. Support of EDGE in GSM is considered to be key point in its evolution to the third-generation mobile system Universal Mobile Telecommunication System / International Mobile Telecommunication (UMTS/IMT-2000).

The three technologies that seem to be gaining momentum in digital cellular and PCS industry are: CDMA, TDMA and GSM (Kim & Litman, 1999). Picking the ultimate winner technology can yield advantages in lower cost from economies of scale and make it easier to enter into roaming agreements. On the other hand, picking the wrong technology can leave the provider and customer stranded. Because such a decision is critical and strategic, cellular or PCS providers tend to enter into nationwide strategic alliances, and the strategic alliance may select a technological standard (Westerhold, 1996).

Mobility characterization

The need for mobility is a fundamental market factor that is driving the evolution of telecommunications networks. In telecommunications terms, mobility can be defined as the ability to access all of the services that one would normally have in a fixed wireline environment such as a home or office, from anywhere (Jing, Helal & Elmagarmid, 1999). Examples include the ability to have a telephone conversation from your car, while on the move, or at the beach. More complex examples would be the possibility to be reached via your traditional telephone number anywhere in the world. Other examples are cellular roaming or the ability to receive all of your voice, email and fax messages while traveling in a foreign country and being able to receive all the lectures online, download course material, be able to chat with facilitator while on move.

A mobile computing infrastructure should support different wireless and wireline communications devices optimized for their specific environment. As a result, a person is able to initiate or receive information anywhere, at any time. The concepts enabling the provision of universal personal communications include terminal mobility provided by wireless access, personal mobility based on personal numbers, and service portability through the use of intelligent network capabilities.

Terminal mobility systems are characterized by their ability to locate and identify a mobile terminal as it moves, and to allow the mobile terminal to access telecommunication services from any location. It is associated with wireless access and required that the user carry a wireless terminal while being within a radio coverage area.

Personal mobility, on the other hand, is centered on a user carrying a personal subscription identity (personal telecommunication number) rather than a terminal. With an identity card containing a personal telecommunication number, a user can access services from any terminal, whether it is in fixed or mobile communications network. When a caller dials this number, it is the network's responsibility to route the call to the terminal of the subscriber's choice. The subscriber could make this choice known to the network by the use of personal identity module, based on time-of-day/day-of-week, or the network could make attempts to deliver the call at more than one terminal.

It refers to the capabilities of a network to provide subscribed services at the terminal or location designated by the user. The exact services that a user can evoke depend on the capabilities of both the terminal and the network in service.

Implementation Approaches

To implement mobile wireless Internet applications, two complementary approaches or technologies have been developed; a third-generation cellular radio transmission technology (3G) and a wireless application protocol (WAP). 3G focuses on high-data-rate communications with portable devices. Data rates cited in technical standards are 384 kbps for devices moving outdoors at high speed in cars or trains, for example, and 2 Mbps for slowly moving devices in or near a suitably equipped building. At these rates, proponents of 3G expect people to use portable devices for many of the exotic information services they enjoy at home and work (Goodman, 2000).

WAPs underlying assumptions differ fundamentally from 3Gs. Rather than transmitting a Web content and other Internet applications through the air, WAP recognizes that cellular phones are not PC, and that many information services developed for PC are of little use to people moving about with small devices. Therefore, WAP focuses on applications tailored to the capabilities of cell phones and their users' needs. By taking into account the constraints of mobile radio channels, WAP uses various compression techniques to reduce the number of bit transmitted through air.

With respect to information delivered to the phones, WAP uses WML, to display text and icons on a telephone screen. Instead of point-and –click navigation through hypertext, people use the phone's small keypad to send information upstream. Thus, WAP created an information web for cellular phones, distinct from the PC-centric Web. WAP functions well in a low-data-rate, low-power environment of present cellular systems.

WMI for Open and Distance Learning System

Historically, we have not done a very good job of implementing the concept of learner-centered education in distance education. It is difficult, at best, to instill a mindset of lifelong learning in others if we don't understand it and demonstrate it ourselves. One of the reasons that we have failed in this area has been that the tools were not available to do much besides deliver education (as opposed to enable learning) at a distance. Now, computer and communication have opened the ways to formats other than pen –and- paper correspondence courses and allow for a more interactive, interactive learning environment. Web offers one such format to enhance learner's experience (Perkins, 1991; Lebow, 1993; Clark, 1994; Filipczak, 1995; Howard-Vital, 1995; Shotsberger, 1996 and Piere, 2001). Wireless mobile Internet design can contribute greatly to the following guiding principles and practices of open & distance learning:

- Learning Goals and Content Presentation
- Interactions
- Assessment and Measurement
- Instructional Media and Tools
- Learner Support and Services.

The identification and articulation of the learning goals and objectives provides the foundation for the instructional design, development, delivery, and assessment of an educational event. These goals define what is to be taught and what is to be learned. Communicating these learning goals is a crucial step in assuring an effective learning experience.

As knowledge in many fields increases exponentially, Present day situation demands to develop motivated, skillful, lifelong learners. We cannot hope to fill up students as if they were passive, empty vessels. During formal schooling, aspiring professionals can only begin to take in the amount of information that they will need during their career life times. The knowledge base of certain fields may have appeared static for decades, but we can no longer accept that view. Therefore, we must define the goals in such a way that students become lifelong learners by helping them locate the resources to continue learning. Distance educators are now focusing on a related set of notions: (a) there are different learning styles (Kolb, 1985; Jonassen, & Grabowski, 1993; Messick, 1984; Kranc, 1997; Day, Raven, & Newman, 1998; Weety, 1998; and Terrell, & Drinkgus, 1999-2000), (b) students create their own meaning when learning new things (Mezirow, 1991; Bills, 1997; Gifford, 1997), and (c) what makes a difference in content retention and transfer is not so much what is done by teachers, but what students as learners can be encouraged to do themselves Keller, 1988; Fjortoft, 1996; Pintrich & Schunk, 1996; and Bullen, 1998). Much has been written about the importance of accommodating the learning styles of different kinds of students. It is enough to say here that too often students have little choice in what to learn, how to learn it, or when to learn it. When content is meaningless to the students' world view, when they are taught as if they were passive recipients of knowledge, or when they have little engagement in the instructional tasks, students have no incentive to construct their own knowledge and little motivation to retain information or transfer its use to novel situations (Goodman, 2000).

The notion of practice-centered learning (PCL) is also important to distance learning. As we learn more about how learning occurs, it becomes increasingly clear that the educational process takes place in a complex internal and external environment. One of the teacher's roles is to become the creator of an effective external learning environment that stimulates the environment within. How do teachers and developers of instruction create environments that are conducive to and enhance student learning? The WMI can help provide these new environments for open & distance learning as it permits contents anywhere, anytime. The wireless mobile access to web allows us to utilize such methods as cooperative learning, to recognize such concepts as interdisciplinary needs in education, and to provide an environment in which collaborative efforts are rewarded.

WMI Learning Model

In distance learning, there is a great relationship between the use of technology and the user of technology. It is very important that technology should not drive the educational content, in fact, the needs of the learners and the perceived outcomes must be prime. Harasim, Hiltz, Teles & Turoff (1996: 24) indicated, “The real question is not whether a course can be done online but what is the best media mix to achieve the goals of the course within the constraints of the available resources or geographic dispersion of the students. More fundamentally, how should the media be used? What approaches to teaching and learning are most effective in a computer networking environment?” When learners interact with one another, with an instructor, and with ideas, new information is acquired, interpreted, and made meaningful. If students feel that they are part of a community of learners, they are more apt to be motivated to seek solutions to their problems and to succeed (California Distance Learning Project, 1997). One of the challenges for distance educators is to develop strategies and techniques for establishing and maintaining “learning communities” among learners separated by space and/or time. A good WMI design provides an effective learning environment with frequent and meaningful interactions among learners, between learners and instructional materials, and between learners and the instructor.

There can be different types of interaction, which are possible through Wireless Mobile Internet according to predominant communication paradigm: one-alone, one-to-one, one-to-many, and many-to-many. One-alone applications are that utilize online resources: information (online databases and online journals), software (online applications and software libraries), and people (online interest groups and individual experts). Online information about distance education may be obtained through many sources and is available in many forms. There are several scholarly discussion groups distributed via LISTSERVs, for example, that focus on issues of concern to distance educators and learners. In addition there are archives of papers, conference announcements, calls for papers, electronic journals, literature reviews, software, books, guides, library catalogs, resource databases and more-all accessible with a few keystrokes. Examples on one-to-one interaction include learning contracts, mentorship, apprenticeship, and correspondence study. These applications are characterized by one-to-one relationships and by individualized learning. One-to-many applications, such as lectures and skits, are differentiated from other forms of interaction by their use of presentation techniques in which learners are not usually invited to interact. With many-to-many applications, all participants have the opportunity to take part in the kind of interaction that can be facilitated in computer conferencing systems. The mobile sets (which can send and receive pictures) are making video conferencing possible. Techniques such as debate, simulation, role-play, discussion groups, transcript- based assignments, brainstorming, and project groups can be performed with the links on web site.

The bulletin board can be used to stimulate interaction among students and the instructors. A variety of different strategies can be used to encourage interaction on the BBS, including assignments, discussion questions, and team activities. The Bulletin Board System (BBS) networks can be used as an educational resource. BBS networks are distributed group

conferencing systems that allow teachers and students from around the world to interact with each other electronically in "virtual classrooms," sharing information and collaborating on learning projects.

Effective design is essential to the success of an online course, which include overall course design issues, resource allocation, syllabus creation, activity selection, online structure production, and evaluation planning. Appropriate attention to these items during the design phase informs the development and delivery phases of the online course, thereby creating a "good learning experience" for adult college students. Instructions should be designed using WAP or 3G which are compatible to WMI and supports collaborative and cooperative learning by encouraging positive interdependence (group projects), individual accountability, appropriate interpersonal skills, and/or group self-evaluation.

Assessment and Measurement

Assessment and measurement strategies provide information on learner progress, measure achievement of learning goals, and provide learners with benchmarks for monitoring their progress and adjusting their learning strategies. In a distance learning model, assessment and measurement become even more critical in the absence of the face-to-face interactions that enable teachers to use informal observation to gauge student response, obtain feedback, and progress toward goals.

Concluding Thoughts

The use of web technologies and wireless mobile Internet in Instructional media and supporting software tools have enabled distance educators to address the two primary barriers to distance education: the learner’s feelings of remoteness and isolation, and the time it takes to complete an instructional transaction.

The courses offered via web are based on a learner-centered approach to education in which facilitators and students share responsibility and participation in learning and teaching. To initiate such a process, facilitators must make sure they and their students have adequate training and support on the electronic system. They must also do a great deal of advance planning to teach a course via the new medium. By initiating a variety of activities, both on and off-line, facilitators can encourage an active, challenging learning environment. As the class conference progresses, it is required that different strategies are necessary to keep energy high. Those involved should be satisfied with this mode of learning once they get past initial difficulties with technology. Because the courses are delivered by web, students are able to take considerable control over their learning in terms of how they should schedule both personal study time and group-interaction time, how much personal contact they should have with the instructor and other learners, and how they can contribute to the class.

Courses delivered via web can meet immediate learning needs as well as help learners increase self- direction in their ongoing learning. The selection of web as instructional media and tools has been influenced by the accessibility by learners. Web incorporates a technology base that is appropriate for the widest range of students within a program’s target audience. In justifying the support for web also indicate a number of requirements for success: (a) web must have a strong user base at the local level before it can be widely used at a distance, (b) effective use of web demands specific conditions and skills, and (c) teachers and students must be supported in acquiring those skills (Kim & Litman, 1999). Distance learners bring varied social and cultural backgrounds and diverse experiences to a distance-learning situation. The unique contexts in which learners live and work influences the way they think about and use wireless mobile Internet.

Web sites offer the most important components in the design of distance learning programs that establish the organizational and administrative infrastructures to ensure that such programs are efficiently and effectively developed, managed, and executed. The learner support systems and services offered through WMI will be at least as complete, as responsive, and as learner-oriented as those provided for the on-campus learner (Thronburg, 1991).

References

Bills, C.G. (1997). *Effects of Structure and Interactivity on Internet-Based Instructions.* Paper presented at the Interservice/ Industry Training, Simulation, and Education Conference, Orlando, FL, December 1-4(ERIC Document ED416317).

Bullen, M. (1998). Participation and critical thinking in online university distance education. *Journal of Distance Education. 13*(2), 1-32.

California Distance Learning Project. (1997). "What is Distance Education?" available online http://www.otan.dni.us/cdlp/distance/whatis.html

Clark, R.E. (1994). Media will never influence learning. *Educational Technology Research and Development*, 42(2), 21-29.

