2009

Teaching and Learning Collaboratively and Virtually

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ABSTRACT

In this paper we describe five knowledge areas for IS educational activities called for in the MSIS 2006 Model Curriculum. The knowledge areas are business processes, emerging technologies, globalization, human–computer interactions, and the impacts of digitization. We then describe two graduate-level courses which pursue these activities — each from a different perspective. One perspective focuses on students learning concepts about virtual teams and collaboration technologies. Another perspective centers on students finding, implementing, and evaluating virtual team and collaboration technologies. We describe the results of educational activities we embedded within these courses that purportedly helped students learn about the five knowledge areas. Next, we share feedback from students. We close the paper by encapsulating our lessons learned.

Keywords

IS Education, Learning, Virtual Teams, Collaboration, Virtual Worlds, Augmented Reality

INTRODUCTION

As educators of information systems (IS) professionals, some of our goals are to develop individuals who can identify, obtain, design, develop, implement, use, evaluate, market, and manage people, information technologies, and systems that address discovered problems or capitalize upon opportunities and thus enable their organizations. To be successful, these graduates should have strong analytical, critical thinking, communication, and collaborative skills (Gorgone et al., 2002; Gorgone et al., 2000). However, scholars have recently noted that information technology and systems (ITS) work is now frequently globally distributed and that "the IS discipline is becoming more and more global" (Topi, 2007). And others have recently indicated the need for additional focus in IS education and upon business processes, emerging technologies, globalization, human–computer interactions, and the impacts of digitization (Gorgone et al., 2006). To address these needs, we recently developed and taught two courses—a Current Topics in MIS course and an IS Project course—both in the knowledge domain of virtual teams and collaboration support technologies. In this paper, we describe our courses, results of these courses, and impressions of our students after they had completed the courses.

THE COURSES

In fall 2008 and an intensive and condensed semester at the beginning of spring 2009, we taught two interlinked courses:

- Virtual Teams and Collaborative Technologies: Current Topics in MIS
- Virtual Teams and Collaborative Technologies: IS Project

These two courses are elective graduate courses for MBA students in the [name removed for blind review] Graduate School of Business at the University of [name removed for blind review]. During the fall semester, six students were enrolled in both of these courses. In the spring, six students were jointly enrolled for both courses, while an additional student was enrolled for only one of the two courses.

Virtual Teams and Collaborative Technologies: Current Topics in MIS

In global organizations, successful managers enable collaborations in and among teams of knowledge workers across organizational boundaries, cultures, locations, and time. To support this teamwork, managers leverage quickly evolving information technologies such as virtual workspaces, shared applications, multi-touch and interactive 2D and 3D models, as well as more traditional tools such as smart boards and Internet-based video/audio conferencing. Effective and capable managers will need to continue to monitor, select, and implement these tools based upon their ability to maximize individual and team performance.

In this Current Topics in MIS course, students learned concepts about different collaboration technologies and developed their abilities to apply them to manage and support diverse, distributed teams. Through a combination of readings, discussions, presentations, and hands-on experiences, students examined (i) the capabilities and limitations of various collaboration tools (including, but not limited to, hosted tools, content management systems (CMS), and physical and virtual tools); (ii) techniques for selecting and applying team-support technologies; and (iii) methods for evaluating these technologies' impact on the collaboration process. Although it was not a requirement, it was recommended that this course be taken in conjunction with the IS Project course. Table 1 shows the assignments for each semester's version of the Current Topics in MIS course.

Fall 2008	**Spring 2009**
Team Technology Report	Team Technology Report
Team Technology Product Comparison Report	Team Technology Product Comparison Report
Team Leadership & Member Competency Assessment	Team Leadership Assessment
Team Assessment	Member Competency Assessment
Virtual Meeting Experience Report	Virtual Worlds Presentations Comparison Report
Virtual Worlds Comparison Report	Virtual Worlds Collaboration Comparison Report
Organizational Assessment	Virtual Worlds as Educational Tool Assessment

Table 1. Assignments for Current Topics in MIS course

When students completed the team technology report, they developed an audio-annotated MS PowerPoint presentation that described a particular collaborative technology. These reports discussed the technology (e.g., virtual worlds, augmented reality), applications of the technology (e.g., collaborating, designing), products that provided the technology (e.g., ProtonMedia's ProtoSphere [http://www.protonmedia.com], Qwaq Forums, [http://www.qwaq.com]), and prospective stakeholders (and their interests) in or near an organization that might use the technology. Students then created team technology comparison reports. During this task, students focused upon and analyzed two competing products that used the same underlying technology.

