Journal of the
Research Center for Educational Technology

Kent State University

www.rcetj.org

ISSN 1948-075X

Volume 7, Number 1
Spring 2011

Edited by:

Mark van 't Hooft, Ph.D.
Editor

A. Quinn Denzer
Managing Editor

Special Section
Learning Without Frontiers 2011: Mobile Research Strand

Research Center for Educational Technology

Journal of the Research Center for Educational Technology

Kent State University

The *Journal for the Research Center for Educational Technology* is published twice a year by RCET (http://www.rcet.org). It provides a multimedia forum for the advancement of scholarly work on the effects of technology on teaching and learning. This online journal (http://www.rcetj.org) seeks to provide unique avenues for the dissemination of knowledge within the field of educational technology consistent with new and emergent pedagogical possibilities. In particular, journal articles are encouraged to include video and sound files as reference or evidence, links to data, illustrative animations, photographs, etc. The journal publishes the original, refereed work of researchers and practitioners twice a year in multimedia electronic format. It is distributed free of charge over the World Wide Web under the Creative Commons License (Attribution-Noncommercial-No Derivative Works 3.0 United States) to promote dialogue, research, and grounded practice.

Journal of the
Research Center for Educational Technology

Kent State University

Volume 7, Number 1
Spring 2011

RCETJ 7 (1), 2-15

Considerations in Choosing Online Collaboration Systems: Functions, Uses, and Effects

Robyn E. Parker
Plymouth State University, USA

Albert Ingram
Kent State University, USA

Abstract

In this article, we explore the functions, uses, and effects of collaborative technologies in higher education classroom contexts. Increased interest in collaborative learning strategies and the burgeoning number of courses offered online indicate the need to consider collaborative technologies as part of the instructional design process. Existing and upcoming technologies provide potentially powerful and useful collaborative features, but we argue they are not neutral choices. The functions a particular collaborative technology offers, along with how the functions are utilized, will affect the learning environment. We explore the functions, uses, and effects of two collaborative systems as a way of assisting instructors in choosing a system to meet their learning objectives.

Keywords

Collaboration; Collaborative Technologies; Online Learning

Introduction

Two trends affecting teaching and learning in higher education are the increasing interest in using collaborative learning strategies and the increasing number of courses offered online. Collaboration is seen as an effective way to enhance student learning as it facilitates student-centered learning and fosters social construction of knowledge (Johnson, Johnson, & Smith, 1998; Johnson, Johnson, & Stanne, 2000). At the same time, enrollment in distance learning continues to accelerate. According to the Sloan Consortium's 5th annual study of the state of online learning, more than 20 percent of college students take at least one class online. That translates to 3.5 million students, representing an increase of 10 percent over enrollment rates reported the previous year (Sloan Consortium, 2007).

These trends suggest that online collaboration could be a central process in higher education courses, whether instruction occurs wholly online or is blended with the traditional classroom format. Interest in this process inspired members of a faculty learning community to spend four years exploring online collaboration and various technologies used to facilitate it. Learning communities are groups in which individuals with similar interests come together to build knowledge through interaction and practice. Milton Cox, a faculty development scholar at Miami University of Ohio, has proposed that learning communities are change agents for transforming institutions into learning organizations (2001).

This article provides an overview of the learning community's research agenda and describes the results of an exploratory study. In this study, we examined representative differences in collaborative system functions, their uses, and their effects, so that instructors might have a framework for choosing the system that offers the functions that best support their learning objectives. We compared the functions, uses, and effects of two specific software programs offering a representative range of functions: (a) Web CT ™[1] a common course management system, and (b) Groove, a peer-to-peer collaborative system. Our research focused on collaboration, hence we were most interested in functions designed to facilitate information sharing and student-to-student interaction. We begin by providing the relevant background about our research before providing the theories informing it.

Background

The Collaborative Technologies Faculty Learning Community at Kent State University was first established during the 2001-2002 academic year to explore ways to use technology effectively in collaborative classroom endeavors. The research team included members from education, the humanities, the natural sciences, and the social sciences; in other words, the team was made up of individuals with vastly different worldviews. One of the challenges of interdisciplinary research is agreeing on a vocabulary that allows for meaningful discussions. Therefore, our first task was to reach a shared understanding of what it means to collaborate. To help us define collaboration, we borrowed heavily from the small group communication literature (see Hagen & Burch, 1985; Mennecke, Hoffer, & Wynne, 1992) and an earlier study conducted by two members of the research team (Hathorn & Ingram, 2002). To help extend our thinking about collaboration to the online context, we turned to the limited collaborative technologies literature (see Burgoon, et al., 2002; Jehng, 1997; Russo, Campbell, Henry, & Kosinar, 1999) and the computer-mediated communication (CMC) literature (see Garton & Wellman, 1995; Spears & Lea, 1992; Sproull & Kiesler, 1986; Walther, 1992).

