Abstract

Skill sets related to teamwork and collaboration are in demand in all sectors of employment. Accreditation agencies for college programs have responded to the demand by incorporating requirements related to teamwork into statements of program outcomes. This is true, for example, for both the 2004-2005 Criteria for Accrediting Engineering Technology Programs established by TAC of ABET and the draft accreditation criteria for Information Technology Programs being developed through the Computing Accreditation Commission (CAC) of ABET. While higher education faculty have recognized the need for individuals with skills related to teaming by incorporating content about teaming into courses and by requiring students to complete team projects, it is a challenge to create for students an electronic collaboration environment resembling what they may encounter in a modern workplace.

Modern workplaces incorporate technologies that enable high speed sharing of information and provide workers with mobile information devices and wireless access to communication networks. Because of these enabling technologies, virtual workplaces are more and more common. A virtual workplace is comprised of workers separated by either or both geography and time that collaborate electronically toward a common goal or purpose. It is often temporary, in existence only until the goal is achieved. In addition to teamwork competencies, virtual workplaces require graduates well-versed in the technology used to store, process, and deliver information electronically. The investigators embarked on a curriculum development project that attempts to develop the students’ skill in electronic collaboration. In the process, they learned that just providing electronic tools and content about working in teams did not automatically produce electronic collaborators. They learned that electronic collaboration is both similar to and different from face-to-face collaboration. This paper shares their experiences.
Introduction

With increasing globalization, organizations frequently rely on electronic means of collaboration as they form more virtual project teams. A virtual team is a team of people for which the primary means of interaction is something other than face-to-face, although team members may meet face-to-face occasionally. Often the team members are separated geographically, sometimes even across multiple time zones. Reasons for creating virtual teams include organization-wide projects or initiatives in geographically distributed organizations; alliances or mergers with or acquisitions of other organizations even in other countries; emerging markets in different geographic locations; individual preference (or need) for telecommuting; and high cost of business travel. In addition, modern workplaces incorporate technologies that enable high speed sharing of information that drive the fast pace of today’s commerce. Proliferation of mobile information devices and wireless access to communication networks also contribute to the evolution of the workplace into a flexible, modular, compendium of fixed and virtual workplaces. With virtual teams using electronic means as their primary communications medium, there is great demand in the workplace for employees well-versed in the technology used to store, process, share and deliver the information that drives it.

Employee collaboration skills are highly valued and eagerly sought by employers across many job sectors. The recent Gartner Group forecast and market overview report for real-time and team collaboration software states that, while it continues to be difficult to measure the business value of collaborative interactions, it is nonetheless accepted that “collaboration strengthens business processes and increases the value of personal interactions.” Accreditation agencies for technology programs recognize the importance of collaboration skills since they are included as required program outcomes. For example, the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET) includes in its Criteria for Accrediting Engineering Technology Programs Effective for Evaluations During the 2004-2005 Accreditation Cycle that “An engineering technology program must demonstrate that graduates have … an ability to function effectively on teams.” Similarly, the Information Technology education community addresses collaboration skills in draft accreditation criteria developed through the Computing Accreditation Commission (CAC) of ABET. The draft criteria state that
“… IT graduates … must possess the ability to collaborate in teams to accomplish a common goal by integrating personal initiative and group cooperation.”

In addition to the value placed on collaboration skills in the workplace, a widely accepted educational practice is to use cooperative/collaborative strategies to enhance learning. Collaborative learning approaches engage students in active learning and give them access to the shared knowledge, experience, and insights of other members of a learning team. This is particularly important for high-order, critical thinking skills that must move beyond passive memorization of facts to a constructivist engagement in which students comprehend, assess, and apply information in ways that lead to new insights and understanding.

Technology education has long embraced the mission of preparing students technically. And, while technology educators also have recognized the value of collaboration skills and have responded by incorporating content about teaming into courses or requiring students to complete team projects, the current state of business urges expanding curricula to include experiences with electronic collaboration technologies.

Collaboration Tools in Technology Enabled Learning Environments

Numerous technologies support electronic collaboration. Some technologies support synchronous interaction and others support asynchronous interaction. Some technologies support real-time sharing of the same files and others support the management, tracking, and version control of asynchronous passing of static files to different team members. Some technologies focus more on a collaborative design process; that is, the creation and authoring of files that are part of design development, and others focus on reviewing and markup associated with the refinement of design. The assumption behind the technologies is that by promoting collaboration through the technologies, social interaction will be improved, worker productivity will be increased, and hence organizational performance will be improved.

Improvements in computer hardware and network connectivity accompanied by an increase in geographically distributed project teams have led to a strong and growing demand for a variety of collaboration software tools. Software that is used in support of collaboration includes e-mail, instant messaging, online chat, e-calendaring, discussion boards, e-whiteboards, shared folders,
shared documents, application sharing, online survey tools, video conferencing, audio conferencing and groupware. From this list, web conferencing, application sharing, and electronic shared whiteboards are in the category of real-time collaboration products. They support synchronous use and interaction among participants in real-time, in a meeting or presentation format.³ The other tools mentioned are asynchronous.