After immersing themselves in technologies, the assignments in these Current Topics in MIS sections asked the students to reflect upon their own and their peer's abilities and dispositions, in the context of their collaborative teams. In the team leadership assessment tasks, students evaluated each other, and themselves, as leaders. Leadership areas they considered were coaching, cross-cultural management, trust-building, and adapting. With regards to assessing team membership they reflected upon each others' (and their own) ability to network, be interpersonally aware, use technology, and manage themselves.

With basic understandings about particular technologies and products, as well as their own abilities and dispositions, students were then asked to meet virtually, that is, meet using a distributed teams technology, with team members in several geographic locations. Students then analyzed this meeting. In the second instance of the course, this particular assignment was split into two assignments: 1) An assignment that focused on analyzing presentation-oriented virtual meetings where the primary purpose was to distribute information; and 2) analyzing collaborative virtual meetings where the meeting supported the team members interacting substantively and synergistically. Finally, at the end of the spring and fall courses, respectively, students analyzed an organization in terms of how it might use the primary technology that they had investigated, or they analyzed the use of virtual worlds as an educational environment.

Virtual Teams and Collaborative Technologies: IS Project

While the Current topics in MIS course helped students to think critically about performing business processes; identifying, using, and evaluating emerging technologies; experiencing globalization, analyzing human–computer interactions, and imagining the possibilities of digitalization, in an abstract fashion, the project course allowed the students to engage these processes, concretely. Collaboration and team support technologies are an increasingly more important part of organizational infrastructures. Whether supporting telecommuting within a crowded urban area, overseeing geographically distributed operations, or executing a globally sourced business-development effort, managers must efficiently and effectively identify, apply, and evaluate collaboration technologies necessary to successfully realize business objectives.

In this IS Project course, students had the opportunity to learn experientially by selecting, applying, and evaluating a product representing a collaborative technology. This product could have been used face-to-face (FTF) or in a geographically distributed manner. It should be noted that four out of five teams chose to use and evaluate products that supported geographically distributed (sometimes referred to as virtual) collaboration. Two of these teams used state-of-the-market products while the other two used state-of-the-art virtual world or augmented reality collaboration tools. Students made the business case, acquired the products, implemented the technology within the business school, attempted to improve their team performance, and evaluated its use and impact.

In this course, students gained first-hand experiences with the opportunities, benefits, costs, and risks associated with collaboration technology development initiatives in today's and future organizations. Although it was not a requirement, it was recommended that this project course be taken in conjunction with the Current Topics in MIS course. The deliverables for this project course were an initial proposal and project plan, four status reports, feedback to and critiques of the other team(s), and a final report and presentation. Table 2 shows the projects.

Semester	Project Area	Description
F2008	Web-Conferencing Experiment	Students investigated VYEW, a product that supported live video, VoIP, recording, whiteboard w/annotation, text chat, surveys, and application sharing. (http://www.vyew.com)
F2008	Voice Recognition and Speaker Identification Experiment	Students investigated using a voice recognition product (Dragon Naturally Speaking) to provide visual cues to web conference participants to relay speaker identities. (http://www.dragonvoicerecognition.com)
F2008	Wii Remote (Wiimote) Interactive Multi-Touch Whiteboard Experiment	Students used the Wii Remote video game controller for Nintendo's Wii console in order to provide a multi-touch interactive whiteboard. (http://www.nintendo.com/wii)
S2009	Virtual Collaborative Office	Students used MindMeister mindmapping software and Google Apps app-sharing software in a collaboration-oriented virtual world (Qwaq Forums). (http://www.mindmeister.com, http://apps.google.com, http://www.qwaq.com).
S2009	Augmented Reality for Enhanced Retailer/Customer Interaction	Students used augmented reality software to show how customers can 1) hold a product, such as a car, "in their hands" and seemingly manipulate the product, without holding it in their hands, and 2) "try out a product" such as furniture, appliances, or other home furnishings in their home, without bringing the product home.

Table 2. MIS Projects Associated with Virtual Teams and Collaboration Technologies

STUDENT EXPERIENCES

I hear and I forget…

"I hear and I forget. I see and I remember. I do and I understand." (Confucius).

This proverb comes alive when we think about the fact that the term "business process" is understood almost automatically and intuitively by individuals that have many years' experience, while the term and its shades of gray can be amazingly ambiguous to young people that have never used a budget, hired or fired an employee, managed a production line, or identified and purchased or marketed and sold a product. Sometimes students will claim understanding, but, when pressed, will provide shallow explanations.