In the end, we defined online collaboration as the integration of effort by small groups whose interactions were mediated through a software program designed to support such interactions. Collaboration involves the active engagement of all members of the group in all phases of the activity or project. Rather than just dividing up the labor, collaborators interact to make consensual decisions about all aspects of the project; and, rather than assigning subtasks to individuals to carry out autonomously, collaboration keeps cognitive processes intertwined throughout the endeavor (Dillenbourg, Baker, Blaye, & O'Malley, 1995; Hathorn & Ingram, 2002). Defining collaboration in this way increases the ongoing interaction needs of group members, which has implications for collaborative technology functions and uses.

Exploring the various functions of collaborative technologies and their use in higher education contexts became our next task. We use the term *function* to refer to broad categories of program features that facilitate interaction processes among peers. Typical functions for collaboration are email, threaded discussion, and document sharing. More advanced functions are voting, collaborative writing, and presence awareness. Functions have intended purposes, but are frequently adapted by the interactants to meet specific needs. In other words, they are not always used as expected. Over the course of four years, we explored the functions and uses through a variety of research methods (survey, observation, interaction logs, and interviews). Ultimately, the community studied the convergence of collaboration and software uses to explore the effects of these technologies.

Later, we present the results of a representative study comparing how students used the functions of two different collaborative technologies and exploring their effects to inform instructor selection of collaborative technologies in higher education. First, we present the theories we drew upon in considering which collaborative technology to choose to enhance collaborative learning.

Theoretical Framework for Exploring Collaborative Technologies

Two theories commonly used to explore communication media choice across a variety of interaction

[1] At the time of this study, WebCT was a trademark of WebCT, Inc. 1899 L Street NW, Ste. 500, Washington D.C. 20036, U.S.A. Presently it is a trademark of Blackboard, Inc.

contexts are media richness theory (Timmerman & Kruepke, 2006; Trevino, Lengel, & Daft, 1987) and social presence theory (Short, Williams, & Christie, 1976; Swan, 2003). Media richness refers to the information carrying capacity of a channel. The theory proposes that different interaction tasks require varying levels of richness to reduce uncertainty (Daft & Lengel, 1984; 1986). Channels are set out on a continuum from lean to rich. Lean channels, such as numerical data or written documents, carry content but are devoid of contextual cues; they also do not support immediate feedback. Conversely, rich channels, such as face-to-face, carry non-verbal cues that provide contextual and relational cues as well as a means for immediate feedback to clarify meaning.

Media richness theory suggests that it is the level of uncertainty involved in an interaction that dictates which channel should be used (Trevino, Daft, & Lengel, 1987). For instance, an organizing task, such as scheduling a meeting, requires a fairly lean medium like a memo. A problem-solving task requires ongoing feedback, indicating the need for a rich channel such as a face-to-face meeting. The introduction of new electronic forms of communication has challenged the explanatory power of media richness theory as it has been suggested that the capacity to reduce uncertainty rests in the perception of the user. For example, email is experienced as a rich channel for some people, facilitating heightened levels of information disclosure. It is experienced as a lean channel to others, useful primarily for organizing tasks (Fulk, Schmitz, & Ryu, 1995; Walther, 1996).

Past research shows that satisfaction with the tools by which collaboration is enabled appears to play a significant role in predicting their continued use within workgroups (Benbasat & Lim, 1993; Reinig, Briggs, Shepherd, Yen, & Nunamaker; 1996). Satisfaction isn't necessarily brought about through the most robust tools, however. Results of a meta-analysis of computer-assisted instruction, media richness, and student performance suggest that using a medium that carries too much information (i.e. high in media richness) may result in the receiver experiencing content overload (Timmerman & Kruepke, 2006).

A second theory commonly used in educational media studies across disciplines is social presence theory. Short, Williams, and Christie (1976) placed media on a continuum similar to that proposed by media richness theory. This continuum is based upon the psychological closeness respondents perceive, rather than the information carrying capacity of the channel. In the original study, Short et al. proposed that visual channels stimulated more psychological closeness than any audio channels did. This was true even when the audio channel was synchronous, as with the telephone, and the visual channel was not, as with videos. Again, the explanatory power of this continuum is weak when applied to new communication technologies. Education researchers have moved away from examining the usefulness of the continuum to focus more on behaviors that reduce psychological distance in the classroom (e.g. Rourke, Anderson, Garrison, & Archer, 2001; Swan, 2003).

In traditional classroom research, social presence theory is used to explain how teacher immediacy behaviors reduce psychological distance between teachers and students (e.g. Gorham, 1988; Kearney, Plax, & Wend-Wasco, 1985). In online teaching and learning, social presence is believed to extend beyond teacher immediacy to include student immediacy behaviors as well (Swan, 2003). Students' levels of perceived learning have been positively related to their level of perceived interaction with peers in past research (Shea, Swan, Fredericksen, & Pickett, 2002).

