Appalachian
STATE UNIVERSITY
BOONE, NORTH CAROLINA

Teaching and Learning in Cross-Disciplinary Virtual Teams

By: **Robert Sanders, Alanah Mitchell, Paul Wallace, David D. Wood** & Pam Brewer

Abstract

Virtual teams collaborate across distances using information communication technologies (ICTs). A distinctive set of communication skills is needed by people who work successfully in virtual teams, and few universities or companies provide structured education and training in virtual teamwork. At a midsized southeastern Masters Comprehensive University, professors from the Colleges of Arts and Sciences, Business, and Education came together to explore how they might use cross-disciplinary student teams (groups comprised of students with different backgrounds and educational goals) to teach concepts in their own disciplines while providing students with the opportunity to become more proficient in virtual team communication. Can cross-disciplinary student team projects successfully support learning in virtual team communication as well as address the learning objectives of specific courses? (2) What can faculty learn from a cross-disciplinary teaching model that can be applied to virtual teams? Experiential learning is based on performing real tasks and reflecting on that process; it benefits learners by engaging them in complex, authentic situations. Virtual teams are significant because they support a great deal of the work currently taking place in our global economy; they are significant in higher education because students need to develop skills in international virtual communication before they are introduced to high-stakes work environments. In previous cases, students have collaborated across national cultures to develop project deliverables, such as websites, reports, and usability studies and present them in virtual environments using such tools as WebEx, Skype, and live streaming. The findings from this case are based on individual student reflections, which were used to create a data matrix for each project, and instructor observation and evaluation. In Spring 2013, six faculty from the same university worked together to incorporate virtual teams into their classrooms. These six faculty members were divided into two groups of three with each group representing three colleges mentioned earlier. The faculty developed two interdisciplinary projects (one on infographics and another on social media) that enabled rich and diverse student collaboration. In both groups, the three faculty leaders worked together to define a project scope that students could achieve and that would relate to learning goals in each discipline. The lessons learned from this experience are that: (1) technical challenges will occur; (2) students from all disciplines must receive the same information; (3) instructors must balance respect for their colleagues and support for their students; (4) team assignments need to be consistent and fair; (5) instructors need to establish appropriate and fair assessment measurements for their own students; and (6) projects need to be realistic in order to show the students the value of virtual work

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Teaching and Learning in Cross-Disciplinary Virtual Teams

—Pam Estes Brewer, member, ieee,
Alanah Mitchell, Robert Sanders, Paul Wallace, and David D. Wood

***Abstract*—Background:** *Virtual teams collaborate across distances using information communication technologies (ICTs). A distinctive set of communication skills is needed by people who work successfully in virtual teams, and few universities or companies provide structured education and training in virtual teamwork. At a midsized southeastern Masters Comprehensive University, professors from the Colleges of Arts and Sciences, Business, and Education came together to explore how they might use cross-disciplinary student teams (groups comprised of students with different backgrounds and educational goals) to teach concepts in their own disciplines while providing students with the opportunity to become more proficient in virtual team communication.* **Research questions:** *(1) Can cross-disciplinary student team projects successfully support learning in virtual team communication as well as address the learning objectives of specific courses? (2) What can faculty learn from a cross-disciplinary teaching model that can be applied to virtual teams?* **Situating the case:** *Experiential learning is based on performing real tasks and reflecting on that process; it benefits learners by engaging them in complex, authentic situations. Virtual teams are significant because they support a great deal of the work currently taking place in our global economy; they are significant in higher education because students need to develop skills in international virtual communication before they are introduced to high-stakes work environments. In previous cases, students have collaborated across national cultures to develop project deliverables, such as websites, reports, and usability studies and present them in virtual environments using such tools as WebEx, Skype, and live streaming.* **How this case was studied:** *The findings from this case are based on individual student reflections, which were used to create a data matrix for each project, and instructor observation and evaluation.* **About the case:** *In Spring 2013, six faculty from the same university worked together to incorporate virtual teams into their classrooms. These six faculty members were divided into two groups of three with each group representing three colleges mentioned earlier. The faculty developed two interdisciplinary projects (one on infographics and another on social media) that enabled rich and diverse student collaboration. In both groups, the three faculty leaders worked together to define a project scope that students could achieve and that would relate to learning goals in each discipline.* **Conclusions:** *The lessons learned from this experience are that: (1) technical challenges will occur; (2) students from all disciplines must receive the same information; (3) instructors must balance respect for their colleagues and support for their students; (4) team assignments need to be consistent and fair; (5) instructors need to establish appropriate and fair assessment measurements for their own students; and (6) projects need to be realistic in order to show the students the value of virtual work.*