One way to help students learn about business processes is to ask students to perform them. Experience-based learning has [at least] three components: active construction of knowledge, situated learning, and social interaction (Krajcik and Blumenfeld, 2006). The business process we were primarily interested in students understanding was the choice, implementation, use, and evaluation of a software product; thus they were actively creating their knowledge, situated in a complex context, and required to interact in order to accomplish the task. Many of the Current Topics course assignments (Team Technology Report, Team Technology Comparison Report) focused on students learning how to compare products, and hence the choice and evaluation portions of that business process.

While we frequently teach about how one should identify a problem and find the appropriate solution/software, we rarely allow students the ability to experience the process, especially the implementation, use, and evaluation aspects. The deliverables in the IS Project course helped our students experience these business processes with the products they were considering. One of our students learned that it was hard to agree with others on a team goal and that finding products that actually addressed his/her team's needs was actually very difficult.

> *"In performing these business processes, we felt as if we were taking two steps forward but then one step back. Building a model/concept [about] what we really wanted to do and with what software was already difficult. After agreeing upon the concept of 'marketing and selling in a virtual environment' as a target purpose for our project, finding software companies with products that fulfilled our needs was not easy. We didn't find many suppliers that could provide us with the required technology."*

Another student, on the "augmented reality for enhanced retailer–customer relationships" project, indicated that not only did they experience the business process of finding and evaluating software, but they actually practiced the business processes of sales/purchasing and product design/revision with the software.

> *"Working on the emerging technologies to facilitate virtual collaboration in multi-cultural, multi-experienced teams and globally distributed teams helped us to understand the business processes better. We are not only identifying technologies but also trying to incorporate them in different business processes (based on our experiences). This made us understand that virtual collaboration technologies allow us to perform business processes in an easier way. They also reduce dependencies and increase productivity in performing these business processes."*

Finally, another student discovered that business processes are changing.

> *"I have learned that business processes are being transformed into automated processes. Most of the required steps which were previously performed manually are now today done by an automated process."*

Give a Man a Fish…

We were not just interested in our students' understanding the software acquisition business process; we were primarily interested in making it so that these students, in the future, could capitalize upon this business process. We wanted to realize the maxim:

"Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime."
(Lao Tzu)

If our graduate information systems and technology students are going to be successful, they will need to be able to lead organizations by identifying, using, and evaluating emerging technologies. These two courses allowed our students to develop their ability to navigate the world of leading and bleeding-edge products, so that they would be able to do this in the

future, as ITS managers. The following quote outlines a particular student's process as s/he considered virtual collaboration tools. While web conferencing is state-of-the-market, virtual collaboration tools such as Qwaq Forums (http://www.qwaq.com) and ProtonMedia's Protosphere (http://www.protonmedia.com) are 3D immersive, collaborative worlds and are emerging technologies.

> *"Identification and evaluation of an emerging technology is a challenging task. The exact purpose and usability of the application is hard to decipher. There should be an exact match between the needs and the functionalities of an emerging technology. First, I assessed the technologies on whether they were desktop or online applications. During my research I found that there are a lot of online applications but very few desktop applications for virtual collaboration. There are a flood of online applications offering key functionality for collaborating… like file sharing, conferencing, and sharing workspaces. I also found that some of the basic features for collaborating are available in many of these applications but they differ on performance. For example, one application may support up to 500 users whereas another only 20 or 30. Performance was a major criterion on evaluating these technologies. I also registered and downloaded from many sources and used the application. I found many of them user friendly and effective for small-size projects, but not for enterprise-wide applications."*

Another student echoed the importance and the difficulty of the identification task:

> *"In today's technological world, using the technology is not a big deal—identifying the right technology is the toughest and most crucial part of the process."*

A third student provides some transparency into his/her thinking. He/she also provides heuristics that this student may use in the future when he/she considers emerging technologies.

> *"A class highlight for me was realizing how difficult it is to identify and evaluate emerging technologies. Search engine results are mostly unsuccessful. The best information sources are good market overviews. The downloading and testing [of software] gave a good look and feel but filled the computer with a lot of data. The more complex [collaboration] solutions overburdened the capabilities of typical networks."*

One heuristic it appears this student has constructed is "Be sure to use market overviews, because search engines may not return the results that represent the products that are available." Another heuristic might be "Be sure that you have the network that is necessary for distributed software, BEFORE you make any commitments to use or buy distributed software."