In applying these theories to student online collaboration, we explored the functions of collaborative technologies and how they were used to determine how effective they were in facilitating interaction needed to accomplish group work. In the next section we describe the functions of two specific collaborative technologies before describing the methods by which their uses and effects were compared.

Comparison of Systems Functions

The two software systems, WebCT and Groove, have several features in common. Both can be used to post and retrieve files and information. Both systems support threaded discussions, and both have email and chat features. Both systems have at least some planning tools, such as calendars. There are, however, some significant differences between the two in both functions and use.

WebCT, now part of Blackboard, is a centralized, web-based course management and delivery system. It is instructor-controlled, with little student autonomy in access to tools and information. Its primary strength is in providing a place for instructors to post course information and content. In contrast, Groove is a peer-to-peer software system that depends only peripherally on centralized servers. It allows for complete autonomy for all users to add tools and content to the workspace.

Another important difference between the two systems is how they utilize the Internet. WebCT can be used from any computer with access to the World Wide Web, while Groove is tied to specific accounts on specific computers, which is where the peer-to-peer nature of the tool shines. Groove does not work well when users do not have dedicated computers, for instance when students depend upon computer labs for access to software systems. Groove also consumes large amounts of computer resources such as memory, hard disk space, and network bandwidth. Although WebCT avoids some of these problems by being based on a Web server, it has neither the range of collaborative tools, especially those with opportunities for student input, nor the sense of a shared space that is found in Groove.

The functions of collaborative technologies afford the user the ability to interact with others. Table 1 lists common functions and indicates whether WebCT or Groove provide this feature.

Table 1: Online Collaborative System Functions

Functions	**Online System**	
	WEBCT	GROOVE
E-Mail	✓	✓
Synchronous Chat	✓	✓
Archived Chat		✓
Threaded Discussions	✓	✓
Discussion	✓	✓
Presence Awareness	✓	✓
Anonymous comments		✓
Voting		✓
Document Sharing	✓	✓
File Sharing	✓	✓
Collaborative Writing		✓
Calendar	✓	✓
Co- web navigation		✓
Clipboard		✓
Notepad		✓
Instant messaging		✓

Even within functions that both systems possess, there are differences in how they work that can affect collaboration and learning. For example, both WebCT and Groove have threaded discussion. This feature is frequently used to facilitate discussion of course content that mirrors discussion that might occur in the traditional classroom. One feature that helps to facilitate threaded discussion is awareness that others in the class are online and in the collaborative environment. Called *presence awareness*, this feature has been found to increase productivity in business by allowing employees to reduce telephone and email tag and access someone who is available (Shaw, Scheufele, & Catalana, 2007).

Presence awareness functions differently in WebCT and Groove. In WebCT, presence awareness is indicated outside of the actual learning environment. When students first enter WebCT, there is a list of all classes they are enrolled in and next to it the number of people in each class who are presently online. To find out specifically who is online, a student clicks the link to get a list of individuals from which they can then issue an invitation to chat. At the time this study was conducted, there were no indicators of online presence once the student entered the individual course space. Blackboard has recently added this feature through a “Who Is Online” button.

Conversely, presence awareness is integrated within the Groove workspace, which better facilitates chat. Upon entering the workspace, there is a full list of those registered in the workspace, whether they are currently online, and whether they are currently in the workspace. Groove also includes a variety of additional tools to help groups accomplish tasks together. These include communication tools such as an internal messaging system, text and audio chat, and collaborative web navigation. In addition, there is a file (document) sharing tool, a notepad, and a means for editing Word or PowerPoint documents simultaneously while chatting.

Although there is little in the education literature about presence awareness specifically, studies about instant messaging (IM), which includes presence awareness via an icon indicating a person’s availability, report that students who use IM are more likely to state that it was easier to communicate with peers and that they felt more like being a part of a learning community than those who did not use IM (Nicholson, 2002). Presence awareness appears to be an important component to reducing separation and enhancing social presence. The synchronous nature of chat also supports feedback, increasing the channel’s carrying capacity (media richness).

Comparisons of System Uses

In examining considerations in choosing collaborative technologies in higher education, we not only explored functions designed to facilitate communication, but we also looked at how they were used and what perceptions users had about their effects. Our initial efforts, reported here, are exploratory. In researching the use and effects of the technologies, we used naturally occurring classes in which professors freely chose to use the particular collaborative technologies under study here. Our goal was simply to examine how the different technologies were actually used by students in real classes and to explore possible effects to begin to inform practice.