Index Terms*—Cross-disciplinary, experiential learning, multiple disciplines, teaching case, virtual teams, virtual teamwork, virtual world.*

Introduction

Organizations increasingly benefit from the work of virtual teams which enable them to leverage a rich pool of employees, markets, and resources from around the world. Virtual teams are at work within organizations and between organizations as well as within nations and between nations. With such benefits to be gained, the use of virtual teams within organizations is only likely to grow.

A distinct set of communication skills is needed to work successfully in these virtual teams, and few universities or companies provide structured education and training in virtual teamwork. Quite often, when universities and organizations perceive the need for preparation in virtual team skills, they silo them—teaching virtual communication *or* team skills *or* a genre of communication. However, the manner in which one would practice these skills separately is very different from the manner in which one would practice them together. Furthermore, engineering and communication professionals have described a lack of effective training to prepare them to work effectively in virtual teams [1]. Thus, it is common that the first time professionals experience a

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P. E. Brewer is with the Department of Technical Communication, School of Engineering, Mercer University, Macon, GA 31207-0001 USA (email: brewer_pe@mercer.edu).
A. Mitchell is with the Department of Computer Information Systems and Supply Chain Management, John A. Walker College of Business, Appalachian State University, Boone, NC 28608-2049 USA (email: mitchellaj@appstate.edu).
R. Sanders is with Cratis D. Williams Graduate School, Appalachian State University, Boone, NC 28608 USA (email: sandersrl@appstate.edu).
P. Wallace is with the Department of Leadership and Educational Studies, Reich College of Education, Appalachian State University, Boone, NC 28608-2086 USA (email: wallacepr@appstate.edu).
D. D. Wood is with the Department of Finance, Banking & Insurance, John A. Walker College of Business, Appalachian State University, Boone, NC 28608-2058 USA (email: wood@appstate.edu).
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virtual team environment, they are working in a high-stakes context where mistakes in the form of miscommunication are costly. However, experiential learning projects, such as those described in this teaching case, offer the opportunity to practice virtual team skills in a low-stakes context.

At a midsized southeastern Masters Comprehensive University, professors from the College of Arts and Sciences, the College of Business, and the College of Education came together to explore how we might provide interdisciplinary learning experiences that would result in students' becoming more proficient in their virtual team communication. These exploratory projects began with two faculty who had identified the need for student skills in virtual team communication. Through subsequent conversations, four other faculty became a part of this group. After several face-to-face meetings, these faculty identified two objectives: (1) use experiential learning and cross-disciplinary teams to better prepare students for a future that will include work in virtual contexts and (2) begin to build a knowledge base that could be used by other faculty and expanded into other contexts.

These six faculty members committed to piloting two projects. They represented six disciplines from three colleges: professional writing and political science from the College of Arts and Sciences, information systems and finance from the College of Business, and instructional technology and library science from the College of Education. The six faculty members broke into two teams of three each, with one representative from each of the three colleges in each team. Each team designed an interdisciplinary virtual project in which three classes participated. Classes were selected from among those being taught by these faculty during the approaching semester. As part of these two projects, students in Group A researched and created an infographic and a one-page summary of the concept of coinsurance. Students in Group B created a poster presentation and paper related to a social movement's use of Twitter. Both projects were based on the realistic scenario where team members are required to collaborate with others who may have widely differing perspectives, in this case different disciplines. In addition, all students presented their projects in a 3-D virtual world at project completion. Group A held a synchronous virtual conference for presenting their materials while Group B relied on a week-long asynchronous presentation period. We formulated two central research questions regarding the projects:

RQ1. Can cross-disciplinary student team projects successfully support learning in virtual team communication as well as address the learning objectives of specific courses?