No this definitely wasn't Kansas…

"No this definitely wasn't Kansas. It didn't even seem like India." (Thomas Friedman).

Since within IT, globally-distributed teams are becoming the norm (Friedman, 2005), we also sought to support students experiencing globalization. Particularly, we sought to sensitize students to alternative cultures. While this was not planned, during fall 2008, we had four Indian students and two American students, and during the spring 2009 semester, we taught four German students and two Indian students. The two different instructors, one in the fall, and one in the spring, were both American. Based on the comments below, it seems our students valued learning about each others' cultures.

> *"We had a diverse course, consisting of [people of] different nationalities currently working for or having worked in international companies, therefore we experienced globalization very intimately…. The ability to exchange [thoughts] with people from other cultures has really contributed to the class and the topic of virtual teams. In business environments this form of collaboration is also very common."*

Another student expressed similar thoughts.

> *"I feel virtual technology is bringing people together on a common platform. This course talks about the social aspects and cultural issues of such technologies. The class consists of people from different nations and hence we get to interact and learn about perspectives from different cultures. There are behavioral aspects to how a team member performs in such a setting."*

Our students also saw the distinct relationship between collaboration technologies and the globalization of the IT industry. Consider the following quotes.

> *"The experiences with the Indian culture were very high due to a close collaboration within and between the groups. The different approaches to project work and the attendant social interaction were very interesting to me. This kind of teamwork (Germans and Indians meeting in the United States to work together) shows that virtual collaboration software will be a central part of globalization because it makes international collaboration very easy."*

One student recognized the need for virtual worlds (and collaboration technologies in general) to mature, and be able to support social maintenance group functions.

> *"Using this type of technology definitely will lead to even more globalization since no matter where you are, interacting with your group is possible. Traveling can be avoided. So far, globalization was always linked with wasting huge amounts of resources; using a plane is not very environmentally friendly. However, to get really better in touch with other group members in a virtual world, the offered programs need to be developed towards having the ability of enabling better social contact, like shaking hands, etc."*

A Robot May Not Injure a Human Being…

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey orders given to it by human beings, except where such orders conflict with #1.
3. A robot must protect its own existence as long as such protection does not conflict with #1 or #2.
(Isaac Asimov, 1950)

Isaac Asimov's three laws for robots are instructive. These interlinked laws indicate the complexity that is (and will continue to be) built into human–computer interfaces and the resulting interaction. Modern human–computer interfaces are event-based and interact automatically with their environment. However, events in the world are highly dynamic and therefore computer responses to events can be surprising as well as (sometimes) frustrating.

One of the teams in our courses sought to create a virtual collaborative office. This virtual collaborative office consisted of a 3D workspace within a virtual world platform. The virtual platform that was chosen by this team was Qwaq Forums. In Qwaq Forums, users (represented by avatars that they control) meet others inside a 3D space. Users can "see" others and the 3D space through many perspectives, including first person and "birds' eye" views. Users can share applications that are supported by the OpenOffice software suite. They can also collaborate using 'in-world' whiteboards. Perhaps most interestingly, users in the virtual world can import, move, change the size or proportions of, or otherwise manipulate Google Sketchup (or other software-generated) 3D models within Qwaq Forums—similar to how the augmented reality system discussed above can add to our perceived reality. These students also placed a mind-mapping tool and access to other Google apps within their "office." However, the students did find some issues with the human–computer interaction. This student expressed his/her understanding of human–computer interactions and what s/he felt was an appropriate user interface for a virtual world.

> *"Again [virtual world HCI] needs to be worked on; however, it is only a question of defining what else needs to be included in a software package. An avatar should be able to sit down in-world, and avatars should be able to 'virtually' shake hands; what really needs to be improved is the ability to use one's own files in a virtual world and to have the option of changing these files. This functionality did not work very well."*

This student indicates a judgment about how necessary it is for collaboration software to be supported by the right infrastructure, and the productivity costs if the software is not supported well.

> *"Software enables us to do our jobs better by increasing productivity and making tasks easier through automation. But, we observed that software programs have many limitations too. The hardware should support the software adequately. Also, if the software is still in its beta version and has limited capability, this increases confusion and workload. But, when the software is completely developed and supported by appropriate hardware, the interface will be smoother."*

This student evaluates how the human–computer interface should be used to connect people.

> *"The discussions we had about the differences between real and virtual teams stimulated a lot of ideas and helped me to understand why certain mistakes have been made, historically. In my eyes, the computer can reduce perception to merely the exchange of data. Even though we have the ability of audio and video technologies, we sometimes cannot*

communicate emotions using other technologies. This fact that we are almost always missing information needs to be carefully managed."