We performed our study by asking instructors who were using either WebCT or Groove to have their students log their online activities by responding to a set of survey questions every time they used one of the collaborative tools. After each work session, students were asked to disclose their primary and secondary purpose for entering the collaborative space, the activities they participated in and their level of satisfaction with the session on an electronic log (see Appendix A). Examples of purposes offered for entering the space were to chat with the professor, chat with students, send a message, read or post to the discussion, or share documents. Examples of activities offered were: to see what’s new, share information, connect with others, get information, work on tasks, or organize an activity. By asking students to report their purposes and activities, we obtained ongoing information about the patterns of use for each collaborative technology.

In all, 97 students from 6 graduate classes representing disciplines in the humanities, social, and natural sciences responded at least once to the survey, with a total of 320 usable responses recorded. At the end of the semester, we asked the 5 course instructors to answer several open-ended questions about the systems and their use. Groove was used in classes taught by faculty in Communication Studies, Education, and Physics. WebCT was used in classes taught by faculty in Education, English, and Sociology. Focus group interviews with student volunteers from each of the 6 classes were also conducted. Survey results were used to determine how functions were used. Open-ended response items and interviews with students and faculty were used to explain uses, differences in usage patterns, and their effects.

Student Survey Responses

Groove users were much more likely to enter the collaborative space with the primary purpose in mind of and posting to the threaded discussion board. In other words, they entered the space to communicate and collaborate. Specifically, 75% of Groove responses indicated reading discussion items as a primary reason for logging into the session as compared to 50% of WebCT responses. Further, 48% of Groove responses indicated posting to the discussion as a primary reason for logging in, compared to 31% of WebCT responses. This is made more significant by the fact that discussion boards are a prominent part of both systems. Groove users were more likely to enter the collaborative space primarily or secondarily in order to share documents and other files than were WebCT users (49% in Groove vs. 24% in WebCT).

Both WebCT and Groove users reported primary activities as entering the space to find information by indicating in their log that they wanted to “see what’s new” (84% in Groove; 89% in WebCT). Both sets of users als reported wanting to “connect with other members of the space” (41% in Groove; 29% in WebCT); “work on tasks” (63% in Groove; 47% in WebCT); and “organize an activity of the group” (37% in Groove; 53% in WebCT). Connecting, working on tasks, and organizing activities are essential parts of collaboration. Another key element of collaboration is the sharing of documents and information. Groove was used more often for these activities than WebCT (61% in Groove; 39% in WebCT). Both WebCT and Groove were used often to “get information” (81% in Groove; 91% in WebCT), but Groove users appeared to get information in conjunction with discussion and other more collaborative activities. Complete comparison data is shown in Table 2.

Table 2: Comparison of Groove and WebCT Usage in % (Responses in Student Electronic Logs (*N*=320)

		Groove (*n*=177)	WebCT (*n*=143)	Difference
Purpose of Entering Technology				
Chat with Professor				
	Primary	7.3	7.7	0.4
	Secondary	18.1	16.8	1.3
Chat with Classmates				
	Primary	17.5	16.8	0.7
	Secondary	22.6	11.2	11.4†
Send Message to Professor				
	Primary	13.6	21.0	7.4*
	Secondary	21.5	17.5	4.0
Send Message to Classmates				
	Primary	27.1	25.2	1.9
	Secondary	23.7	19.6	4.1
Read Discussion Items				
	Primary	75.1	50.3	24.8†
	Secondary	14.7	13.3	1.4

Table 2: Continued

	Groove (*n*=177)	WebCT (*n*=143)	Difference
Purpose of Entering Technology			
Post to Discussion			
Primary	48.0	30.8	17.2†
Secondary	24.9	14.0	10.9†
Post/Share Documents, etc.			
Primary	32.8	10.5	22.3†
Secondary	16.4	13.3	3.1
Suggested Purpose of Activities			
See What's New	83.6	88.8	5.2*
Share Documents/Information	60.5	38.5	22.0†
Connect with Others	40.7	29.4	11.3†
Get Information	81.4	90.9	9.5*
Work on Tasks	62.7	46.9	15.8†
Organize an Activity of the Group	37.3	53.1	15.8*
Satisfaction Level Reported by Category			
In This Specific Session			
Very Satisfied	64.4	63.6	0.8
Fairly Satisfied	28.8	34.3	5.5*
Not Satisfied	6.8	2.1	4.7†
With the Technology Overall			
Very Satisfied	67.8	58.0	9.8†
Fairly Satisfied	24.3	39.9	15.6*
Not Satisfied	7.9	2.1	5.8†

† Higher percentage of Groove users answered in the affirmative
* Higher percentage of WebCT users answered in the affirmative

Log responses indicated no real difference in use between WebCT and Groove for chatting with the professor or other students. Neither of these activities were primary reasons for entering either system (7% in Groove and 8% in WebCT; and 18% in Groove and 17% in WebCT, respectively), but much more chatting (with professor or other students) did take place once respondents entered the Groove space as indicated by open responses on surveys.