RQ2. What can faculty learn from a cross-disciplinary teaching model that can be applied to virtual teams?

In the teaching case (comprised of two projects) presented in this paper, we situate the case in current literature, describe how this case was studied, describe the details of the case including administration and results, and draw conclusions based on the two projects. We seek to provide practical ideas that can be used by other educators to prepare students for the complex communication challenges of virtual teams. Professional communication often takes place within multidisciplinary groups in which communication and collaboration are mediated through technology. This case describes a classroom experience where the skills necessary for professional communication are tested and challenged. We expect that other faculty interested in adding virtual projects to their courses can benefit from reviewing the lessons learned from this case.

Situating the Case

This section situates our teaching case within the broad literature related to experiential learning and virtual teams. It also identifies similar teaching cases that have helped in providing a foundation for this work. Since the practice of relying on virtual teams becomes more and more common, it is essential to identify ways to educate our students on how to work in this type of environment. Our case is a step in this direction.

Selection of Literature for the Review

Experiential teaching and learning offer an effective approach for preparing students to work in virtual teams. Since our projects use such an experiential approach, our review of literature focuses on theories of experiential learning as well as on the communication skills necessary to work successfully in virtual teams. Because the members of our group represent multiple disciplines, we draw from the literature of professional communication and information systems using the keyword “experiential learning.” Finally, we focus on scholarly research published in the last decade with regard to virtual team communication and on seminal works on experiential learning.

Experiential Learning Experiential learning is a problem-based learning approach that presents students with real-life problems and provides them with the opportunity to apply their concept knowledge and skills [2]–[4]. Using experiential learning to teach virtual team concepts enables faculty to design authentic projects that integrate the skills that are a necessary part of a virtual team communication skill set. Other faculty have also used experiential project designs to teach and study virtual teaming [4]–[6]. Many of these previous cases have highlighted Kolb's experiential learning cycle [2] as a method for teaching students in virtual teams. Kolb's learning cycle has three phases: (1) the abstraction/conceptualization phase, where students are introduced to the concept of virtual teamwork from a theoretical perspective; (2) the active experimentation/concrete experience phase, where students experience working in virtual teams; and (3) the reflection phase, where students discuss the positive and negative aspects of their experience. Our case follows a similar approach by engaging students in an authentic situation, or realistic work practice by bringing together team members with different backgrounds and perspectives, similar to what they might experience in working in any virtual team. They were first introduced to theories of working in virtual teams; they then engaged in projects as members of a real virtual team; and, finally, they reflected on the experience and what was illustrated about performing in such teams.

Virtual Teams Virtual teams are teams that work together through the use of information communication technologies (ICTs) and are geographically dispersed [7], [8]. Virtual team members can also be dispersed in other ways, including culture, time zones, organizations, and even expertise. Organizations increasingly rely on virtual teamwork in order to save time and travel expenses as well as to take advantage of specialized employees [9] in the globally competitive market. Educational institutions have also started taking advantage of virtual teams [10].

While virtual and colocated teams have much in common, virtual teams have some characteristics that make them distinct and for which students should be prepared. Among some of the most important characteristics are the importance of an articulated purpose; the challenges to informal communication, trust development, and knowledge transfer; and the limitations of technology. In all of these areas, the more abstract nature of the virtual team can exacerbate challenges. For example, a clearly articulated purpose is a necessity for any team [11] but is especially important to the virtual team. In fact, one quick gage of the health of a virtual team is to ask members to articulate the team purpose. A common understanding of purpose is one indication of a healthy team [7], [11].

Virtual teams may find it particularly challenging to support a flow of informal communication that is essential to building trust and transferring knowledge due to the dispersed nature of their work. Such informal communication helps people get to know one another and is critical in the more abstract space of online teams [12]. In turn, informal communication can contribute to the development of trust. Trust is critical to team performance [13]–[18] and is slower to develop in virtual teams [11], [19], [20] than in colocated teams. Trust, in turn, has been linked to the effective transfer of knowledge [21], [22], including the tacit knowledge that supports teams [23], [24]. To be successful in an online environment with such characteristics, virtual teams must use informal communication to build trust, and trust to support the transfer of knowledge with limited misunderstandings.