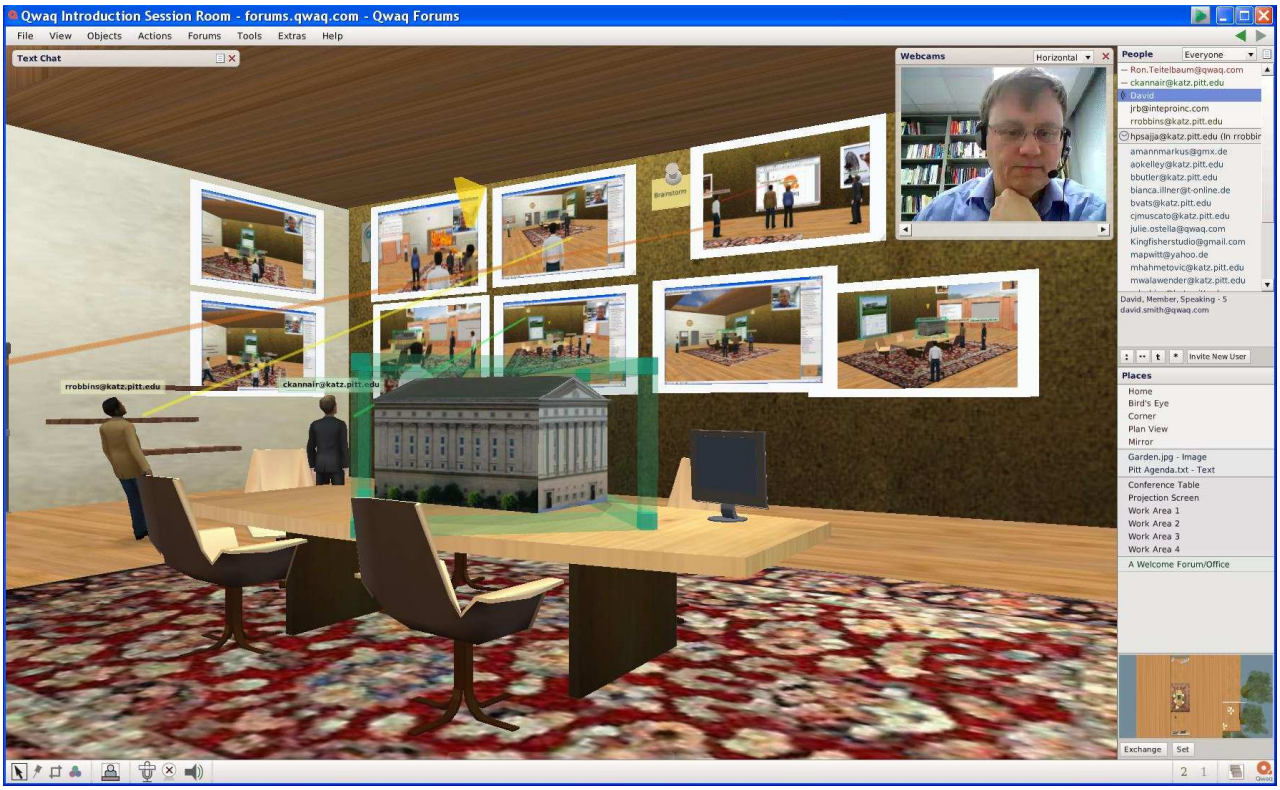

Figure 1: Distributed and Collaborative Team Ranks Solutions in Virtual World

And one student representing the eternal optimist noted:

"The interaction between humans and computers is becoming easier. There are advanced operating systems which are enabling the common man to use the computer and run various programs. The installers for various software programs are easy to use and they do most of the jobs..."

I think there is a world market for maybe five computers

"I think there is a world market for maybe five computers." (Thomas Watson, Sr., IBM Founder)[1]

We also hoped that our courses would help students begin to imagine the worlds that can be, based upon the intersection of business processes, emerging technologies, globalization, improved human–computer interfaces, and the impacts of digitalization. If our graduate information systems and technology students are going to be successful, they will need to be able to lead organizations by imagining possible worlds. One example of our beginning success toward this goal was in the case of the student team that investigated using augmented reality for the purposes of allowing customers to "hold a product in their hands without holding it in their hands" or "try a product out without trying it out."