We looked to open-ended responses and focus group interviews to explain these uses. In open-ended comments recorded on the survey, students using Groove reported that they liked that they could see who was in the space and what they were doing. They felt that, "it provides a good forum to post thoughts as you think of them and adds life to an online class as you can set up your space anyway you like." That said, students found it frustrating to go to Groove and find no one was there.

Overall, there were fewer comments posted in the logs by WebCT users. Comments mostly described the space as a place to get information. Of primary concern to users was finding enough material to be able to post to the discussion to meet class expectations, but this may have more to do with the course design than the collaborative system. Either system could work. For instance, one student reported changing his/her perception of the discussion process through the use of WebCT: “I hadn’t thought of it [WebCT] as connecting with others… But now I see that the others [comments] are just as important to my understanding of the class.” Even so, the value of collaboration in learning seemed to be more obvious to Groove users.

Exploring Effects of Functions and Uses

System functions, in conjunction with the way they are actually used, affect student satisfaction with collaborative technologies and overall learning experience. In the present study, Groove and WebCT users reported similar levels of satisfaction in using the tools, although explanations for their satisfaction varied qualitatively as indicated in the previous section.

Faculty using the technologies indicated that Groove was easier to learn than WebCT. They reported that students take more ownership in the space than they do with WebCT. WebCT was seen as an instructor-centered system, whereas Groove was considered to be a group-centered system. Those familiar with other collaborative technologies, such as Groove, found WebCT to be less immediate, that is, communicators perceived more psychological closeness through Groove than through WebCT. This is an important outcome, as immediacy has been positively correlated with student motivation and learning (Frymier, 1994; Chesebro & McCroskey, 2001)

During interviews, faculty reflected upon pedagogical issues related to the use of collaborative technologies in general. They reported more upfront preparation time is required, and in some cases courses were even completely redesigned. Most recommended making the facilitation of collaboration a central process in teaching; by doing so, the purpose of the collaborative system becomes more obvious to students and also facilitates student influence on the learning process. Ultimately, instructors believed students more readily reach learning objectives and enjoy learning more when they use collaborative technologies — it is novel and exciting.

Although beyond the scope of this particular study, we suggest that there are effects besides satisfaction that are likely to result from the functions of collaborative technologies and their uses. We begin to explore those in the next section and propose considerations that instructors should make in choosing collaborative technologies. We then provide a visual map of common functions for instructors to consider in choosing the system that offers those functions that best support their learning objectives.

Considerations in Choosing Collaborative Technologies

Collaborative technology choices need to be considered during the instructional design phase (Gerber & Scott, 2007). When designing courses for online teaching and learning, it is not just a matter of digitizing activities once carried out in the traditional classroom. The restructuring effects of technology have long been discussed in studies of organizations (Rice & Gattiker, 2001; Thompson, 1967; Woodward, 1984). Technology and its functions similarly restructure the classroom by altering interactions and the social construction of community (Coleman, 2005; Mucherah, 2003).

In choosing a collaborative technology, instructors should determine how much and what type of student interaction is needed to complete group assignments and facilitate learning. Functions are one part of the selection equation, but more features are not necessarily better (Timmerman & Kruepke, 2006). Just because a function is available doesn’t mean students will use it. Media richness theory suggests that the medium should fit the information needs of the task. Consequently, having too many tools or tools with a steep learning curve can impede, rather than facilitate, student learning (Falowo, 2007).

Past research has shown a perceived lack of engagement can cause resistance among users to adopt the technology, even when it is enhancing productivity (Reinig et. al, 1996). Instructors should choose collaborative technologies that afford students opportunities to interact in ways best suited to course content and that add student interaction experiences and expectations without adding unnecessary complexity. In other words, if advanced functions are not needed, it is best not to offer them as they introduce added uncertainty (Falowo, 2007; Timmerman & Kruepke, 2006).

We suggest keeping the following questions in mind as faculty consider which collaborative technologies to choose. Answers to these questions will help in identifying needed key functions and the means to facilitate their use to achieve the desired effects.

1. What are the course learning objectives?
2. How do I envision the objectives will be met? (assignments; activities)
3. What are the interaction needs? (student-to-student; student-instructor)
4. What are students' interaction experiences and expectations?

Applying Considerations to Web 2.0 Technologies

Trying to chart the progress of collaborative technologies in recent years is to aim at a quickly moving target. New technologies and new versions of existing software appear frequently. The technologies that we studied here have changed substantially themselves, and new ones now vie for our attention and consideration as well. The key functions and uses of collaborative technologies change much more slowly, however, so while there are new approaches to collaborating through technology, most notably through what is called Web 2.0, the considerations we propose for their selection remain relevant.