Some of the tools have gained widespread acceptance in both business and academia such as e-mail and threaded discussion boards. Others, including Web logs (also known as blogs) and wikis are less commonly used with students, yet a Gartner Group forecast predicts that this collaboration software segment will grow at a rate of 17.1 percent from 2003 through 2008.³ Wikis and blogs are both web applications; that is, the interface is delivered through a browser. A wiki is a collaborative Web application comprised of the perpetual collective work of many authors. It is similar to a blog in structure and logic, but a wiki allows anyone, using a browser interface, to edit, delete or modify content that has been placed on the Web site, including the work of previous authors. In contrast, a blog is typically authored by one individual and does not allow visitors to change the original posted material. The blog manager can allow visitors to add comments to the original content.⁷ A blog is similar to a discussion board, but a blog usually belongs to a single user. Blogs are connected to each other when users unite their blog with a blog ring that focuses on a specific topic.

In academic settings, many of the potential collaboration tools are used as individual applications to support class work. Another approach is the integration of several tools, especially the widely used and accepted tools, into a web learning environment such as WebCT or Blackboard. These products belong to the class of products known as information management portals. These products strive to simplify the computing environment by offering users several applications through one information source and interface, often web-based. While academic portal products have gained acceptance, students who become familiar with these applications through their academic work will not see these products used in a business environment. Thus, there is reason to strive to provide students with an electronic collaboration experience that is more authentic to what they might see when they are employed.
One generic enterprise information portal solution is Microsoft® SharePoint Portal Server (MSPS). It is designed to facilitate collaboration, provide document management and searching, and do this in harmony with the Microsoft® Office suite of applications. This product provides a decentralized environment as opposed to the centralized environment of a product like WebCT. In the decentralized MSPS environment, end users decide how to collaborate without being restricted to collaboration schemes or methods defined by the software. MSPS provides the capabilities for sharing and collaboration without dictating the process. MSPS also adds indexing and searching functionality that make it easy for users to find shared information easily.  

**UH College of Technology Curriculum Development**

At University of Houston College of Technology, Information Systems Technology (IST) faculty are experimenting with introducing content about teaming, together with content and experience with electronic collaboration, in a freshman level information literacy course. The course is required for a variety of majors including Construction Management Technology, Electrical Power, Information Systems Technology, Consumer Science and Merchandising, Logistics, and Technology Leadership and Supervision. In addition, UH is recognized as the most ethnically diverse major research university with no single majority group in its student body. Thus, the student population served is heterogeneous with respect to a number of factors including prior computer experience. IST faculty members have chosen to use a variety of technologies that support collaboration with students in the course. Technologies used with students include e-mail and discussion boards through the centralized interface provided by WebCT, Web logs, ad-hoc networking using Tablet PCs in a Mobile Learning Laboratory, and MSPS.

Students interact with each other and the instructors throughout the course using e-mail and discussion board features of WebCT, a course information management portal and content delivery tool selected and supported by UH information technology staff. Several assignments early in the course target these technologies. The students then are introduced to Web logs (blogs). A blog is a web application that contains reverse chronologically ordered postings on a webpage. The blog webpage is generally accessible to any Internet user and is often managed as a forum for discussion by allowing visitors to leave public comments. This can lead to the creation of a community of readers centered on the blog topic. The totality of weblogs or blog-
related websites is sometimes called the blogosphere. Bloggers also join blogrings dedicated to particular topics of interest. Individual weblog entries are almost always date and time-stamped, with the newest post at the top of the page. Blogs originated in the late 1990’s and became very popular in 2003 when bloggers were credited for having influence over a number of politically controversial events. In the UH course, students use the free blog host service Xanga to create their own blog. Then they join a blog ring that the instructor sets up for a particular ‘controversial’ current issue. Each student posts commentary to their own blog and reacts to postings made by other students. This activity is information sharing, but it is not collaboration that is directed toward the achievement of a goal.

As early adopters of an emerging technology, the Tablet PC (TPC), Information Systems Technology faculty began to integrate Tablet PCs into the undergraduate curriculum as early as Fall 2003. The College supported the establishment of the mLearning Lab, a powered cart housing 30 Toshiba Tablet PCs. In the freshman information literacy course, the mLearning Lab is used to help students develop skills required of information workers in an academic environment, including note taking, presenting, collaborating, marking up documents, and information management. One collaboration activity involves using Colligo® Workgroup Edition (WE) software to enable the wireless capable Toshiba TPCs to network to one another, no matter where the students’ class is scheduled. Students form ad hoc workgroups to complete two small-group activities. One activity uses whiteboard and chat features of WE. The students play a game similar to Pictionary, with one student drawing on the whiteboard, which all the other students in the temporary workgroup can see. They guess what’s being drawn using the chat feature. They are not supposed to communicate verbally or with gestures (since they are physically in the same room) to simulate the reality of true geographically separated electronic collaboration, but this is a difficult restriction to enforce.