Cranton, P. (1994). *Understanding and Promoting Transformative Learning: A Guide for Educators of Adults*. San Francisco: Jossey-Bass.

Day, T.M., Raven, M.R., & Newman, M.E. (1998). The effects of World Wide Web instruction and traditional instruction and learning styles on achievement and changes in student attitudes in a technical writing in an Agri-communication course.. *Journal of Agricultural Education, 39*(4), 65-75.

Falconer, D.D.; Adachi, F., & Gudmundson, B. (1995). Time division multiple access methods for wireless personal communication , IEEE Personal communication ,6(2),22-30

Fasbender and Reichert (1999). Any network, any terminal, anywhere, IEEE Personal Communication 6(2),22-30

Filipczak, B. (1995). Putting the learning into distance learning. *Training.* 32(10), 111-112, 114-118.

Fjortoft, N.F. (1996). Persistence in a distance learning program: A case in pharmaceutical education. *American Journal of Distance Education, 10*(3), 49-59.

Gibson, J. D. (1999). The Mobile Communication Hand book, CRC Press, Miami

Gifford, L.J. (1997). *Graduate students' perceptions of time spent in taking a course by Internet versus taking a Course in a regular classroom*. Paper presented at the Annual Mid South Educational Research Association Conference. New Orleans. LA, November 4-6, 1998. (ERIC Document ED 427767).

Goodman, D.J. (2000). The wireless internet: promises and challenges. IEEE Computer 33 (7), 36-41.

Harasim, L., Hiltz, S.R., Teles, L., and Turoff, M. (1996). *Learning Networks*. Cambridge, Mass: MIT Press.

Howard-Vital, M.R. (1995). Information technology: Teaching and learning in the twenty-first century. *Educational Horizons*, 73(4) 193-196.

Jing.,J., Helal,A., Elmagarmid, A. (1999). Client Server Computing in mobile environment, ACM Computing Survey 31(2),117-157.

Jonassen, D.H. & Grabowski, B.L. (1993). *Handbook of individual differences, learning, and instruction.* Hillsdale, NJ: Lawrence Erlbaum.

Keller, J.M. (1988). Use of the ARCS motivational model in courseware design. In D. Jonassen (Ed.), *Instructional designs for microcomputer courseware* (pp. 401-434). Hillsdale, NJ: Erlbaum.

Kim, S and Litman, B. (1999). An economic analysis of the US wireless telephone industry: responses to new technologies, Telematics and Infomatics16(1-2),27-44.

Kolb, D. (1985). *Learning style inventory*. Boston: Hay/McBer Training Resources Group.

Kranc, B.M. (1997). *The impact of individual characteristics on telecommunicatioin.* Unpublished doctoral dissertation, North Carolina State University.

Lebow, D. (1993). Constructivist values for instructional systems design: Five principles for a new mindset. *Educational Technology Research and Development,* 41(3), 4-16.

Messick, S. (1984). The matter of style: Manifestations of personality in cognition, learning and teaching. *Educational Psychologist, 29*(3), 121-136.

Mezirow, J. (1991). Transformative Dimension of Adult Learning. San Fransisco: Jossey-Bass.

Myers, C., and Jones, T. (1993). *Promoting Active Learning: Strategies for the College Classroom*. San Francisco: Jossey-Bass.

Negus K.J, Stephens A.P., Landford, J. (2000). Home RF : wireless networking for the connected home. IEEE Personal Communication 7(1), 20-27.

Ojanpera and Prasad (1998). An overview of third generation wireless personal communication : a European perspective, IEEE Personal Communications 5(6),59-65.

Pandya, R. (1999). Mobile and Personal Communication systems and services. IEEE Press ,new York.

Perkins, D.N. (1991). Technology meets constructivism: Do they make a marriage? *Educational Technology,* 31(5), 18-23.

Piere, S. (2001). Mobile computing and ubiquitous networking: concepts, technologies and challenges, Telematics and Informatics, pp. 109-131.

Pintrich, P.R., & Schunk, D.H. (1996). *Motivation in education*: *Theory, research and applications.* Englewood Cliffs, NJ: Prentice-Hall.

Rappaport, T.S. (1996). Wireless Communication : Principles and practices, Prentice-Hall, Upper Saddle River.

Sheingold, K. (1991, September). Restructuring for learning with technology: the potential for synergy. Phi Delta Kappan, pp. 17- 27.

Shotsberger, P.G. (1996, March/April). Instructional uses of the World Wide Web: Exemplars and precautions. *Educational Technology,* 36(2), 47-50.

Sollenberger, N.R.; Seshadri N., & Cox, R. (1999). The evolution of IS –136 TDMA for third generation wireless services, IEEE Personal communication ,6(3),8-18.

Terrell, S.R. & Drinkgus, L. (1999-2000). An investigation of the effect of learning styles on student success in an online learning environment. *Journal of Educational Technology Systems. 28*(3), 231-238.

Thornburg, D.D, (1991). Education, Technology and paradigms of change for the 21st century, Starsong publication.

Weety, L.S.C. (1998). The influence of a distance-learning environment on students' field dependence/independence. *The Journal of Experimental Education*, 66(2), 149-160.

Westerhold, M.W. (1996). Major challenges to Wireless Providers. Annual review of Communication 1137-1142.

About the Authors

Sanjay Jasola

Sanjay Jasola is Deputy Director in Computer Division of Indira Gandhi National Open University, Maidan Garhi, New Delhi – 110 068. (INDIA)
Email: sjasola@ignou.ac.in

Ramesh Sharma

Ramesh Sharma is Regional Director at Regional Center Karnal of Indira Gandhi National Open University, Old Govt College Campus, Railway Road, Karnal, Haryana – 132 001 (INDIA) Email: rcsharma@ignou.ac.in

Editor's Note: The computer is frequently used in laboratory instruction to guide the student step-by-step as he learns a complex activity. The computer has many advantages: It can combine text with color images and sound; it can be paced by the student on a step-by-step basis and steps are easily repeated; it can simulate the experiment so that the student can practice prior to conducting the experiment. It can even be used as a replacement for an activity that would otherwise be too time-consuming, costly, or dangerous for the student to perform without expert assistance. Add to this the advantage that the computer can be a management system to monitor – even measure – student performance. This paper discusses options for design and development of the computer software for a professor in India.

Development of Computer Software Support for Undergraduate Electronics Science Laboratory Practical Learning

Yogendra Babarao Gandole

Abstract

The use of computer-based resources in supporting the teaching of a electronics laboratory course is described where the course has been enhanced to develop skills in experimental design, data analysis and links to theoretical parts of the subject. In particular, a computer software comprising laboratory demonstration, background theory, worked examples and sample data, was created using "mixed" design methodology. The "Electronics experiments" package is described in detail. The packages contain a course management element, which allows students to be assessed on their understanding of the background theory and their competence to carry out experiments. It is concluded that interactive computer software packages can be routinely customised to meet the individual needs of teaching and learning situations.

Introduction

Electronics is a laboratory-based course designed to expose students to basic analog and digital devices and circuits. Students are encouraged to discover concepts through laboratory experiences and apply their knowledge to problems and projects.

Laboratory work should aim to encourage students to gain

- Manipulative skills
- Observational skills
- Ability to interpret experimental data
- Ability to plan experiments
- Interest in the subject
- Enjoyment of the subject
- A feeling of reality for the phenomena talked about in theory

The role of the laboratory is central in Under Graduate electronics courses since students must construct their own understanding of electronics ideas. This knowledge cannot simply be transmitted by the teacher, but must be developed by students in interactions with nature and the teacher. Meaningful learning will occur where laboratory activities are a well-integrated part of a learning sequence.

It is not clear that our existing courses provide opportunities for students to develop all these skills. Indeed, Johnstone (1997) suggests that "it is possible to reach the end of a laboratory

period having learned nothing with the exception of some hand skills. Masson and Lawrenson (1999) used computer testing to highlight problem areas with first year laboratory classes and concluded that problems relate to poor understanding of background theory and general scientific concepts and to difficulty with dealing with experimental results. This conclusion is consistent with our own observations of first year students working in the electronics laboratory.

Students at the beginning of a university course face a number of problems in the electronics laboratory. In the first place they lack experience with the procedures concerned, and the accompanying lack of manipulative skills often means the data they collect is of poor quality.

Furthermore the amount of time available is too short for them to collect sufficient data for interesting analysis or to repeat observations in an attempt to improve their technique through practice. Tutors often respond to these problems by providing a detailed protocol for the students to follow; this is designed to minimize the faults in technique and to ensure that data is collected under optimal conditions. One consequence of this is that students carry out the manipulations mechanically and without thought; this lack of engagement with the process means that students gain little inspiration from laboratory work and lose faith in the theory which underpins it. Different suggestions have been made to deal with these problems. For example Mishra R.A. (2000) reported some success following the introduction of a number of changes into first year electronics practicals, including laboratory exercises involving audio-video learning and data analysis. Nicholls (1999) designed computer software for use as pre-lab exercises in the inorganic chemistry laboratory. Garratt et. al. (1997) prepared computer simulations which they claimed to be useful both as pre-lab exercises and to provide students with the means to learn about experimental design and data interpretation.

This paper reports on research related to two issues. The first involves the extent to which properly designed computer software can serve as a cognitive bridge that can help electronics students in development of the target instructional model. The second examines the mutual roles that laboratory and computer software tools can play in the learning process.

Design Methodology:

The first step in designing an application is to decide which design methodology to use. For the vast majority of computer applications it is hard to say that one correct implementation is better than another. There is always a certain amount of artistry involved and evaluating between two correct implementations usually involves subjective arguments based on the preferences of the evaluator. In an investigator belief, such artistry extends beyond the choice of implementation into the choice of design methodology. An investigator may, for instance, prefer one method for developing a certain type of application while another person prefers another. In a project such as this where there is only one programmer involved, an investigator would say that the design methodology to use is the one that the programmer can achieve results with most confidence. The methodology does not have to agree exactly with any well-known methodology.

Personally, an investigator feels most confident with "mixed" design methodology. An investigator had selectively used the objects of, top-down and bottom-up design based on the current task to solve. Overall the development structure could be called evolutionary with some rapid prototyping. Most of the professional programmers that an investigator knows use some variation of the technique when designing small to medium sized applications. It allows the flexibility of matching a particular style to the task in hand.

Perhaps the best way to illustrate the method is to go through the design process of the project in roughly chronological order.

It has to be said that the design did not occur wholly before the implementation; rather it was an ongoing processing throughout the implementation. The separation of the design from implementation is something that is inherent to the Waterfall method of design - a method which is widely regard as a nice idea, and perhaps even the ideal, but not something that accurately reflects programming reality. A design is not properly assessed until it is implemented, by which time, according to the Waterfall method, it is too late to change the design. This is even more apparent in experimental projects, such as this one, where there is little readily available knowledge as to which project design is correct because nobody has implemented such a project before. My technique for designing this project, which I believe to be the best one for experimental, time constrained projects, was to design a part of the project, implement it, assess the design, redesign if necessary and then move on to the next part of the project.

Steps in Software Development

- Clear understanding of the problem: Problem Specification.
- Careful solution design paying attention all the constraints:
- Transform algorithm into a program code: Abstraction and coding.
- Complete debugging: Error removal.
- Thorough testing:
- Maintenance dictated by the environmental changes

Problem specification

The essential function of laboratory instruction is to teach theory and process of experimentation. The computer software may be found suitable for communicating process of laboratory work effectively to the students. The Aim of the Computer software support is to:

1. Communicate the basic knowledge (theory) related to practical work in electronics.
2. Assist the students in selecting the measuring instruments and electronic components require performing an experiment in laboratory.
3. Develop the competency of assembling the practical electronic circuit.
4. Communicate procedure of an experiment.
5. Communicate demonstration of an experiment.
6. Reduce the labor of calculation and to obtain accuracy in design, results etc.

Design

A) Output Design

Output, generally refers to the results and information that are generated by the application. For many end-users, output is the main reason for developing the system and the basis on which they will evaluate the usefulness of the application, when designing output, investigator accomplished the following:

1. Determined what information to be presented.
2. Decided whether to display, print, or “speak” the information and selected the output medium.
3. Arranged the presentation of information in an acceptable format.
4. Decided how to distribute the output to intended recipients.

B) Design of Input

The design of input includes the following input design details:

1. What data to input.
2. What medium to use.
3. How the data should be arranged or coded.
4. The dialog to guide users in providing input.
5. Data items and transactions needing validation to detect errors.
6. Methods for performing input validation and steps to follow when errors occur.

The design decisions for handling input specify how data are accepted for computer processing.