Functions of Web 2.0 Technologies

The explosion of online applications collectively known as Web 2.0 presents us with a multitude of new Web-based programs that could enhance and extend collaboration. Some of these applications have been around for a few years; others are quite new. All Web 2.0 applications have in common the fact that they are much more interactive than older, more static websites. Where once a website might have had a discussion board where people could interact and discuss issues, they may now have blogs, where individuals post opinions and information and receive feedback from others, wikis, which allow far-flung groups to collaborate to develop a website, and other features.

Course Management Systems, such as Moodle ™[2] (www.moodle.org), are starting to incorporate wikis into their feature lists, and several sites now exist where groups can set up and use free wikis that are restricted to their group's members (e.g. www.wikispaces.com and www.pbwiki.com). A key difference between blogs and wikis is that wikis are truly collaborative efforts among all who work on them, while blogs are usually one person's ideas, which are then commented on by others.

Educators are increasingly aware of the variety of Web 2.0 services and their importance for education (Brown & Adler, 2008). There are a number of reasons for this. Most important for this paper is that such tools are often inherently collaborative and provide new ways for people to work together formally and informally. In addition, students are increasingly more likely to be familiar with them as opposed to course management systems. Finally, the tools are usually free and hence widely available, although this isn't always perceived as beneficial.

Some Web 2.0 applications are developing reputations that may make them somewhat unsavory to educators. Facebook™[3] (www.facebook.com) and MySpace™[4] (www.myspace.com) are sites that provide a variety of services, but are seen as primarily social and often perceived as trivial by educators. There are, however, other sites that provide similar functions and uses without either the openness or the

[2] Moodle is an individually owned trademark by Martin, Chris, Sarah, & Janet Dougiamas, 6/44 Bronte Street, East Perth WA6004 Australia.
[3] Facebook is a trademark of Facebook, Inc. 156 University Avenue, Palo Alto, CA 94301, U.S.A.
[4] MySpace is a trademark of MySpace, Inc. 407 North Maple Drive, Beverley Hills, CA, 90210, U.S.A.

clutter. For example, the Internet search company Google (www.google.com) offers Google Docs, which allows people to produce professional word processing documents, presentations, and spreadsheets. These files can be shared with others in a way that facilitates collaborative creation and editing. Google Groups offers online discussion forums and other services, such as calendaring and chatting, that may be useful as well.

It is increasingly possible to put together complete websites for classes and other purposes using Web 2.0 tools that contain most of what might be found in a Course Management System such as WebCT or Moodle. For example, NING™[5] (www.ning.com) allows you to essentially design your own social networking site with a variety of tools such as discussions and blogs. This site even has a few widgets, small programs that allow you to add new capabilities. As more widgets are created, the possibilities of these types of sites only increase.

Virtual reality used to be the province of specialists with high powered computer hardware and software. In the past decade or so, however, several companies have tried to bring virtual worlds to everyone with an Internet connection. The primary example is Second Life (www.secondlife.com), a vast virtual world where people can interact, build and alter the environment, buy and sell land, buildings, and objects, and do a variety of other things. To a certain extent they may collaborate as well, not just on these ‘in-world’ activities, but also on projects and products.

We expect to see many functions of Web 2.0 become more widely available, although some systems may mostly appeal to educators while others may be more popular with their students. We also expect that elements of Web 2.0 and virtual reality will continue to come together, so that users can do more collaborative activities in systems such as Second Life, and web-based systems will continue to add the presence and immediacy of virtual worlds. In addition, the functions of Web 2.0, especially those that genuinely encourage and enhance collaboration, will be increasingly incorporated into a variety of educational systems.

What will not change as rapidly is the fact that most of us—faculty and students alike—will need to learn a great deal about how to collaborate through technology and how to choose the right tools for the job. The software is likely to get easier to use, but learning how to use it effectively will remain an issue over time. Instructors will need to choose a set of online applications with the functions they see as important and useful and help students learn to use them to collaborate effectively.

Uses and Effects of Web 2.0 Technologies

This overview of current and coming collaborative software merely scratches the surface of what is or will soon be available. The needed functions of collaborative technologies remain much the same, however. To collaborate successfully, people need to be able to interact both synchronously and asynchronously, edit shared documents of different types, and create new products. The major differences among systems will lie in how the collaborative functions are designed and implemented, how central they are to the core purposes of the system, and how easily they are learned by teachers and students.

Conclusions

With the increasing interest in using collaborative learning strategies, along with the heightened demand for online courses, we need to better understand how students use and experience technology and, ultimately, how that affects learning. It is clear that existing and future technologies provide potentially powerful and useful collaborative features. These do not necessarily need to involve the latest digital gadgets. Many systems can enable effective collaboration with basic tools such as discussion forums, document sharing, wikis, and others that have become nearly ubiquitous.