The second TPC collaboration activity is a group decision making exercise. The students are given a list of twenty items left intact after a crash landing on the moon. They have to decide as a group which items are the most important as they have to carry items overland to a rendezvous point a number of miles away and they cannot carry all the items. The students each discuss and decide which items are the most important and produce a single document that justifies each item
chosen by the group. The students use the chat and file sharing capabilities present through WE to complete the activity.

In the information literacy course, students are first introduced to Microsoft® SharePoint server technology in the third of a series of three Table PC workshops. Students working in a lab setting, each using a TPC, access a MSPS site. The site includes three web parts with which the students interact. One web part contains links to information about Tablet PCs. Another web part implements an on-line survey regarding the student’s opinion of the TPC workshops the student has already completed. A third web part delivers shared documents in support of a group activity. The document available in the shared document space is a Microsoft Word® document with questions about the students’ in-class experience with the TPCs. The students informally organize themselves into small groups of three or four and collaborate face-to-face during the workshop to answer questions posed in the word document, turning in a single document for their group.

After this introduction to MSPS, students are assigned to groups numbering four or five to complete a group project. The current project requires students to collaborate to evaluate nine information items submitted by other students in completion of earlier course assignments. Each earlier assignment focused on the presentation of information about a career interest of the student. One assignment asked the students to present information in the form of a report, another assignment asked the student to present information in the form a presentation slides, and the third assignment asked the student to present information as a web site. The group develops a qualitative evaluation report for the nine items.

In Fall 2004 a survey was administered to gauge the students’ former experience with electronic collaboration and to learn what they thought of using the the MSPS in support of their group project. The survey items and results are in Table 1. Interesting results from the survey include:

- Most students knew of the existence of electronic collaboration software before the class experience but most had not used any.
- Most students thought MSPS was easy to use and made it easy to share documents.
• Most students felt compelled to meet face-to-face in spite of the supporting technology.

• Most students remained undecided as to the whether or not electronic collaboration could produce a deliverable of the same quality as face-to-face collaboration.
### Table 1 Survey Questions and Results

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Using the SharePoint Server collaboration site was my first experience with a web-based or computer-based collaboration tool.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I never accessed the SharePoint Server collaboration site for my team.</td>
<td></td>
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<tr>
<td>3</td>
<td>Before using the SharePoint Server collaboration site, I was not aware that technology existed specifically to support electronic collaboration.</td>
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<tr>
<td>4</td>
<td>The SharePoint Server collaboration site was easy to understand and use.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>The tools on the SharePoint Server collaboration site (Shared Documents and Discussion) were easy to understand and use.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>The SharePoint Server collaboration site made it easier to work with my team on completing the project.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>It was difficult for me to access the SharePoint Server collaboration site because when I tried I could not get in.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>My team mostly met face-to-face instead of collaborating electronically.</td>
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<tr>
<td>9</td>
<td>If I had to collaborate only electronically to complete a team project, the project deliverables would be equal in quality to deliverables created with face-to-face collaboration.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The SharePoint Server collaboration site made it easy to share documents with my team.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Collaborating electronically is fun.</td>
<td></td>
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</tbody>
</table>

### Plans for Future Curriculum Development and Research

The investigators plan to continue to develop the introductory information literacy course and to emphasize more the benefits of collaboration. Currently, anecdotal evidence suggests that
students prefer assignments that do not require collaboration because collaborating face-to-face is inconvenient for the largely commuter student body of UH. Thus, one goal is to create a vibrant and highly interactive on-line community among students enrolled in the course, a community where real learning takes place. Such a community is sometimes referred to as a community of practice, and is described as promoting collaboration, improving social interaction, increasing productivity, and improving organizational performance. Research indicates that benefits to the individual, the community, and the organization are derived from communities of practice. \(^{10}\)

A question for future research based on this curriculum development goal is whether electronic support for collaboration enhances collaboration activity in the classroom and improves student performance. That is, do the tools and the way the tools are implemented make a difference in terms of the expected performance improvements? This question is already being actively researched with respect to organizations, but it is proving to be difficult to study for a number of reasons. One difficulty lies in separating the impact of technology on collaboration activity from other contextual factors that influence the quality of collaboration such as organizational support. A second problem is that it is more difficult to evaluate a collaboration application just by the multi-user nature of it and all the interrelated qualities of teamwork that may have nothing to do with the implementation of the application. \(^{11}\) Perhaps narrowing the question to higher education classroom settings will improve the accessibility of the question.

Another way to narrow the research question is to define the usefulness of collaboration tools in terms of how well they help the information (knowledge) worker complete tasks related to knowledge work—searching, processing, synthesizing, decision-making, interacting, coordinating. To the extent that workers perceive individual, as well as community and organizational benefits, to using collaboration tools, then the tools add value to the student and hopefully will continue to be used in other classes. This perspective suggests survey questions that could be validated and used to evaluate the effectiveness of different collaboration tools in supporting an online learning community.
References


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