Finally, technology, while enabling the growing network of virtual teams, also introduces challenges to communication. In particular, the uses of technologies may be perceived differently among team members, and technology comes with limitations. For example, technologies reduce cues and change the patterns of work and relationships [25] requiring adaptive measures among workers. Furthermore, the design of the technology for a team must align with the emotional and task processes of the team [26], [27].

Similar Teaching Cases While classroom experiences cannot replicate what students will experience in the working world, experiential projects can bring students much closer to an understanding of the world of work through authentic situations. Previous research has studied the challenges and successes of using virtual teamwork in the classroom [4], [5], [28]–[32]. Specifically, virtual teams in the classroom have been used to teach concepts from software development [28], [29] to intercultural communication [4], [5], [31]. For example, Sorensen, Hammer, and Maylath [32] report on their experiences teaching in the Trans-Atlantic & Pacific Project (TAPP). Since 1999, 19 universities in 12 countries have participated in international virtual team projects in professional

communication. Their purpose is to prepare students to collaborate successfully across large distances. In another example, Zemliansky [4] directed an experiential virtual team project among U.S. and Ukrainian students. Team members in this project adapted their discourse to accommodate differences between countries and professional fields. In yet another example, Herrington and Tretyakov [30] teamed US and Russian students. Regarding the authenticity of such projects, these authors commented, "[Students] may be driven by the need to complete assignments, but the actual communication that allows them to complete the assignments themselves, by necessity, is real" [30, p. 272]. In addition, two of this paper's authors have also engaged in experiential virtual team projects bringing together students from multiple disciplines and nations [5], [31]. They have found the learning within these virtual teams to be rich and multilayered.

Similar to previous virtual team projects in the classroom, the projects described in this paper were designed to allow students with different roles and expertise to work together through the use of technology, increasing their competence in collaborating in virtual contexts. However, this project was unique compared to previous research in that the students came from three different colleges within a single university. In addition, the faculty who participated in this project shared a goal of establishing within their university a common knowledge base for teaching with virtual teams.

How This Case was Studied

This section includes details regarding our experience report, including the research methodology and characteristics of the participants. It also includes an explanation of how the data were collected and analyzed. It concludes with a discussion of credibility and trustworthiness.

Choice of a Research Methodology Due to the exploratory nature of the two projects in this case, a qualitative research approach was chosen. Qualitative data-collection methods include observation, participant observation (such as fieldwork), interviews, questionnaires, documents, texts, and the researcher's impressions and reactions [33]. The two projects in this teaching case included many of the observation methods, specifically observation, student deliverables/documents, and the collective researchers' impressions and reactions to the experience. Furthermore, the use of case studies often leads to the successful identification of practices and lessons learned due to the realistic setting. In this case, it was our goal to identify a knowledge base (that is, lessons learned) from the experiences in both Group A and Group B, further supporting the choice of qualitative research.

Participants The student participants in this research represent different disciplines in order to achieve cross-disciplinary collaboration. Group A included students who were enrolled in an undergraduate English course, an undergraduate insurance course, and a graduate library science course. Group B students were enrolled in an undergraduate government course, an undergraduate information systems course, and a graduate-level instructional technology course. Both undergraduate and graduate students were included in this project. While we did not specifically evaluate the impact of the two different levels, we did expect that the use of graduate students would enhance the diversity of our project teams, much like one would find in a work situation where some employees hold master's degrees and others do not. All students enrolled in these six courses were required to participate in their collaboration project. As far as assignment participation, the assignment was required as part of each course being taught. We studied the required assignment and did not simply create an assignment for the purpose of the study. Both projects were determined to be exempt by the the Institutional Review Board (IRB) because the research was conducted in established or commonly accepted educational settings, involving normal education practices. It should also be noted that the faculty involved represent another aspect of cross-disciplinary collaboration, since the six faculty involved represented different disciplines.