C) Design of Procedure

Procedures specify what tasks must be performed in using the application. The important procedures include:

- Data entry procedures: Methods for capturing input data and entering it into the system.
- Run-Time procedure: Steps and actions taken by end-users who are interacting with the application to achieve the desired results.
- Error-handling procedures: Actions to take when unexpected results occur.

D) Design of Program Specification

Designing computer software is important to ensure that

- The actual programs produced perform all tasks and do so in the manner intended.
- The structure of the software into modules permits suitable testing and validation to be sure procedures are correct.
- Future modifications can be made in an efficient manner.

E) Stages in the development of a simulation Option

- The object, system or phenomenon was analyzed and ample data collected bout it
- A model was designed based on the data and the purpose of the simulation
- A software model was created
- The model was tested against the real life equivalent. This process is called validation.
- The model was improved and further testing carried out until it behaves as much like the real thing as is possible.
- Then the model was used to examine unknown situations

Coding

After designing the user interface, the next stage was to decide how each control reacts to user actions, such as click of a mouse, keystrokes, and so on. As the application does not determine the flow of; instead, the events caused by the user determine the flow of the application. Hence coding is essential to react to various external conditions (Events), and the user's actions determine the application's flow.

Testing

Testing is the major quality control measure employed during software development. Its basic function is to detect errors in the software. During requirements, analysis and design, the output is usually textual and non-executable. After the coding phase, computer programs are available that can be executed for testing purpose. This implies that testing, not only has to uncover errors introduced during coding, but also errors introduced during the previous phases. Thus, the goal of testing is to uncover requirements, design or errors in the programs.

The starting point of the testing was unit testing. In this a module was tested separately and is often performed by the code himself simultaneously with the coding of the module. The purpose was to exercise the different parts of the module code to detect coding errors. After this the modules were gradually integrated into subsystems, which were then integrated themselves to eventually forms the entire application. After the system was put together, application testing was performed. Here the application was tested against the requirements to see if all the requirements are met and the application performs as specified by the requirements.

Software Tryout (Initial Stages)

The questionnaire has been designed by investigator to evaluate the quality of computer software program. This questionnaire contains 13 statements refer to the technical aspects of the software.

Their aim was to evaluate its technical adequacy to the learning objectives of the program. They deal mainly with questions related to the general structure of the product navigation, interactivity, design and other aspects that can favour or hinder the learning process. Overall 27 statements refer to curricular design aspects, usefulness and intend to evaluate the integration capacity of the program in the learning process of an electronics practical.

Responses of students were in five-point scale. The 45 students (15 students from each class FY, SY & TY B.Sc.).,offering electronics subject at B.Sc. level were selected randomly for this piloting. The students were divided into three batches. Initially the investigator demonstrated the each module of the software using LAN for each batch and they asked to operate the each module of the software freely. Finally the questionnaire was given to every student and they asked to write ‘1’ for very bad or NO, ‘2’ for bad or sometimes, ‘3’ for acceptable or average, ‘4’ for good or almost always and ‘5’ for very good or Yes. The students who respond either 4 or 5 were grouped together which indicated the good quality of computer software. On the other hand the students who responded either 3, 2 or 1 are grouped together which indicated the poor quality of software and requires modifications. It was later on converted into percentage. The consolidated list of percentage for every statement was given in table 1.

From the analysis of piloting it was found that the development of computer software programme for laboratory communication was very good.

Finally, acceptance testing was performed to demonstrate to the students, teachers and experts in electronics and computer field, on the real life data of the practical.

Implementation

Even well designed and technically elegant software can succeed or fail because of the way they operated and used. Hence those who will be associated with or affected by the software must know in detail, what their roll will be, how they can use the software and what the software will or will not do. To overcome this problem, the investigator visited the selected colleges and provided a detail training of operation of software to the concerned teachers.

Table 1

Analysis of computer software tryout (initial stage).

Item No.	STATEMENT	%of positive response	%of negative response
A. Technical-Instructive Adaptation :Interface Design (Screen design)			
1	The quantity of colour on screen is adequate for the sort of information contained	84.44 %	15.56 %
2	The quantity of the images is adequate for the sort of information contained	77.78 %	22.22 %
3	The sound quality level is adequate for the sort of information transmitted	71.11 %	28.89 %
4	The quantity of graphics and images is adequate for the sort of information transmitted	82.22 %	17.78 %
5	The resolution of graphic and images is adequate for the sort of information transmitted	82.22 %	17.78 %
6	The text presentation on screen is adequate for the information transmitted, Access and control of the information	97.78 %	2.22 %
7	The student has control over different parameters of presentation (colour, sound level, etc.)	82.22 %	17.78 %
8	The program facilitates the paper printing of selected information by the student	95.56 %	4.44 %
9	The program facilitates the navigation through the contents	88.89 %	11.11 %
10	The program gives the student the possibility of modifying the information contained.	84.44 %	15.56 %
11	The interaction tools (buttons, menu, commands) facilitate the learning process	86.67 %	13.33 %
12	The program, in general, is easy to use	88.89 %	11.11 %
13	It is easy for the student to learn how to use the program	88.89 %	11.11 %
14	The running of the program is adequate (there are no bugs which block it)	86.67 %	8.89 %
B Didactic or Curricular Adaptation			
B1 Learning contents			
15	Are clearly presented	93.33 %	6.67 %
16	Emphasize the most important things	77.78 %	22.22 %
17	Are sequenced	93.33 %	6.67 %
18	The information is updated	88.89 %	11.11 %
19	Are enough to achieve the objectives	80.00 %	20.00 %
20	Are beneficial to the improvement of attitudes	91.11 %	8.89 %
21	Are extra-laboratory activities	91.11 %	8.89 %
22	Are free of grammar or spelling errors	95.56 %	4.44 %
B2 Learning activities			
23	Require different levels of mastery	8.89 %	91.11 %
24	Follow a logical sequence in relation to the objectives	84.44 %	15.56 %
25	The number of different activities is enough	80.00 %	20.00 %
26	Allow different tries for answering	91.11 %	8.89 %
27	Examples of the activities to be done are shown	93.33 %	6.67 %
28	Examples are clear and adequate	93.33 %	6.67 %
B3 Evaluation			
29	The program is constantly evaluating the student's output	84.44 %	15.56 %
30	Shows the student the errors he/she has made	82.22 %	17.78 %
31	Provides specific help for the student's errors	91.11 %	8.89 %
32	The feed-back is immediate	88.89 %	11.11 %
33	The feed-back is motivating for the student	86.67 %	13.33 %
34	The feed-back provides clear and significant information	88.89 %	11.11 %
35	Facilitates self-correction	86.67 %	13.33 %
36	Constantly informs the student about his/her output	82.22 %	17.78 %
B4 Motivation			
37	The program increases the active involvement of the student on the laboratory task	91.11 %	8.89 %
38	Students show a better interest in learning practical	93.33 %	6.67 %
C. Usefulness			
39	Use it as self-instruction material	88.89 %	11.11 %
40	Use it as complementary laboratory material	68.89 %	31.11 %
41	The program makes it possible for the students to work in groups of two or three	71.11 %	28.89 %

Table 2

Opinion Scale

Item No.	Item	Response	
		Yes	No
1	Was the SOFTWARE material relevant to the objectives of the Electronics experiment?		
2	Was the Software interested in your progress in Electronics?		
3	Were the experiments presented in an interesting manner?		
4	The laboratory demonstration contained instructions that were easy to follow.		
5	What is required in the write-up of an experiment is clear.		
6	The theory behind the experiments was clearly presented		
7	The simulation module made me feel I have the ability to continue in Electronics science		
8	The laboratory demonstration, experimental techniques and write-up were all interlinked		
9	The experiments were interesting		
10	Time in practical was spent effectively		
11	I felt free to use software.		
12	The software stimulated my interest in the subject area.		
13	The software did his share in helping us to learn electronics experiments.		
14	The software is user friendly.		
15	The content of the software is fully self-instructional.		
16	The interactive nature of the software made the experiment more interesting		
17	Does the software enhance your enjoyment of learning about electronics subject?		
18	Does the software helped make the experiment concepts easy to understand ?		
19	Did the content of the software assume too much prior knowledge?		
20	When needed, I found the written instructions & simulation to be helpful		
21	Had any problems gaining access to the software in the laboratory?		
22	Were the instructions provided with the software adequate?		
23	Does the software give sensible results?		
24	Does the software help electronics practical learning?		
25	Does the software add value over conventional practical methods?		
26	Did the software save you any practical time?		
27	Did you get a feeling of personal satisfaction from using the software?		
28	Did the software meet the needs for your electronics practical?		
29	Do the software make the student think about the subject matter?		
30	Are the software relevant to the learning practical objectives?		
31	Is the demonstration well laid out and of practical use?		
32	Did you have any difficulty using any part of the software?		
33	Would the software help you teach [the electronics experiment]?		
34	Does the software support activities that are otherwise difficult to learn?		
35	Does the software have the potential to add anything new to the students learning experience that traditional practical method would not provide?		
36	Will students learn by using the software?		
37	Would you recommend the software for teaching students about electronics practical?		
38	Do the tasks in software engage the students?		
39	Can the learner test out their ideas and receive feedback using software?		

Please use the following scale for the next item: (item No 40)

5. Outstanding (Among the top 10%)
4. Excellent (Among the top 30%)
3. About Average (Middle 40%)
2. Fair (In the lowest 30%)
1. Poor (In the lowest 10%)
0. Not Applicable / Don't Know / There were none

40	Overall, I would rate this software	5	4	3	2	1	0

Table 3 (a)

Students opinion towards computer software (analysis)

Item No.	Number of positive response				Number of negative response			
	FY.B.Sc.	SY.B.Sc.	TY.B.Sc.	Total	FY.B.Sc.	SY.B.Sc.	TY.B.Sc.	Total
1	39	35	37	111	11	15	13	39
2	44	40	45	129	6	10	5	21
3	48	40	40	128	2	10	10	22
4	47	42	45	134	3	8	5	16
5	50	40	45	135	0	10	5	15
6	50	50	50	150	0	0	0	0
7	45	46	45	136	5	4	5	14
8	48	45	45	138	2	5	5	12
9	45	40	40	125	5	10	10	25
10	40	40	45	125	10	10	5	25
11	41	40	45	126	9	10	5	24
12	46	46	48	140	4	4	2	10
13	48	45	45	138	2	5	5	12
14	42	45	45	132	8	5	5	18
15	40	45	45	130	10	5	5	20
16	47	47	45	139	3	3	5	11
17	48	49	45	142	2	1	5	8
18	40	40	40	120	10	10	10	30
19	10	10	10	30	40	40	40	120
20	48	48	48	144	2	2	2	6
21	12	10	10	32	38	40	40	118
22	40	41	40	121	10	9	10	29
23	41	40	40	121	9	10	10	29
24	42	40	40	122	8	10	10	28
25	48	49	45	142	2	1	5	8
26	41	40	40	121	9	10	10	29
27	48	49	50	147	2	1	0	3
28	40	39	40	119	10	11	10	31
29	41	45	45	131	9	5	5	19
30	39	35	35	109	11	15	15	41
31	40	45	45	130	10	5	5	20
32	12	15	15	42	38	35	35	108
33	40	35	40	115	10	15	10	35
34	45	48	48	141	5	2	2	9
35	45	47	48	140	5	3	2	10
36	38	35	35	108	12	15	15	42
37	44	45	45	134	6	5	5	16
38	46	48	48	142	4	2	2	8
39	46	46	45	137	4	4	5	13

40	Overall, I would rate this software	FY B.Sc	SY B.Sc	TY B.Sc
	5. Outstanding (Among the top 10%)	30 %	40 %	36 %
	4. Excellent (Among the top 30%)	50 %	40 %	44 %
	3. About Average (Middle 40%)	20 %	20 %	20 %
	2. Fair (In the lowest 30%)	0 %	0 %	0 %
	1. Poor (In the lowest 10%)	0 %	0 %	0 %
	0. Not Applicable / Don't Know / There were none	0 %	0 %	0 %

Table 3 (b)
Students Opinion towards Computer Software (Percentage analysis)

Item No.	Response in Percentage					
	FY.B.Sc.		SY.B.Sc.		TY.B.Sc.	
	Positive	Negative	Positive	Negative	Positive	Negative
1	78%	22%	70%	30%	74%	26%
2	88%	12%	80%	20%	90%	10%
3	96%	4%	80%	20%	80%	20%
4	94%	6%	84%	16%	90%	10%
5	100%	0%	80%	20%	90%	10%
6	100%	0%	100%	0%	100%	0%
7	90%	10%	92%	8%	90%	10%
8	96%	4%	90%	10%	90%	10%
9	90%	10%	80%	20%	80%	20%
10	90%	20%	80%	20%	90%	10%
11	82%	18%	80%	20%	90%	10%
12	92%	8%	92%	8%	96%	4%
13	96%	4%	90%	10%	90%	10%
14	84%	16%	90%	10%	90%	10%
15	80%	20%	90%	10%	90%	10%
16	94%	6%	94%	6%	90%	10%
17	96%	4%	98%	2%	90%	10%
18	80%	20%	80%	20%	80%	20%
19	20%	80%	20%	80%	20%	80%
20	96%	4%	96%	4%	96%	4%
21	24%	76%	20%	80%	20%	80%
22	80%	20%	82%	18%	80%	20%
23	82%	18%	80%	20%	80%	20%
24	84%	16%	80%	20%	80%	20%
25	96%	4%	98%	2%	90%	2%
26	82%	18%	80%	20%	80%	20%
27	96%	4%	98%	2%	100%	10%
28	80%	20%	78%	22%	80%	20%
29	82%	18%	90%	10%	90%	10%
30	78%	22%	70%	30%	70%	30%
31	80%	20%	90%	10%	90%	10%
32	24%	76%	30%	70%	30%	70%
33	80%	20%	70%	30%	80%	20%
34	90%	10%	96%	4%	96%	4%
35	90%	10%	94%	6%	96%	4%
36	76%	24%	70%	30%	70%	30%
37	88%	12%	90%	10%	90%	10%
38	92%	8%	96%	4%	96%	4%
39	92%	8%	92%	8%	90%	10%

The training included the following points:

1. Computer literacy. (Fundamentals of computer and software)
2. Installation of software through CD (Compact disk) and installation guide document.
3. How to turn the software on and familiarization with run procedure, which involves working through the sequence of activities.
4. Troubleshooting list that identifies possible problems and remedies for them.
5. How to use this software for laboratory practical learning.
6. Observation and collection of the data.