[5] NING is a trademark of NING, Inc. 73 Emerson Street, Palo Alto, CA, 94301, U.S.A.

At the same time, some newer systems appear to integrate key collaborative functions better than others. When one enters a space that feels like an exclusive space where a small group can work, and when that space has a set of powerful and easy-to-use tools that encourage people to work together, then it seems likely that more and better collaboration will occur. The data about Groove and WebCT discussed above suggest that Groove provides a better collaborative space than WebCT for just those reasons. The key is not to just provide a set of functions, but to design and combine them in ways that make it easy and natural for students and others to work together.

This paper provides some areas for consideration when choosing a collaborative technology in higher education. Choosing a system with the needed functions and preparing students to use them will better facilitate the intended effects on learning. Functions should include key ones such as discussion forums, chat, document sharing, and others. They may be supplied in a variety of ways, but it is always important that people have a sense of a shared space, are able to identify when others are available for discussion and collaboration (presence awareness), and have the ability to work on documents, both together (synchronously) and apart (asynchronously).

Future research should focus on learning more about the micro and macro level effects of technology on teaching and learning, such as classroom climate and class dynamics. Socialization and expectation setting strategies may help to reduce uncertainty and build community. However, if technology is truly experienced differently by different users, then the effects may vary by user as well, and studying its effects at multiple levels of analysis is a necessity. One step will be to extend the examination of the uses and effects of different collaborative technologies beyond the exploratory findings that we report here. Another step may be to examine how instructors can best move students beyond learning the chosen technologies to learning how to use their functions to collaborate effectively, no matter what technology is used.

It is our hope that as we gain more experience with, and collect data about, online collaboration we will see two new trends. First, software designers should take into account how people actually use various kinds of spaces as well as what features and implementations lead most reliably to enhanced collaboration. Second, educators in particular should recognize the need to help students learn both how to collaborate effectively in general and how to use a variety of software tools to enhance that collaboration.

References

Benbasat, I., & Lim, L. H. (1993). The effects of group, task, context, and technology variables on the usefulness of group support systems. *Small Group Research*, *24*(4), 430-462.

Brown, J. S., & Adler, R. P. (2008). Minds on fire: Open education, the long tail, and learning 2.0. *EDUCAUSE Review*, *43* (1), 1-19.

Burgoon, J. K., Bonito, J., Ramirez, A., Kam, K., Dunbar, N., & Fischer, J. (2002). Interactivity and communication processes in interpersonal and mediated interaction. *Journal of Communication*, *52*, 657-677.

Chesebro, J. L., & McCroskey, J. C. (2001). The relationship of teacher clarity and immediacy with student state receiver apprehension, affect, and cognitive learning. *Communication Education, 50*, 59-68.

Coleman, A. (2005). Un/becoming digital: The ontology of technological determinism and its implications for art education. *Journal of Social Theory in Art Education*, *25*, 278-305.

Cox, M. (2001). Faculty learning communities: Change against for transforming institutions into learning organizations. *To Improve the Academy, 19*. 69-93.

Daft, R. L., & Lengel, R. H. (1984). Information richness: A new approach to managerial behavior and organization design. *Organizational Behavior*, *6*, 191-233.

Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements: Media richness and structural design. *Management Science*, *32*, 554-571.

Dillenbourg, P., Baker, M., Blaye, A., & O'Malley, C. (1995). The evolution of research on collaborative learning. In P. Reimann & H. Spada (Eds.), *Learning in humans and machines. Towards an interdisciplinary learning science* (pp. 189- 211). London: Pergamon.

Falowo, R. O. (2007). Factors impeding implementation of web-based distance learning. *AACE Journal*, *15*(3), 315-338.

Frymier, A. B. (1994). A model of immediacy in the classroom. *Communication Quarterly, 42*, 133-144.

Fulk, J., Schmitz, J., & Ryu, D. (1995). Cognitive elements in the social construction of communication technology. *Management Communication Quarterly*, *8*(3), 259-288.

Garton, L., & Wellman, B. (1995). Social impacts of electronic mail in organizations: A review of the research literature. *Communication Yearbook*, *18*, 434-453.

Gerber, S., & Scott, L. (2007). Designing a learning curriculum and technology's role in it. *Educational Technology Research & Development*, *55*(5), 461-478.

Gorham, J. (1988). The relationship between verbal teacher immediacy behaviors and student learning. *Communication Education*, *37*(1), 61-74.

Hagen, B. J. H., & Burch, G. (1985). The relationship of group process and group task accomplishment to group member satisfaction. *Small Group Behavior*, *16*(2), 211-233.