How Data Were Collected This section presents the case specifics related to the research environment, specifically the technology used to facilitate the virtual collaboration teamwork. This section also includes background on the process for collecting data.

Research Environment: Teams from both projects were required to use the same collaboration platform, an OpenQwaq software solution referred to as *AET Zone*. (See Figs. 1 and 2.) AET Zone is an open-source immersive environment that enables participants to meet together in a shared 3-D space. AET Zone was chosen for this project because it was already being used by the graduate students in both groups for their coursework and

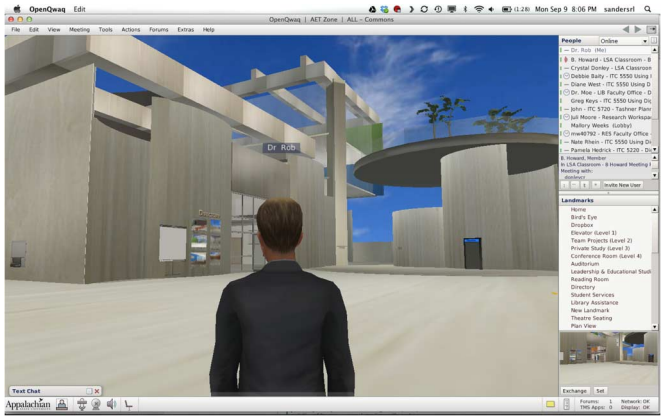

Fig. 1. Screenshot of the AET Zone with instructor avatar.

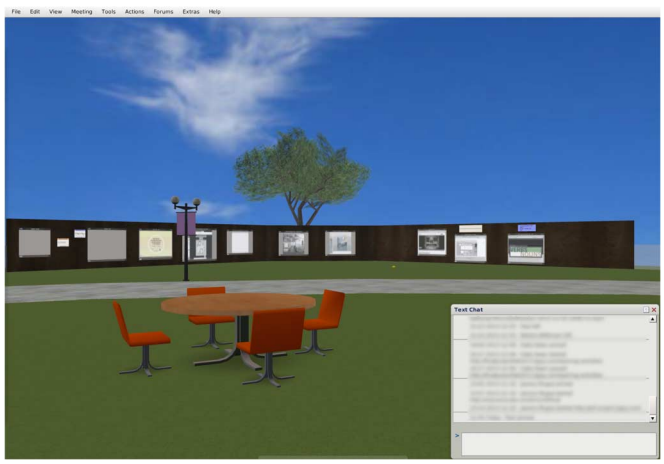

Fig. 2. Screenshot of the AET Zone meeting area.

would allow for virtual world communication and collaboration among all of the students. Some features of the AET Zone environment include the use of avatars to represent participants, synchronous audio and text chat capabilities, and use of display panels for shared viewing of web resources as well as collaborative editing of rich text and spreadsheet documents. These technology capabilities are similar to other types of tools that students may have access to in the real world. Participating faculty created 3-D representations of meeting spaces in this environment that facilitated synchronous and asynchronous student interaction and collaboration. Student presence in these spaces was represented by their embodiment as avatars that could communicate through audio, video, text chat, and manipulation of tools and resources in these spaces. In addition to the AET Zone, students could use any other technology they desired to support their group work.

Process for Collecting Data: Each student in the respective groups was required to write and submit a project reflection and peer evaluation at the conclusion of their project. These reflections were to include responses to the following prompts:

(1) Report what you contributed to the project. List specific tasks.
(2) Evaluate each of your team members, using specific examples and an accurate account of work contributed.
(3) Discuss what you learned from completing this project including what you learned about working in a virtual team. Do you think that you were able to successfully work on the assigned task with your virtual team members? Why or why not? Describe the most positive aspects of the experience you just had as well as the most negative aspects.