Finally the effect of computer software, on the development of competency of performing an experiment was studied in this experimental research work. The investigator had used opinionnaire to collect learner's opinion towards Computer software support for laboratory communication.

The investigator used opinionnaire (given in 2.) to collect learner's opinion regarding Computer software support. This opinionnaire was containing 39 items related to various educational aspects. The analysis of data collected with the help of opinionnaire is given in table 3.

Conclusion

The investigator has developed the computer software support program related to selected experiments for study. These tests were pilot-tested/validated for use in collecting data for study.

Most of the students of experimental group were of opinion that the demonstration of laboratory experiment must be a part of laboratory communication. Therefore, the investigator is of opinion that the animation approach including demonstration of an experiment must be a part of communication tool. While communication, science subject through distance education mode, it is necessary to arrange contact programme or a laboratory workshop where the demonstration of an experiments will be given by teacher and then only students can perform the experiments.

The effectiveness of laboratory communication may further increase if the animation of demonstration of an experiment will be included in Computer software support for communication. Thus, Computer software media for laboratory communication no doubt support the learners for their laboratory activities but they never replace the role of teacher in laboratory.

The positive responses by students and staff to the material tested at the four colleges affiliated to Amravati University, Amravati (India), suggests that the difficulties of producing high quality video on a PC and meaningful interactivity (self-learning and self assessment) have been overcome. The challenge now shifts to Universities in order to facilitate a student culture in which all students have a CD ROM PC on day one of their degree course, a teaching and learning culture in which students can proceed at their own pace, laboratory experiences where students develop both practical and presentational skills, and staff development facilities whereby staff can be enabled to produce the new IT materials for the 21st century.

References

James A. Senn , (1989), Analysis and design of Information systems, 2nd, edition, MCGraw-Hill Publication, New York.

Evangelos Petroutsos, (1998), Mastering Visual basic 6, BPB Publication, New Delhi.

Brown, J. and Clement, J. (1989). Overcoming misconceptions via analogical reasoning: Abstract transfer versus explanatory model construction. Instructional Science, 18, 237-261.

DeJong, T. and van Jooligen, W.R. (1998). Scientific Discovery learning with Computer Simulations of Conceptual Domains. Review of Educational Research, 68(2), 179-201.

Duit, R. and Treagust, D. (1998). Learning in Science--from behaviorism towards social constructivism and beyond. In B. Fraser and K. Tobin (eds.), International Handbook of Science Education.

Dordrecht, Netherlands. Klluwer, 3-25. Goldberg, F. (1997). Constructing physics understanding in a computer-supported learning environment. In Rigden, J. (Ed.) Proceedings of the International Conference on Undergraduate Physics Education Volume II. American Institute of Physics.

Hutchins, E. (1995). Cognition in the Wild. Cambridge, MA: MIT Press.

Morse, Robert Otero, V. (2001). The Process of Learning about Static Electricity and the Role of the Computer Simulator. Unpublished doctoral dissertation. San Diego State University.

Mishra R.A. (2000) , Development and Tryout of audio/Video support for electronics experiments at UG level - (pp 40). Research Article, Y.C.M.O.U. Nashik.

Best John W. (1978) , Research in Education (3rd Edition), Prentice-Hall of India Private Ltd. New Delhi.

Campbell, J.O., Lison, C.A. (1995), Using computer and video technologies to develop interpersonal skills. Computers in Human Behaviour, 11(20,223-239).

Capper, J., and Copple, C. (1985), Computer Use in Education: Research Review and Instructional Implications. Washington, DC: Center for Research into Practice,

Casey, C. (1996), Incorporating cognitive apprenticeship in multi-media. Educational Technology Research and Development, 44(1), 71-84.

Casey, P. (1997), Computer programming: a medium for teaching problem solving. Computers in the Schools, 13(1-2), 41-51.

Dewhurst DG, Meehan AS. (1993), Evaluation of the use of computer simulations of experiments in teaching undergraduate students. Br J Pharmacol Proc Suppl 108:238P.

Dodge, B. (1991), Computers and creativity: Tools, tasks, and possibilities. Communicator: The Journal of the California Association for the Gifted, 21 (1), 5-8.

Garcia, J. R. (1995), Use of technology in developing problem-solving/critical thinking skills. Journal of Industrial Technology, 11(1), 14-17.

Gokhale, A. A. (1996), Effectiveness of Computer Simulation for Enhancing Higher Order Thinking , Journal of Industrial Teacher Education, 33(4), 36-46

Vedensyagam E.G. (1988), Teaching Technology for college Teachers, Sterling Publishers Private Ltd., New Delhi

Woolf, B., & Hall, W. (1995), Multimedia pedagogues: Interactive systems for teaching and learning. IEEE Multimedia, 74-80.

About the Author

Yogendra Babarao Gandole

Yogendra Babarao Gandole is Lecturer at the Department of Electronics, Adarsha Science, J.B.Arts and Birla Commerce, Mahavidyalaya, Dhamangaon Rly. - 444 709, India.

Mr. Gandole has a M.Sc. in Applied Electronics from Amravati University, M.Sc. in Electronics from Y.C.M.O.U.Nashik, and A.D.C.S.S.A.A. from Bombay technical Board, Mumbai.

In 2000, he presented a "Information Technology for Masses and Globalisation" at the national seminar on *Information Technology - Current Trends.* at the Department of Computer Science and Energy. Amravati University.

E-mail: ygandole@indiatimes.com Office Phone: (07222) - 237045

Editor's Note: This article breaks new ground in theory development. It helps to advance knowledge of computer mediated communication and its role in community building through a lens of storytelling. Note that OOPS is not Object Oriented Programming. OOPS refers to a multinational project called Opensource Opencourseware Prototype System (OOPS), a cooperative project to translate and adapt MIT's Opencourseware (OCW) courses into Chinese.

Story Thread Analysis:
Storied Lives in an Online Community of Practice

Meng-Fen Lin

KeyWords: online community, community of practice, content analysis, transcription analysis, asynchronous discussion, online discussion forum, story thread analysis, qualitative analysis

Introduction

Classroom experiences only account for a small portion of the ways students learn. Time in the library, interacting with professors and peers and reading textbooks are important and meaningful learning activities (H. Strauss, 2004, p.101). As technology becomes more prominent in our daily lives, and as knowledge consumers become knowledge producers, we need to look at learning beyond the classroom walls and extend the educational environment into the Internet where informal communities can provide energetic venues for learning. The importance of understanding online communities lies in its linking to our everyday lives, its situatedness in the domain-specific practice, and its potential to create shared knowledge and repertoires. A model called Community of Practice (CoP) (Wenger, 1998; Wenger, McDermott, & Snyder, 2002) provides the first lens in the current study.

We are storytellers because stories are vital to human understanding of how we bring order and meaning to our lives (Bruner, 2002). Human beings live storied lives that socially are intertwined with others' storied lives. Understanding storied lives is one way to understanding human social phenomena. Storytelling provides the second lens in the current study to uncover the lived experience people undergo as they become and participate as members in an online CoP.

Background

The case under study is a multinational project called Opensource Opencourseware Prototype System (OOPS). OOPS is a cooperative project to translate and adapt MIT's Opencourseware (OCW) courses into Chinese. Completely independent from MIT, OOPS employs a volunteer-based project model. Volunteers self-select course(s) they wish to translate and "adopt" the course(s) through an online application form. In addition to the project web site within which all of the courses reside, volunteers interact with each other through an asynchronous discussion forum. Because this online forum uniquely ties all volunteers together it is a "commonplace" where volunteers come to and interact, a place where volunteers build relationships.

This *commonplace* provides the social fabric in which volunteers intertwine their individual stories with others' stories. This location is the Story Landscape, a place where individual stories intersect with others' stories. The Story Landscape affords a stage where OOPS volunteers live their shared lives. It is therefore important to examine the kinds of storied lives that are displayed, told, and retold in this online CoP. This understanding, in turns, provides the background context that will assist later in broadening, burrowing, storying and restorying in the follow-up inquiry. The purpose of the current study is to understand the storied lives in OOPS' Story Landscape.

Searching for a Method

Story Landscape

In order to understand the lives in this landscape, it is first necessary to understand the context. Figure 1 displays a snapshot of the online forum, the *Story Landscape*. This forum is similar to any other web-based asynchronous discussion board. It has a title (1 in the picture) and a table-of-contents like navigation structure. Each row in the picture is a thread, defined as "an ongoing discussion of related messages that grows from one particular posting" (AOL).

A thread might receive no replies or multiple replies. All replies, as well as the initial message are considered to be individual postings that constitute the thread. There are five columns available in display for each thread: the title (3), the total number of replies to this particular thread (4), the person who initiated this thread (5), the total number of times this thread as a whole has been viewed (6), and the last person to respond to this thread, with a time stamp (7).

As newcomers and seasoned members come here and interact, they enter into the Story Landscape within the structure described. Each page displays fifty threads in the table-of-content-like fashion in the *thread list*. Users can navigate to the next page, which contains the next fifty threads. All threads are displayed in reverse chronological order with the newest ones on top. As people respond to threads, the order of the threads dynamically changes.

During OOPS' first year operation, between project inception of February 2004 to January 2005, there were seven hundred and thirty four (734) threads posted, yielding a total of two thousand nine hundred and seventy seven (2977) responses. This large amount of archival data posits a challenge in adapting a methodological lens that could help make sense of them.

Figure 1. The OOPS Story Landscape

Reflecting back to the original question – understanding storied lives in the OOPS Story Landscape, what is needed is a broad, big-stroke approach to understanding story lines embedded within the computer-mediated asynchronous forum. The nature of the question and the kind of data available guided the content analysis approach.

Methodological Considerations

Content Analysis, broadly defined, is a systematic way to identify the essence of the textual content and sort threads into categories (Berg, 2004). After a brief review of the literature, it was clear that a theory-based method was needed to analyze the abundant data produced in synchronous or asynchronous communications. However, challenges lie in the lack of a long-term research base (Marra, Moore, & Klimczak, 2004; Rourke, Anderson, Garrison, & Archer, 2001), the inherent methodological issues such as subjectivity, complexity, and time (Harry, Sturges, & Klingner, 2005), and the lack of ways to include passive learners (Hew & Cheung, 2003). One reason why this line of research lacks a long-term tradition is the uniqueness of each research case and research question. Researchers created their own methods to provide the most appropriate lens for examining each individual research question (Rourke et al., 2001).