This student team investigated several products that crossed the spectrum of distributed collaboration. These included web conferencing, Web 2.0-enabled groupware, virtual worlds, and software and devices that augment (change our perceived) reality. Based upon this team's analyses of these products and its consideration of various business processes, these students chose to experiment with augmented reality and how it might support the product designing/redesigning and/or product selling/purchasing processes.

These students used the Unifeye software platform in order to represent 3D animated images. They then placed these animations (seemingly) into their hands, schematic drawings, and photographs, as well as video recordings of one of their teammate's living room. In other words, these students merged files and

Figure 2: Virtual Chair placed within a Actual Living Room Video to Create Augmented Reality

created an environment where our eyes saw things that didn't actually exist. See Figure 2. The chair (that doesn't exist in reality) augments the reality depicted in this video recording snapshot. The first proof of concept they presented to the class as a whole was the presentation of a 3D image of a MINI Cabrio (a new product similar to the MINI Cooper automobile) that "sat" on a piece of paper that a team member was holding. The moving image that was controlled (including turning it to any degree in any direction) by the team member (using a sheet of paper with a special pattern marking) was also captured by a video camera. A similar demo can be seen at http://www.metaio.com.

Technology Type	Website
Web Conferencing	http://www.netviewer.com
Web 2.0 Groupware	http://www.collaba.com
Web 2.0 Groupware	http://www.communardo.com
Virtual Reality	http://www.protonmedia.com
Augmented Reality	http://www.arcane-technologies.com
Augmented Reality	http://www.metaio.com

Table 3. Products Reviewed By One Student Team

The students then progressed in complexity and showed that the software could support placing a 3D image into a drawn picture. In this case it was the placement of a couch within a drawing of a particular room; the 3D drawing was drawn much like what an architect might create. They then placed a 3D couch animation that opened and closed into a photo of one of the students' living rooms. Finally, they placed a 3D image of a seemingly space-age recliner into a video recording of the same living room. As the video ran, the students changed the size, the configuration (i.e., leaned back, upright, etc.), as well as the actual dimensions and size of the recliner. Other students in the class and the professor were indeed impressed with the possibilities. One person remarked, "I can see every furniture store in the world using this technology in three or four years." Another remarked, "Putting the MINI in your hands" is the technological equivalent to a "hard sell" given by an experienced sales person.

With regards to students' overall impressions about the impacts of (as opposed to the ability to imagine the possibilities of) digitalization, our students' perspectives varied. This student recognizes the digitalization that has already occurred.

> *"Digitalization has entered into almost every area of human life. It starts from when we get up in the morning until we go to bed at night. Your refrigerator counts calorie intake. The microwave take cares of the food you eat. Your car tells you the way to the office with the help of GPS, and you work the whole day on your computer. You are connected to the whole world every moment through your cell phone and GPS systems. So digitization has become an inseparable part of human life. Think of what you would do (our wouldn't do)if you didn't have your mobile phone or Internet connection for just one day…."*

This student understands that technology will continue to develop quickly.

> *"The digitalization of the world is an ongoing process and we are right in the middle of it. Our generation, and future generations, will continue to be challenged by emerging technologies…. Today's industries are still far behind the possibilities of these technologies."*

Another student, with significant work experience, also learned through the process of actually finding, implementing, using, and evaluating software. He/she began to see the possibilities of using virtual world software for business.

> *"I am sure that learning about virtual collaboration software will have a significant impact on how I perform business processes in the future. Since I work in procurement and we have numerous contacts in the Far East (i.e., India and China), there are a number of opportunities to use this kind of software. An important issue in the pharmaceutical industry is the detailed specification of the material we purchase. The abilities to communicate via the software and to share applications will be very beneficial."*

LESSONS LEARNED

After teaching these two integrated courses for two semesters our takeaways are the following. It seems feasible for students to learn about business processes by performing business processes. To complement this type of experiential learning with another, students can apply MIS to enable classic business processes. As global organizations apply these improved business processes in our smaller and smaller world, students can appreciate opportunities to learn about other cultures. Further, one of the best ways for students to learn about the value of Human–Computer Interactions in our increasingly interconnected world is to ask students to use emerging technologies. And finally, in this context, if students are given the opportunities to identify, use, and evaluate emerging technologies such as virtual worlds and augmented reality devices, they will astonish us.

ACKNOWLEDGMENTS

We thank our students in these four courses. We are extremely grateful to Ms. Teresa A. Lane for her editorial assistance.

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[1] This "quote" often attributed to Thomas Watson, Sr. may actually be false. We include it here for exemplary purposes.