Hathorn, L. G., & Ingram, A. L. (2002). Cooperation and collaboration using computer-mediated communication. *Journal of Educational Computing Research*. *26*(3), 325-247.

Jehng, J. (1997). The psycho-social processes and cognitive effects of peer-based collaborative interactions with computers. *Journal of Educational Computing Research*, *17*(1), 19-46.

Johnson, D. W., Johnson, R., & Smith, K. (1998). Cooperative learning returns to college. *Change*, *30*(4), 26-35.

Johnson, D. W., Johnson, R. T., & Stanne, M. B. (2000). Cooperative learning methods: A meta analysis. Retrieved from http://www.tablelearning.com/uploads/File/EXHIBIT-B.pdf

Kearney, P., Plax, T. G., & Wendt-Wasco, N. J. (1985). Teacher immediacy for affective learning in divergent college classes. *Communication Quarterly*, *33*(1), 61-74.

Mennecke, B. E., Hoffer, J. A., & Wynne, B. E. (1992). The implications of group development and history for group support system theory and practice. *Small Group Research*, *23*(4), 524-572.

Mucherah, W. (2003). The influence of technology on the classroom climate of social studies classrooms: A multi-dimensional approach. *Learning Environments Research: An International Journal*, *6*, 37-57.

Nicholson, S. (2002). Socialization in the “virtual hallway”: Instant messaging in the asynchronous Web-based distance education classroom. *The Internet and Higher Education*, *5*(4), 363-372.

Reinig, B. A, Briggs, M. O., Shepherd, M. M., Yen, J., & Nunamaker Jr., J. F. (1996). Information technology and its organizational impact. *Journal of Management Information Systems*, *12*, 171-185.

Rice, R., & Gattiker, U. E. (2001). New media and organizational structure. In F. Jablin & L. Putnam (Eds.), *New handbook of organizational communication* (pp. 544-584). Thousand Oaks, CA: Sage.

Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (2001). Assessing social presence in asynchronous text-based computer conferencing. *Journal of Distance Education*, *14*(2). Retrieved from http://auspace.athabascau.ca:8080/dspace/bitstream/2149/732/1/Assessing%20Social%20Presence%20In%20Asynchronous%20Text-based%20Computer%20Conferencing.pdf

Russo, T., Campbell, S., Henry, M., & Kosinar, P. (1999). An online graduate class in communication technology: Outcomes and lessons learned. *The Electronic Journal of Communication*, *9*(1). Retrieved from http://www.cios.org/EJCPUBLIC/009/1/00914.HTML

Shaw, B., Scheufele, D. A., & Catalana, S. (2007). The role of presence awareness in organizational communication: An exploratory field experiment. *Behavior & Technology*, *26*(5), 377-384.

Shea, P. J., Swan, K., Fredericksen, E. E., & Pickett, A. M. (2002). Student satisfaction and reported learning in the SUNY Learning Network. In J. Bourne & J. C. Moore (Eds.), *Elements of quality online education*, *vol. 3* (pp. 211-237). Needham, MA: Sloan Center for Online Education.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. Toronto, Canada: Wiley.

Sloan Consortium (2007). *Online nation: Five years of growth in online learning*. Retrieved from http://sloanconsortium.org/publications/survey/online_nation

Spears, R., & Lea, M. (1992). Social influence and the influence of the ‘social’ in computer-mediated communication. In M. Lea (Ed.), *Contexts of computer-mediated communication* (pp. 30-65). London: Harvester-Wheatsheaf.

Sproull, L. & Kiesler, S. (1986). Reducing social context cues: Electronic mail in organizational communication. *Management Science*, *32*(11), 1492-1512.

Swan, K. (2003). Learning effectiveness: What the research is telling us. In J. Bourne & J. C. Moore (Eds.), *Elements of quality online education, practice and direction*, *vol. 4* (pp. 13-45). Needham, MA: Sloan Center for Online Education.

Thompson, J. D. (1967). Technology and structure. In J. D. Thompson (Ed.), *Organization in action* (pp. 56-65). New York: McGraw-Hill.

Timmerman, C. E., & Kruepke, K. A. (2006). Computer-assisted instruction, media richness, and college student performance. *Communication Education*, *55*(1), 73-104.

Trevino, L. K., Lengel, R. H., & Daft, R. L. (1987). Media symbolism, media richness, and media choice in organizations. *Communication Research*, *14*, 553-574.

Walther, J. B. (1992). Interpersonal effects in computer-mediated interaction: A relational perspective. *Communication Research*, *19*, 52-90.

Walther, J. B. (1996). Relational aspects of computer-mediated communication: Experimental observations over time. *Organization Science*, *6*(2), 186-203.

Woodward, J. (1984). Management and technology. In D. S. Pugh (Ed.), *Organizational Theory: Selected Readings*. pp. 52-66. New York: Penguin.