To resolve this potential shortcoming, a study was conducted of frequently referenced content analysis protocols and comparative studies that adopted more than one protocol. For example, Marra, Moore and Klimczak (2004) reviewed six frequently-cited content analysis protocols and selected two (Gunawardena et al., 1997 and Newman et al., 1996) to analyze identical sets of data. The authors provided detailed step-by-step processes for applying each protocol, including comprehensive descriptions of ways to calculate inter-rater reliabilities. Overall, two protocols produced the intended results. Regarding the first research question, if the two protocols produced similar results, the authors concluded that the two protocols are not comparable. As to the second research question, the relative advantages and disadvantages of each protocol, the researcher favored Gunawardena's model because it was more holistic and easier to apply. In another article, Hew and Cheung (2003) compared seven different models for analyzing online learning communities on three broad issues: interactions among participants, cognitive learner skills, and the role of moderators. The authors reported the limitations of each model and suggestions for overcoming them.

Articles such as these confirm apparent challenges in evaluating online communities. In addition to the often vague definition of coding categories, which could cause difficulty in applying them, it was determined that the goal for this study was not to judge effectiveness or evaluate learning outcomes. The immediate goal was to simply understand the process. In this light, most available content analysis protocols did not address what was needed.

In addition to the basic philosophical difference between judging and understanding, there were three other challenges in finding an appropriate content analysis protocol: unit of measurement, issue of subjectivity, and question of reliability.

The literature showed a content analysis protocol could employ its unit of analysis across a wide range: from individual posting, a thematic unit, a unit of meaning, to words and sentences. The nature of the question needs a holistic, macro-level lens that calls for an aggregated approach instead of a finite examination. The heart of the question demands a way to paint a broad picture of the lives in the community in such way that the traditional sampling concept would not fit. Storied lives are continuous in nature and any attempt to segregate or take them out of context will simply jeopardize the meaning of the analysis (Marra et al., 2004). In order to answer the question, a different unit of analysis was needed than those for existing protocols.

The role of the researcher as a "complete-member researcher" (Angrosino & Perez, 2000, p.677), and engagement with OOPS since June 2004, led to an insider perspective on the different happenings at this forum. Some researchers agree that the sorting of latent contents, whose meanings are not obvious, is inherently subjective and interpretative (Rourke et al., 2001). This study required a method that would not only re-conceptualize the notion of subjectivity in terms of data saturation, but also value grounded insights with the cultural context (Harry et al., 2005).

Lastly, the traditional notion of reliability in content analysis argues for inter-coder reliability. Such reliability is generally calculated when separate coders independently categorize the same content and the percentage of their agreements is calculated. Because of the researcher's grounded insights and active engagement with the culture, the author was the sole coder to achieve "coder stability" as the way to conceptualize reliability. If over time, the author was able to look at the same content and sort threads into the same category, then coder stability over time was achieved (Rourke et al., 2001).

In summary, It was necessary to choose a protocol that is designed to answer the research question (Marra et al., 2004). A methodological lens was sought to provide an aggregated, holistic view of the stories exhibited in the Story Landscape, honor the insider view, and value the inductive, ground-up approach. A method was chosen to facilitate understanding, rather than evaluation of the lived stories in this Community of Practice. After reviewing related literature, thinking about the kind of data available, and examining the nature of the research question, a grounded-theory, ethnological approach was adopted for the *Story Thread Analysis*.

Story Thread Analysis (STA)

Definition

A Story Thread Analysis (STA) is an ethnological approach to understand the asynchronous conversations in an online CoP. In STA, the unit of analysis is the thread. In other words, the thread title and the first posting within each thread are examined and sorted into different storylines as they relate to the culture and context within the Story Landscape. Story is the lens through which the different storylines are sorted. Storytellers tell and re-tell the Storied Activities within the Story Landscape. The researcher also assumes the role of a storyteller while undergoing STA. STA values grounded insights and allows for inductive approaches to sorting storylines. STA enables researchers to be storytellers to sort out Storied Activity in the Story Landscape.

Strengths

STA takes on the lens of storytelling as a way of understanding complex social phenomena. It has three major components, the Storytellers, the Story Landscape, and the Storied Activities. It aggregates the unit of analysis into the unit of a thread, allowing for a holistic view of the storied lives in an online CoP. This aggregation produces a manageable set of cases under examination, with each case objectively identifiable as a thread (Rourke et al., 2001). Each thread is determined by the authors of the message in a naturalistic setting. Because STA reduces the cases into a manageable set, it affords exhaustive and complete study all of cases and therefore avoids the issue of sampling. Lastly, although borrowed from the concept of content analysis, STA, goes beyond frequency counts and employs researcher insights into social happenings.

Limitations

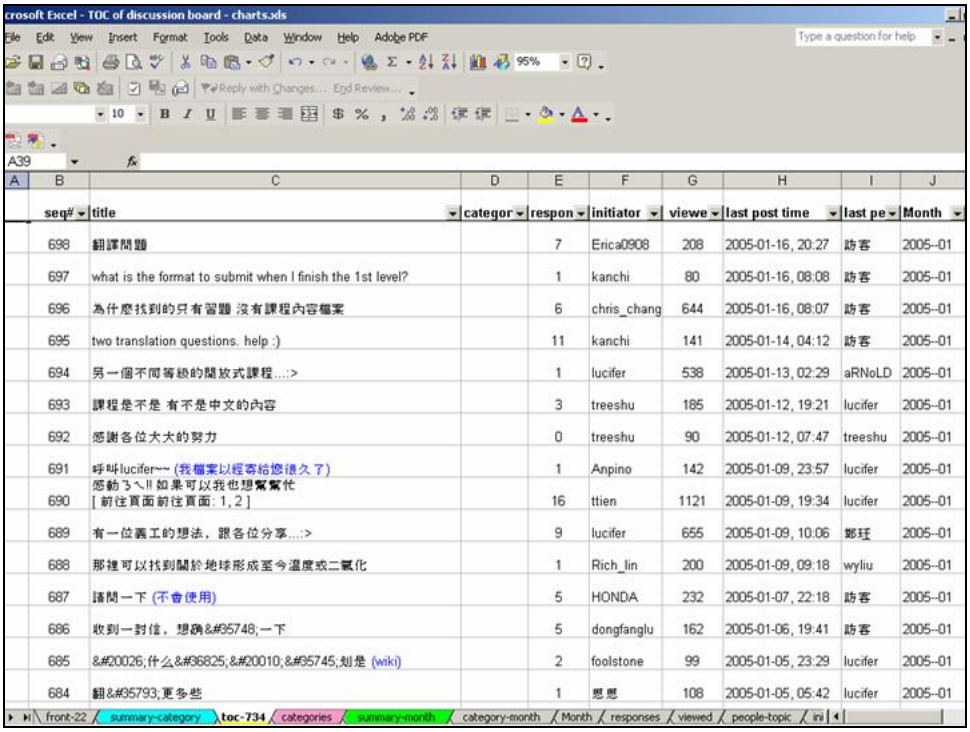
All lenses of analysis involve considerable compromises between meaningfulness, productivity, efficiency, and trustworthiness (Rourke et al., 2001). Asynchronous computer-mediated communications are inherently incoherent. In addition, they suffer from what Herring (1999) called topic decay in that conversations tend to migrate away from the original topic. In this regard, what starts out as one storyline might develop into a different storyline. The aim of STA is to provide the background storylines in a Community of Practice that could ready up for in-depth interviews later. In other words, STA is only the first step in understanding the storied lives in a CoP and should be followed up by another qualitative method in order to obtain a more complete storyline. In addition, readers should be cautioned that even though STA does strive to go beyond frequency counts, the data captured from the forum is a snapshot of that information at

a particular point in time. The online forum is a living and changing thing in that, for example, the number of times a thread is viewed changes everyday.

One of the advantages of STA is the grounded insights the researcher brings into the process. With the same token, however, this requirement poses a limitation as to who could undergo a STA. Until a researcher is been at the field long enough, until a researcher has almost reached the data saturation point, he or she would have limited capacity discerning different storylines, naming different happenings, and sorting them accordingly.

Steps in STA

Figure 1 lists all textual data available to OOPS members. In order to make sense of storied lives in OOPS using STA, data was manually transferred into an Excel spreadsheet. The Excel file kept the thread title, number of replies, initiator, and number of views in separate columns as the way they are displayed online. Last respondent and time stamp were separated into two different columns to capture their characters individually. Several additional columns were created for STA. The first column called "sequential number" contained the continuous thread number from Thread #1 posted on February 2004 to Thread #734 posted on January 2005. A column called "category" contained the sorting of the different storylines. A last column called "month" captured the month of each thread to which they last responded. Figure 2 shows a screen shot of a portion of the Excel file at its initial stage.


crosoft Excel - TOC of discussion board - charts.xls

seq#	title	categor	respon	initiator	viewe	last post time	last pe	Month
698	翻譯問題		7	Erica0908	208	2005-01-16, 20:27	訪客	2005-01
697	what is the format to submit when I finish the 1st level?		1	kanchi	80	2005-01-16, 08:08	訪客	2005-01
696	為什麼找到的只有習題 沒有課程內容檔案		6	chris_chang	644	2005-01-16, 08:07	訪客	2005-01
695	two translation questions. help :)		11	kanchi	141	2005-01-14, 04:12	訪客	2005-01
694	另一個不同等級的開放式課程...:>		1	lucifer	538	2005-01-13, 02:29	aRNoLD	2005-01
693	課程是不是 有不是中文的內容		3	treeshu	185	2005-01-12, 19:21	lucifer	2005-01
692	感謝各位大大的努力		0	treeshu	90	2005-01-12, 07:47	treeshu	2005-01
691	呼叫lucifer~~ (我檔案以經寄給您很久了)		1	Anpino	142	2005-01-09, 23:57	lucifer	2005-01
690	感動ㄋㄟ!! 如果可以我也想幫幫忙 [前往頁面前往頁面: 1, 2]		16	ttien	1121	2005-01-09, 19:34	lucifer	2005-01
689	有一位義工的想法，跟各位分享...:>		9	lucifer	655	2005-01-09, 10:06	鄭玨	2005-01
688	那裡可以找到關於地球形成至今溫度或二氧化		1	Rich_lin	200	2005-01-09, 09:18	wyliu	2005-01
687	請問一下 (不會使用)		5	HONDA	232	2005-01-07, 22:18	訪客	2005-01
686	收到一封信，想碼认一下		5	dongfanglu	162	2005-01-06, 19:41	訪客	2005-01
685	为什么这个计划是 (wiki)		2	foolstone	99	2005-01-05, 23:29	lucifer	2005-01
684	翻译更多些		1	恩恩	108	2005-01-05, 05:42	lucifer	2005-01

Figure 2. STA Excel File Example

Once the data is transferred into Excel and all additional columns are created, it followed Strauss and Corbin's (1998) grounded-theory approach to uncover the storylines in this Story Landscape. It went through series of iterations where the researcher constantly asked "what is going on" when looking at each thread and continuously moved back and forth among threads. This approach is "grounded" in the data and moves inductively toward understanding and potential explanation of the emerged storylines. The process advanced from sorting storylines to theory development (Marra et al., 2004). The iterations are described in detail in the following sessions.

Step 1. Initial Open Coding and Axial Coding

The first step in Strauss and Corbin's grounded theory approach is called "open coding", through which "concepts are identified and their properties and dimensions are discovered" (Strauss & Corbin, 1998, p.101). Since STA assumes storytelling as the lens of analysis and researcher as ethnographer, "open coding" becomes the process in which the researcher's "reflexivity works hand-in-hand with the iterative nature of the research" (Harry et al., 2005, p. 7). In STA, open coding is the first step in naming what is situated within the cultural context.

The initial sorting was conducted in February 2005 by which time the researcher had been involved with OOPS for eight months. Daily reading of the forum and frequent sharing of experiences with colleagues enabled the initial naming and sorting of storylines to be a fairly straightforward task. 150 threads were sorted out by reading their titles and the first message within each thread. In this process, the question was "what is going on" followed by an intuitive naming of the storylines. Each new thread was reviewed to determine if it told a similar story to any threads read so far. If so, it was sorted it into the same storyline. If the answer was no, or maybe, a new storyline was created and its name was based on what came to mind at the time.

The sorting and naming was stopped at 150 threads for a category frequency count using Excel's built-in function. The initial sorting of 150 threads yielded 19 storylines. After further examination of the storylines, it was found that the same storyline occurred sometimes with a different name. For example, the storyline asking for translation help occurred in "trans-help" and "help-trans". The two categories were consolidated into one called "trans-help". Some storylines with very low frequency counts were grouped with other storylines. For example, a thread on how to enter the course number when applying to be a volunteer (thread #434), and a thread asking how to change an email address in the volunteer profile (thread #246) were added to the "administrator" storyline.

The concept of "axial coding" was used for "relating categories to their subcategories, termed axial because coding occurs around the axis of a category, linking categories at the level of properties and dimensions" (Strauss & Corbin, 1998, p.123). STA borrowed this concept but utilized it a little differently.

Using Excel's built-in function, threads were sorted according to their storylines. Threads in each storyline were examined to determine if they really belonged together. At this point, it was possible to conceptualize meanings by sorting through an "interpretative" lens. For example, it was possible to quickly glance through all threads with the storyline of "volunteer" and determine if they formed a cohesive whole. On the other hand, the need was uncovered to further divide some storylines in specific categories. For instance, "admin-system" was a storyline that involved administrative issues relating to technical and system functionalities. It included threads that were apparently personal communication between the volunteers and system administrator regarding system malfunctions. When looking at all the threads belonging in the "admin-system" storyline, the need was identified to separate personal communications from the ones addressing the entire forum. "Personal-com" was created to capture those threads.

At the end of this process, the list of the current storylines was printed out to use as a template for sorting of the remaining threads. This initial list assisted in consistent naming of storylines and creation of new ones when a thread did not fit an existing category. Information was stored in Excel to facilitate sort, re-sort, examine and re-examine as needed.

Step 2. Record Keeping Adjustment

With the initial storylines displayed, sorting continued through five hundred threads. Coder stability was periodically checked and problems corrected. The most common problem was ambiguity of thread titles. For example, thread #668 and #340 had a thread title that read "I can

use your help". After reading the actual content of each thread, it was determined that thread #668 was asking for help to locate a course while thread #340 was asking for translation help. Both threads were related to help seeking, but in two very different contexts. Since STA assumes single coder stability, it was necessary to go back to all the already-sorted five hundred threads and record additional information to ensure coder stability. Threads with an ambiguous title required re-reading of the original posting and marking the reading and thread title in blue-colored text as shown in Figure 2. These blue-colored texts help to maintain consistency across time.

This unexpected iteration of sorting not only provided another round of going back and forth among the threads, it served as a test the coder stability.

Step 3. Complete the coding process

With the list of storylines re-visited and the five hundred threads re-examined, the remaining threads were sorted. There were frequent stops to reflect on the different stories in this Story Landscape and examine similarity and differences among and within storylines. STA as a value-laden process encourages a researcher's grounded insights in sorting the storylines.

At this point it became clear that there was a distinct difference between a manifest content and a latent content (Berg, 2004; Bogdan & Biklen, 2003; Rourke et al., 2001; Strauss & Corbin, 1998). A manifest content is content whose meaning resides on the surface. For example, a storyline such as "admin-trans," whose issues cover administrative problems about translation, could be hardly mistaken for something else. Similar examples are "I want to volunteer", "I cannot locate the course", and "I want to make a suggestion to the project".

On the other hand, there are contents that are latent, meaning it requires interpretation in sorting them into storylines. For example, most subcategories under Social are latent. Four different subcategories under Social and their examples are listed in Figure 3. below. The attempt to make sense of any latent content is inherently subjective and interpretative. Since STA values researcher's grounded insight, researcher's knowledge about this particular culture and context empowers her to be the authority in making those sorting decisions.

Thanks. Thread #683. Posted Jan. 5, 2005.

> Thanks to all the participating partners. Because of you, we transform such a beautiful Chinese language to the propelling power of a more beautiful world. Keep going!

Sharing. Thread #289. Posted June. 22, 2004

> Here are several links to various databases that have compiled academic terminologies in English and Chinese. For your reference.

Personal Communication. Thread #198. Posted May. 26, 2004.

> Have you received the level-one translation file I sent to you two days ago? Please confirm. Thanks.

Social. Thread #378. Posted August 1, 2004.

> Logo voting! We will use the logo for stationary and t-shirt. You can also campaign for your favorite ones! Let's vote!

Figure 3. Sub categories under Social are Latent and require Interpretation.

Appendix A lists the current list of storylines, with explanation, examples, and how they are conceptualized into the CoP characters. Grounded insight that might be transparent to the readers during the analysis is supported by prolonged engagement in the field. In addition, the emerged theory will be tested against participants' perspective, a process sometimes referred to as "member check" (Lincoln & Guba, 1985).

In the next section, the preliminary results and interpretation of the current STA analysis is presented. The results of a STA are broken into three interrelated components: the Story Landscape, the Storytellers, and the Storied Activities.

WHERE - the Story Landscape - Overview

Medium Features

In addition to the "appearance" of this Story Landscape as depicted in Figure 1, several functional characters give features to OOPS' Story Landscape. These characters, regarded as "medium variables" by Job-Sluder and Barab (2004), are descriptors of the affordance for communication by the online forum. Table 1 describes these medium features as they pertain to OOPS.

Table 1

Medium features of OOPS' Story Landscape

Medium Features	Description
Synchronicity	Asynchronous
Directionality	One-way message transmission. Postings appear in their entirety and registered users could edit their postings after the appear
Persistence	Highly persistent. All threads remain online since project inception. This particular forum shares a server space with several other forums ran by the same group. The earliest postings I could find went back to 2000.
Buffer size	Unknown. Postings tend to be mostly short.
Mode	Mainly text communication. Users can attach files and there is also a built-in voting mechanism.
Anonymity	Anonymous postings are the norm. Participation in the site does not require registration.
Private messaging	Registered users could send private messages through the system.
Filter capabilities	Users do not have the ability to filter unwanted messages.
Quoting capabilities	Built-in function to allow quoting previous message.

OOPS' Story Landscape as a messaging medium is very similar to any other web-based bulletin boards. The combination of the "appearance" features and the medium features create OOPS' Story Landscape. In this forum, Chinese, both traditional (primary used in Taiwan and Hong Kong) and simplified (primary used in China), is the main language with occasional postings in English. Forum administrators have additional abilities not available to the forum users.

Administrator privileges

Forum administrators have the option to create two special kinds of threads called "announcement" and "place-top". "Announcement" threads appear on the top of the thread list on every single page. "Place-top" threads appear immediately after the "announcement" threads on the first page of the thread list, but do not appear on consequent pages. Figure 4 shows the screenshot of the first page of the forum. Only forum administrators have the ability to post or change a thread to either category. Administrators can also change a thread back to regular

thread. A total of 22 threads are in the “announcement” and “place-top” combined, in which Luc initiated 16 of them

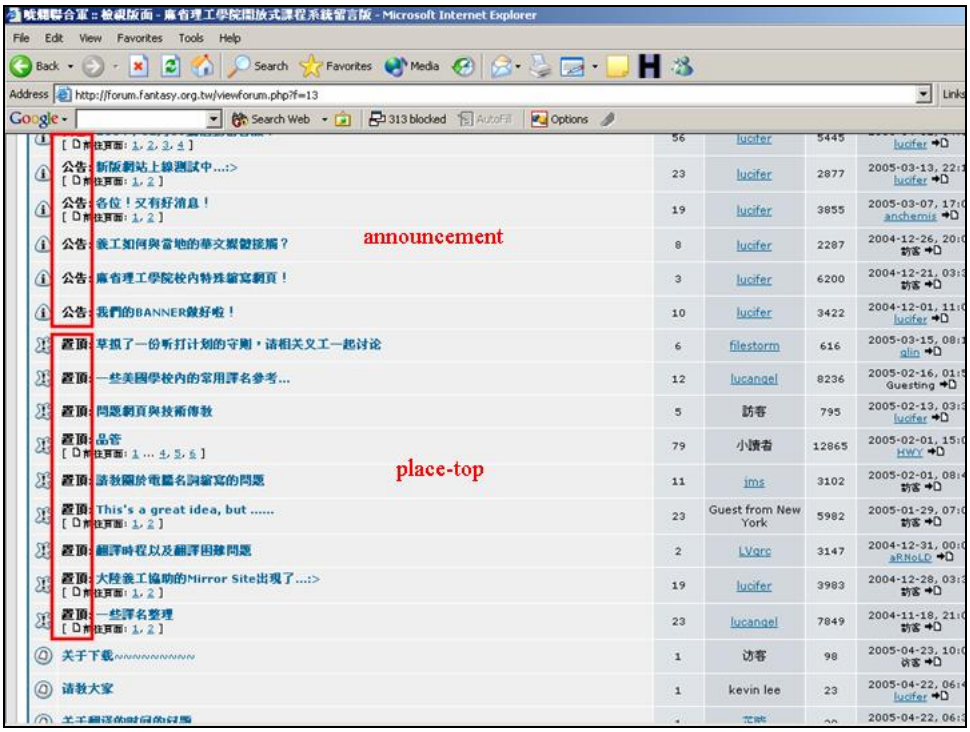


Figure 4. “announcement” and “place-top” threads created by the administrator

Web Traffic

Table 2 shows the web traffic report for this Story Landscape. OOPS seems to draw a steadily increasing number of visitors to the site, with the sudden drop of volume in November 2004. The OOPS server suffered several breakdowns during that month, including a several-day black out by a severe typhoon.

Table 2
OOPS Story Landscape traffic report

Month	Unique visitors	Pages	Hits	Bandwidth
Feb-04	208	915	11,545	65.70 MB
Mar-04	1,679	11,941	102,162	70.44 MB
Apr-04	11,842	146,710	968,029	11.70 GB
May-04	40,067	618,208	3,797,599	58.11 GB
Jun-04	38,004	569,184	3,372,800	56.21 GB
Jul-04	28,241	480,101	2,263,571	37.03 GB
Aug-04	34,690	748,729	3,171,633	80.90 GB
Sep-04	52,961	982,242	5,225,305	80.14 GB
Oct-04	116,410	2,213,695	11,168,529	204.11 GB
Nov-04	682	8,684	31,335	422.38 GB
Dec-04	114,741	1,563,312	9,696,336	149.27 GB
Jan-05	43,157	713,359	3,105,604	56.87 GB
Feb-05	61,004	820,674	4,112,489	64.84 GB
Mar-05	88,640	948,330	5,659,457	84.79 GB

Communication Patterns

In terms of the communication patterns in the Story Landscape, it seems there is no apparent pattern when looking at the number of threads and number of response from month-to-month. Figure 5 shows the month-to-month breakdown. However, in May 2004, there appeared to be a huge spike in both the number of threads and number of responses during that month. Was that a sign of the take-off of a community?

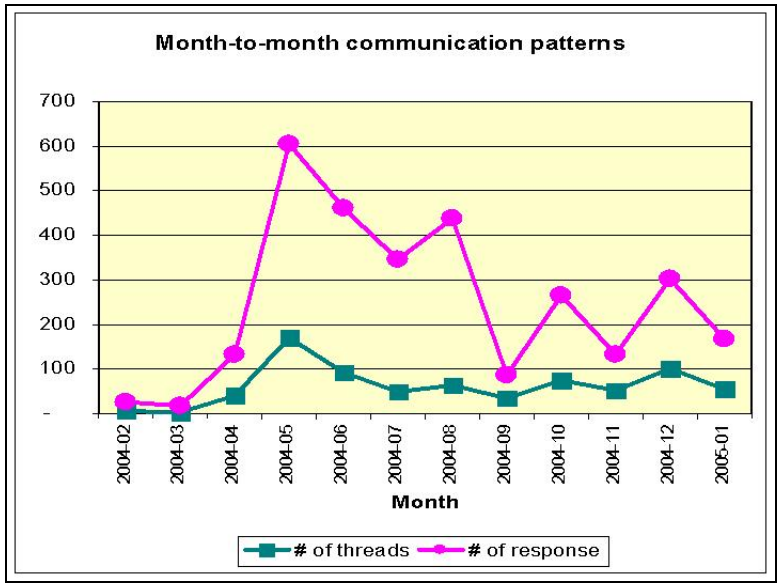


Figure 5. Month-to-month communication patterns

Telling the Story of the Story Landscape

As mentioned earlier, OOPS' Story Landscape – the online forum, has features similar to many other web-based bulletin boards. The combination of potential familiarity and the opportunity of anonymity might encourage participation. It is also possible that the large number of anonymous postings might inhibit group cohesiveness, lacking immediacy without personal information. However, it appears that even though people post anonymously, they often leave their personal email and IM id and encourage private communication. Because of the different Chinese character sets used between China and Taiwan, it was observed that people from China seem more open and willing to share such personal information.

Overall, this Story Landscape seemed adequate to function as a commonplace. People come and they participate in conversations. The researcher is coordinator of an OOPS spin-off project that transcribes audio from video lectures into subtitles. As the spin-off site administrator and project coordinator, the researcher is privileged to interact with volunteers beyond the Story Landscape. In addition, the site administrator can obtain emails, names, and at times more personal information (such as birthday and gender) and interact with them more frequently. For example, an email to encourage volunteers who have not turned in work recently may stimulate sincerity to continue and the openness in sharing personal reasons why they have not been able to keep up with the volunteer work.

The OOPS Story Landscape as is might be sufficient in holding a commonplace. However, the experience gained from socializing with volunteers suggests that if the opportunity is made available, volunteers might choose to socialize more. For OOPS to continue to draw volunteers

and sustain its existing membership, the Story Landscape might need to be expanded to include more socializing features such as an email directory to look up fellow volunteers.

There is insufficient data to determine what caused the month of May to have the highest number of threads and responses. The researcher joined the project in June and was not part of that happening. (Clandinin & Connelly, 2000).

Who – the Storytellers

Overview of the Story Landscape

At the writing of this report, OOPS has 724 registered volunteers who are translating 815 courses. Thirty-five courses have been completely translated. In terms of geographical locations, OOPS volunteers are from fourteen countries and regions, with Taiwan (342) leading, followed by China (148) and the USA (33). Since OOPS is home-based in Taiwan, it is logical that most of its volunteers are the residents of Taiwan. However, with the help of the Internet, OOPS is able to cross these borders and reach into thirteen other countries/regions for its volunteer base.

291 persons with Master's degrees accounted for the majority of the volunteers, followed by 224 people with Bachelor's degrees. Table 3 displays the distribution of volunteers' highest degrees earned. OOPS volunteers are highly educated.

Table 3
Distribution of Volunteers' Educational Level

Highest Degrees Earned	Total (609)	Percentage (%)
Post Doctoral	4	0.7%
PhD	27	4.0%
PhD Candidate	54	9.0%
Masters	291	48.0%
Bachelors	224	37.0%
Junior College	7	1.0%
High School	2	0.3%

Table 4 lists the occupations of volunteers. Interestingly, most volunteers are either students or in the field of education. A note of caution: The number reported here is based on the short biographies volunteers submitted through the online application form. Since not everyone provides this information, this report is limited to what was collected. This explains why the numbers do not add up to the same total as in previous tables.

Table 4
Volunteers' Occupations

Occupational field	Total (459)	Percentage (%)
Student	224	49.0%
Education	70	15.0%
Software engineering	53	12.0%
Management and finance	28	6.0%

Publishing and translation	25	5.0%
Other	10	2.0%
Law	9	2.0%
Medical	8	2.0%
News, media, and entertainment	8	2.0%
Marketing	6	1.0%
Manufacturing	5	1.0%
Architecture	5	1.0%
Transportation	4	0.9%
Professional analyst	4	0.9%

Information collected as part of the STA revealed that there were 360 unique storytellers who initiated at least one thread during this period. This list is called the "Initiator List." The member known as Visitor has the highest number with 91 threads, followed by Luc at 86 and aRNoLD at 52. Two hundred and ninety two storytellers only initiated one thread, a possible indication of low repeating users. During the same one-year period, there were 120 unique storytellers who ended at least one thread during this period. This is named the Last-respondent List. Luc ended the most number of threads of 309, followed by visitor with138 end-postings, and aRNoLD with a total of 35. Ninety two users ended only one thread.

Of the 360 storytellers on the Initiator list, only 59 (16.4%) use a Chinese name as a nickname. Of the 120 storytellers on the Last-respondent list, only 20 people, 16.67%, use a Chinese handle. It is interesting that even though the primary language used on this Story Landscape is Chinese, people select an English nickname. This might have to do with the fact that, until most recently, all emails, URLs, computer programming languages have been in English.

My Telling of the Story of the Storytellers

Forming Reputations

Luc pioneered OOPS and is actively involved with the project. His diverse background in television production, magazine and publishing work "afford [him] to undergo a project of this scope." (Interview 7-22-2004, p.6) As the Chinese translator of the Lord of the Rings and the founder of Fantasy Foundation, Luc has been an advocate since 2002 "to promote fantasy arts in the Great China area, to cultivate our own professors Talkie and J.K. Rowling, and to encourage the sharing of knowledge and thinking creatively." (Interview 7-22-2 004, p.3) His life story shapes his motivation and inspiration of OOPS. Visitors coming to OOPS Story Landscape might figure out that Luc is an administrator and one of the major players in the Story Landscape.

Another person who draws attention has the nickname of aRNoLD. He is number three on both the initiator list and the last-respondent list. Since he is a registered user, the researcher can look at his profile and see that within the OOPS forum, he participated in over two hundred and seventy conversations. His profile also indicates that he joined this forum in May 2004. This information is consistent with what STA reveals. STA indicates that in his first two months after joining OOPS, that aRNoLD initiated 14 and 21 threads in May and June, respectively. The breakdown of the *Last-Respondent* list by month shows that aRNoLD, in May and June, was the last person to respond to 10 and 12 threads in these same months. He started a thread titled "Who are the volunteers from China and what are we translating" in July 6th, 2004. This thread has been kept alive in the sense that it has received steady replies from time to time that keep it active even to this day. This is the most long-lasting thread in this forum that was initiated by a member without administrator privilege.

Reading through postings such as this allowed the researcher to form an impression about him. aRNoLD is a male teacher from China, teaching business in a university in Shanghi. He has his own web site and blog and is promoting OOPS in China. He met with Luc when Luc visited China. aRNoLD is still an active member of OOPS. Literature has shown that the manner in which participants engage themselves in dialogue not only promotes certain impressions about who they are, their dialogues shapes the dynamics and learning environment of the community (Gustafson, Hodgson, & Tickner, 2004). Research has shown that people form impressions about each other in text-based virtual communities where the context of online interaction influences such formation (Jacobson, 1999). One such factor might be the choice of an alias and its influence on forming impressions (Chester & Gwynne, 1995).

The researcher formed an impression about aRNoLD based entirely on what he said online and what kinds of conversations he engages himself in. If the researcher were to meet aRNoLD in persons, would that perception change? Members are also forming their own impressions about other members. How does this contribute to the telling and retelling of stories in this Story Landscape?

Formation of a New Hierarchy

OOPS volunteers are well educated and this might have several implications. First, it probably reflects the value of education in the Chinese population in general. If people are generally well educated, OOPS is able to draw upon this already-existing pool of talent. However, this well-educated group might also exemplify the necessity for undertaking such an ambitious translation project. This could be a challenge to regions with lower education levels; regions that might benefit the most from access to such open knowledge resources. Third, OOPS stands for promoting open access of educational materials to everyone, the notion of breaking down the hierarchical barriers of access to materials. The project has an open-door policy in which all volunteers are qualified volunteers. We do not turn down anyone who wishes to be a volunteer. At this stage of the project, however, it appears the project attracts highly educated people. Research has shown that people with formal education tend to use computer-mediated communication in informal learning (Selwyn & Gorard, 2004). In trying to break down one hierarchy, is it possible that OOPS unintentionally creates a new form of hierarchy?

Relationship Between Off-line and On-line Community

As an online community, OOPS volunteers are not as geographically distributed as most people perceive. Since OOPS is home-based in Taiwan where Luc is recognized as a celebrity, it is easier for Luc to disseminate OOPS using his regional connections and influences. Luc goes on television and radio and is interviewed by newspaper reporters from time to time. News spreads quickly in a tiny island such as Taiwan. Luc organized face-to-face gatherings in Taiwan in August 2004 and another in December 2004. Research has shown that off-line communities might be the base of some online community, and the relationship between these might be closer than we think (Delanty, 2003). Proportionally speaking, OOPS should have a lot more volunteers from China. Moreover, the Internet is supposed to be borderless. Nonetheless, it appears that the face-to-face, tangible presence Luc has in Taiwan has helped aid volunteer recruitment.

Reconceptualizing Legitimate Peripheral Participation

Does the high anonymity in OOPS hinder its group coherence? Research has indicated its benefit to participation. For example, a group of female college students expressed mixed feelings about their online experience, yet cited anonymity as the most important positive aspect of the learning environment (Sullivan, 2002). Bell (2001) reported that anonymity provides inherent comfort to support online involvement in an asynchronous role-playing environment among academic staff members. Freeman and Bamford's (2004) case study confirmed the belief that anonymity encouraged female students' participation; nevertheless, their study also concluded that

anonymity should be removed in all learning environments due to the negative effect of unknown learner identities and their disruptive effect in the learning environment.

One thing the *Initiator List* and *Last-Respondent List* tell me is the high fluidity of membership. People either post messages anonymously or they use a registered handle name only a few times. There is no best way to identify these people as the same few people or truly different people. Nevertheless, the impression about such fluidity of membership somehow gives a feeling of "being in a crowd", a feeling of belonging. Lave and Wenger's concept of a Legitimate Peripheral Participant (LLP) is to value all levels of member contributions and to prepare and encourage members for full involvement (Lave & Wenger, 1991). The concept of LLP should be extended to validate lurkers, spectators, and interested bystanders as having worth in an online CoP by suggesting that they are "being" instead of "becoming". Their lurking and occasional participation create a high volume of fluidity of membership, resulting in the impression of a high-traffic, crowded virtual place. The feeling of "being in a crowd" might be vital to the sustainability of OOPS. Anonymity might help to encourage participation and create a sense of belonging.

What – the Storied Activities

Of all 734 threads, the top three storylines are: "social" (25.97%), "I want to volunteer" (21.25%), and "I need help with translation" (20.44%). The average viewing-rate, calculated as the average number of viewings per thread, is 333, indicating that during this one-year period, on average, each thread was viewed 333 times. The average response-rate, calculated as the average number of response each thread received, is 4, indicating that, on average, each thread received four replies. The average viewing-to-response rate, calculated as the average number of viewings to number of responses for each thread is 82, indicating that, on average, it takes 82 viewings to receive one reply. A summary of quantitative information is listed in Table 5.

Table 5
Summary of preliminary Story Thread Analysis
(Feb. 2004 to Jan. 2005)

Total number of postings (February 2004 to January 2005)	734
Highest number of threads posted per month	May 2004 (169)
Highest number of responses per month	May 2004 (606)
Highest number of responses per month	October 2004 (44,109)
Average viewing-rate	333
Average response-rate	4
Average viewing-to-response rate	82
Initiator list	360 distinct users 59 (16.4%) used a Chinese name Anonymous postings are 12.53%
Last-Respondent list	121 distinct users 20 (6.67%) used a Chinese name Anonymous postings are 19.07%
Top three storylines	"Social" (184 threads, 25.07%) "I want to volunteer" (156 threads, 21.25%) "I need help with translation" (150 threads, 20.44%)

Telling the story of the Storied Activities

After further examining the distribution per month for each category, it appears the majority of the "I want to volunteer" threads occurred during the months of April, May and June 2004. The number was significantly reduced once OOPS introduced the online application function sometime during that period. Once that function became available, volunteers could apply online without entering this forum. This could be a good example of listening to what the community wants and reacting accordingly. On the other hand, "social" and "I need help" threads were evenly spread out across months, which might be an indication of the health of the community, continued commitment of the members, and consistent member participation.

The category, "I need help with translation" stands out. For every five postings, there is one of this nature. It appears in this highly social environment, volunteers do use this forum as a medium for knowledge sharing and construction. Luc describes OOPS as a utopian means of knowledge sharing, a utopia that is rectified through the participation of volunteers. Through discussions, it is possible that volunteers link their everyday experiences into educative experiences. This category received the second highest response-rate of 6.53, meaning on average, each request for help with translation received 6.53 replies. Interesting, the highest response-rate belongs to the category called "solicit".

"Solicit" is the category with stories related to requests for opinions or help in relation to the project as a whole. For example, thread #190 asked if anyone knows Java programming language to help with a system function enhancement. Thread #194 asked if anyone knows an open source searching engine that OOPS could utilize. Thread #342 referred to the issues of creating video subtitles and if anyone knows any open source software that would further enable OOPS' effort to transcribe all videos. Thread #352 solicited volunteers' opinions on naming our project and thread #371 sought ideas on the logo design. There were 19 threads in this category and on average they received 11.79 responses.

One thing worth mentioning is that Luc initiated 15 of those 19 threads. There might be two things in play here. First, Luc as the prominent player in this Story Landscape does draw people's attention when he "speaks". When the nature of his post is related to the overall improvement and welfare of OOPS, such as the examples illustrated above, people tend to respond and offer suggestions. The second potential meaning of this relates to the notion of a community. People care about what we name our community and what our logo will look like. In this sense, we care about our community identity. People care about how we can make this community better by offering information on search engines, java programming for more functionalities and video subtitle software. It seems that volunteers care about the community and tend to respond to solicitations related to such needs and requests.

The complete breakdowns of the details are illustrated in Table 6 below.

One emerging story is called "cannot find". This is the storyline about people coming to OOPS and becoming disappointed when they "cannot find" the courses they were looking for. There are two different issues emerging here. A rather small group of people have difficulty navigating the web site and locating information they need. With no searching capability and over 900 courses available, they experience frustration in locating information. However, the majority of the people who said they "cannot find" what they were looking are indicative of a much bigger problem than web site design and usability.

Table 6

Summary of detailed STA analysis

	Threads	Replies	Viewed	Viewing Rate	Response Rate	Viewing to Response Rate
social	184	781	81,683	444	4.24	105
volunteer	156	400	29,779	191	2.56	74
help-trans	150	979	51,027	340	6.53	52
cannot find	76	161	25,666	338	2.12	159
administrative	69	202	16,282	236	2.93	81
unrelated	29	39	7,815	269	1.34	200
suggestion	21	102	4,795	228	4.86	47
solicit	19	224	17,148	903	11.79	77
criticism	16	54	4,562	285	3.38	84
video lecture	14	35	5,609	401	2.50	160
	734			**333**	**4**	**82**

The content depth of the online material varies from course to course. In the first place, the MIT OCW team can only offer to the public what their professors are willing and able to offer. On top of that, with the limitations of copyright law, only certain copyright-free materials can be openly distributed. In this regard, two problems have been raised continually by dissatisfied learners – the lack of depth in course content and the lack of access to referenced materials (Lin, 2005, in press). Therefore, when they come to the web site and find only a list of books, for instance, they are disappointed and ask "where can I find downloadable materials?" Looking at the distribution of this storyline across time reveals an increase in numbers that started in October 2004. Even though the current STA deals with data from the first year, my preliminary second-year data shows an increasing number of threads in this category.

On one hand, it seems that some of the self-learners still feel a need for the full-blown materials. An outline of the syllabus with readings and assignments does not seem enough for them to start the learning process. On the other hand, open materials are bounded by copyright law and learners in developing countries may not have access to those peripheral materials. In this regard, how far can open courseware and sharing go when access to adjunct materials ultimately is still restricted by copyright and financial factors?

Conclusions – Telling the Story of the Storied Lives in OOPS

This paper argues that existing content analysis protocols do not fit the need of the current study due to the nature of the question and the amount of data available to the researcher. It is therefore proposed that Story Thread Analysis (STA) as a more suitable lens for looking at contextual information through the framework of storytelling. The unit of analysis was further aggregated at the per thread level in the interest of understanding the storied lives in this community. STA aims to understand the storied lives in an online CoP through the lens of the researcher as the storyteller with grounded insight. This project demonstrates how steps in the value-laden process went back and forth through the data to try to make sense through the lens of STA.

STA uses frequency counts as one of the foundations of understanding the phenomena, but it goes beyond simply counting. Through STA, we can grasp the storied lives in OOPS by understanding about the Story Landscape, the Storytellers, and the Storied Activities. We get a glimpse of how

people might hold, express, experience, and distribute knowledge in an online CoP. However, real experience needs to be expressed from real people in a more direct manner.

This investigation showed that OOPS provides an adequate Story Landscape that fosters social interaction and shared knowledge building. OOPS is foremost a place for socialization. However, OOPS is also highly task oriented in that translated-related threads receive high response rates. This seems to be consistent with prior research that socialization at times might be more important than learning in an online place (Hoadley & Pea, 2002)

Overall, Story Thread Analysis has provided a way to describe the background milieu of OOPS and offers abundant leads for further research. STA has prepared the way for further inquiry.

Other textual information is available in OOPS. It may be necessary to expand STA to include not only the asynchronous online forum, but also the project web site, its updates, and information such as individual volunteer's autobiography. STA is a systematic way of understanding storied lives in an online CoP that should be followed by other qualitative inquiry.

Reference

Angrosino, M. V., & Perez, K. A. M. d. (2000). Rethinking observation: from method to context. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 673-702). Thousand Oaks, CA: Sage Publications.

AOL. (2005). *Newsgroup glossary*. Retrieved 3-8, 2005, from http://www.aol.com/netfind/newsgroup/glossary.html

Bell, M. (2001). Online role-play: anonymity, engagement and risk. *Education Media International, 38*(4), 251-260.

Berg, B. L. (2004). An introduction to content analysis. In *Qualitative research methods* (5th ed., pp. 265-297). NY: Pearson Publication.

Bogdan, R. C., & Biklen, S. K. (2003). Data analysis and interpretation. In *Qualitative research for education: an introduction to theories and methods* (4th ed., pp. 147-184). NY: Pearson Publishing.

Chester, A., & Gwynne, G. (1995). Online teaching: encouraging collaboration through anonymity. *Journal of Computer Mediated Communication, 4*(2), online: http://jcmc.indiana.edu/vol4/issue2/chester.html.

Clandinin, D. J., & Connelly, F. M. (2000). *Narrative inquiry: experience and story in qualitative research*: Jossey-Bass.

Delanty, G. (2003). Virtual community: belonging as communication. In *Community* (pp. 167-185). New York, NY: Routledge.

Freeman, M., & Banmford, A. (2004). Student choice of anonymity for learner identify in online learning discussion forums. *International journal on E-Learning, 3*(3), 45-53.

Gustafson, J., Hodgson, V., & Tickner, S. (2004, April). *Identity construction and dialogue genres - how notions of dialogue may influence social presence in networked learning environments.* Paper presented at the Networked Learning Conference, England, UK.

Harry, B., Sturges, K. M., & Klingner, a. K. (2005). Mapping the Process: An Exemplar of Process and Challenge in Grounded Theory Analysis. *Educational Researcher, 34*(2), 3?3.

Herring, S. (1999). Interactional coherence in CMC. J*ournal of Computer Mediated Communication, 4(*4).

Hew, K. F., & Cheung, W. S. (2003). Models to evaluate online learning communities of asynchronous discussion forums. A*ustralian Journal of Educational Technology, 19(*2), 241-259.

Hoadley, C., & Pea, R. D. (2002). Finding the ties that bind: tools in support of a knowledge-building community. In K. A. Renninger & W. Shumar (Eds.), B*uilding virtual communities.* Cambridge, UK: Cambridge University Press.

Jacobson, D. (1999). Impression formation in cyberspace: online expectations and offline experiences in text-based virtual communities. J*ournal of Computer Mediated Communication, 5(*1).

Job-Sluder, K., & Barab, S. A. (2004). Shared "we" and shared "they" indicators of group identity in online teacher professional development. In S. A. Barab, R. Kling & J. H. Gray (Eds.), *Designing for virtual communities in the service of learning* (Hardback ed., pp. 377-403): Cambridge University Press.

Lave, J., & Wenger, E. (1991). S*ituated Learning: Legitimate Peripheral Participation.* Boston, MA: Cambridge University Press.

Lincoln, Y. S., & Guba, E. G. (1985). N*aturalistic inquiry.* Beverly Hills, CA: Sage Publications.

Marra, R. M., Moore, J. L., & Klimczak, A. K. (2004). Content analysis of online discussion forums: a comparative analysis of protocols. E*ducation Technology Research & Development, 52(*2), 23-40.

Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (2001). Methodological Issues in the Content Analysis of Computer Conference Transcripts. I*nternational Journal of Artificial Intelligence in Education, 12,* 8-22.

Selwyn, N., & Gorard, S. (2004). Exploring the role of ICT in facilitating adult informal learning. E*ducation, Communication & Information, 4(*2/3), 293-310.

Strauss, A., & Corbin, J. (1998). B*asic of Qualitative Research: Techniques and Procedures for Developing Grounded Theory.* Thousand Oaks, CA: Sage Publications.

Strauss, H. (2004). A smart learning environment. S*yllabus, 18(*1), 57-28.

Sullivan, P. (2002). "It's easier to be yourself when you are invisible": female college students discuss their online classroom experiences. I*nnovative Higher Education, 27(*2), 129144.

Wenger, E. (1998). C*ommunities of practice: learning, meaning, and identity:* Cambridge University Press.

Wenger, E., McDermott, R., & Snyder, W. M. (2002). A *guide to managing knowledge: cultivating communities of practice.* Boston, MA: Harvard business school press.

About the Author

Meng Fen Lin is a doctoral candidate in Instructional Technology at the University of Houston. Her research interests include online community, open education, and social learning theories.

Email: grace.mf.lin@gmail.com

Appendix

Storyline	Description and Example	Community: mutual engagement	Domain: joined enterprise	Practice: a shared repertoire
Administration				
admin-bug	System problems related to errors in the system functions Thread #554.Homepage searching problem. Search functions do not work. I took a look. It appeared to be a javascript error. submit_form() function does not exist.		x	
admin-file	Administrative issues related to PowerPoint, PDF, and web format Thread #557. Losing the formatting. I copied the text from the PDF file and then pasted it into Word. But the problem is all the formatting was gone. I tried to use the Snapshot tool but then the content pasted into word is not editable.			x
admin-progress	Questions related to the status of their translated courses Thread #504. When will my course be online? As titled. Thank you.	x		
admin-system	Administrative issues related to technical and system functionalities Thread #400. Why does this forum use only traditional Chinese character set? As titled. Thank you.		x	
admin-trans	Administrative issues related to translation Thread #192. Let me ask this first. If I adopt a course to translate, is there a time limit within which I have to complete it? I want to adopt a course but the final exams are approaching. I am afraid I might be able to finish my adopted course quickly.		X	
admin-other	Administrative issues that do not belong to other administrative storyline Thread #246. I left a wrong email address. Very sorry. When I applied to be a volunteer, I think I entered "_" instead of ".".As a result, I have not received any email from you guys. Please change my email.			

Storyline	Description and Example	Community: mutual engagement	Domain: joined enterprise	Practice: a shared repertoire
Social				
announcement	Announcements made from Luc to the volunteers			
	Thread #552. MIT Alumni Association News & Events reported OOPS. Hardly got a chance to be reported in the English medium. Read it when you have spare time.	X		
community	Discussions explicitly related to the forming of a learning community			
	Thread #43. The launch of the OOPS learning community. Welcome everyone to visit the URL. You can login using the guest account or you can register an ID.	X		
personal-com	Personal communication between the volunteers and a targeted person			
	Thread # 198. Level-one translation. I sent out the level-one translation the day before yesterday. Have you received it? Please confirm. Thanks.	X		
share	Volunteers share with each other information or resources			
	Thread #289. Reference here for academic terminologies. Here is the link to the National Institute for Compilation and Translation.	X		X
social	Other storyline related to social activities but do not belong to any subcategories of social			
	Thread #378. Logo voting. Logo voting! We will use the logo for stationary and t-shirt. You can also campaign for your favorite ones! Let's vote!	X		
thanks	Members and lurkers express their appreciation to the volunteers			
	Thread #683. Say thanks to volunteers. Thanks to all the participating partners. Because of you, we transform such a beautiful Chinese language to the propelling power of a more beautiful world. Keep going!	X		

Storyline	Description and Example	Community: mutual engagement	Domain: joined enterprise	Practice: a shared repertoire
cannot find	Problems related to users complaining about not finding course content			
	Thread #696. Why only assignments without the actual course content? When I went to the translated courses, I thought there should have more course materials for download. Instead, there are only course assignments available. Where could I find the actual course content?		X	
criticism	Discussions explicitly criticize parts of the project			
	Thread #373. Reader's confusion. Translation to traditional Chinese is a risky investment. Globalisation requires us to have increased international communication ability, not the other way around.		X	
help-trans	Translation related discussions.			
	Thread # 553. Several questions. I ran into the following words during my translation. After consulting with the dictionary, I don't think the meaning in the dictionary fits. Asking for your opinion.	X	X	X
solicitation	Someone explicitly solicit help, suggestion or opinion			
	Thread #397. Wiki translation lookup table. This is an idea I got from a meeting yesterday. Basically like wikipedia.org, all of you provide the Chinese simplified and traditional translation for each terminology listed and we will end up with a lookup table. What do you all think?	X	X	X
suggestion	Someone explicitly makes a suggestion to some part of the project			
	Thread #223. Proposed Beta version of dissemination effort After talking with Luc and several others, here I listed a couple of directions we can take to put forward our project.	X	X	X
unrelated	Topic unrelated to the project			
	Thread #475. May I ask an unrelated question? What kind of qualifications do I need if I want to study at MIT?	X		

Storyline	Description and Example	Community: mutual engagement	Domain: joined enterprise	Practice: a shared repertoire
video lectures	Discussions related to video lectures Thread #673. About video lectures. I took a look at several courses. All I can find is syllabus, assignment, etc. Where can I locate the video lectures for those courses?			
volunteer	Postings related to people expressing interests to be a volunteer Thread #98. Count me in. I am truly impressed by your motivation and passion. Currently I am a MBA student at Ecole hoteliere de Lausanne (洛桑旅館學院 www.ehl.ch), although living with an extremely intensive schedule, I do love to devote to this terrific project and hope to make some contribution. I am interested in translating "Management Communication for Undergraduates Fall 2002" under Slone since it is relatively smaller and suits my schedule.	X	X	