The reflection questions were intentionally open-ended, which provided for significant flexibility in the responses. This approach was helpful due to the exploratory nature of our case since we did not approach the study with predetermined hypotheses on the success or impact of the project. In fact, the decision to compare and more deeply analyze the data collected was made following the completion of the project, which explains the absence of certain data that, in hindsight, might have been useful in making further sense of the experience. This also explains the exclusion of other data-collection strategies, such as focus groups, since students completed their respective courses prior to the decision being made to conduct the study. Regardless, the instructors for the respective courses collected the available reflections and peer evaluations at the conclusion of the project and compiled the data in a matrix (that is, one workbook for Group A and one for Group B). The complete data matrix included a number of spreadsheets for each group. One spreadsheet included all of the responses to Question 3 and was arranged by the team. Additional spreadsheets were created for each team with student names for each row and column. (See Fig. 3.) These team-specific spreadsheets helped to form a big-picture view of what actually took place within each team.

How Data Were Analyzed In order to minimize any subjectivity, two different researchers reviewed the finalized data matrix for both projects in order to compare student responses to the individual reflection questions by both assigned interdisciplinary team and by faculty member and

discipline. The researchers combed through the group reflections and peer evaluations from each project in order to identify reoccurring patterns. Codes, based on themes common in previous virtual team research, were assigned to the data to identify common themes or categories that could be triangulated across teams and/or discipline (such as technical challenges and task uncertainty). The results section presents the analysis and discussion of the reoccurring themes that emerged from the data analysis in the form of lessons learned.

Assuring Credibility and Trustworthiness The data matrix included qualitative data collected from student reflections and peer evaluations. As mentioned in the previous section, two researchers reviewed the data in order to minimize any subjectivity. The researchers completed an initial data analysis independently. Following the independent review of the data, the two researchers sat together to review their findings and compile the finalized, and agreed upon, list of emergent patterns based on the data.

ABOUT THE CASE

Through the assignment and implementation of this teaching case, the authors sought to explore the research questions: (1) can cross-disciplinary student team projects successfully support learning in virtual team communication as well as address the learning objectives of specific courses? and (2) what can faculty learn from a cross-disciplinary teaching model that can be applied to virtual teams? The authors hoped to learn lessons that can be used to better prepare students for future participation in virtual teams. We also wanted to begin to build a knowledge base that could be used by other faculty interested in developing competencies for virtual teamwork.

Problem In the context of higher education today, students usually receive little or no instruction or experience working in virtual teams, yet are often placed in that environment early in their careers. The virtual teams in which recent graduates find themselves often include employees from other divisions of an organization with different skill sets and perhaps even different cultures and nationalities. Graduates in these virtual team environments must quickly master the technology being used, develop the communication skills necessary to succeed in virtual teams, overcome issues of trust, agree upon an articulated purpose, and transfer knowledge. Universities are not effective in preparing graduates for this challenge. In fact, previous research has argued that teaching students how to work in a virtual team is an area on which universities need to focus [34]. With this project, we wanted to not only teach students how to work in a virtual team, but we wanted to learn whether or not students could learn in cross-disciplinary virtual teams (that is, teams comprised of individuals with different backgrounds and goals).

Solution University instructors are often well-positioned to use virtual teams in the teaching of their subject matter, providing students with rich learning in both specific disciplines and in communication in virtual teams. The purpose of this subsection is to describe the case study of two projects which involved students from different classes formed into interdisciplinary virtual teams. Instructors hoped to facilitate learning, both in specific disciplines and in virtual teaming. This section starts with a brief description of the projects, then discusses the process for developing the solution and finally the results.

Brief Description of the Project: Faculty members from six disciplines participated in the case study. Students were enrolled in the following courses:

- Professional writing (English Department/College of Arts & Sciences) teaches communication and professional writing skills. Fourteen undergraduate students were enrolled.
- Commercial insurance (Finance, Banking & Insurance Department/College of Business) teaches the application of contract provisions found in insurance policies designed to insure commercial ventures. Twenty-five undergraduate students were enrolled.
- Information sources and services (Library Science Department/College of Education) provide background and knowledge on research guidance. Twelve graduate students were enrolled and this course was being taught online.
- Globalization (Government and Justice Studies Department/College of Arts & Sciences) examines the interactions of politics, economic trends, and business actions since they create patterns of international stability, crisis, and change. Thirty-four undergraduate students were enrolled.
- Emerging technologies (Computer Information Systems Department/College of Business) examines the impact and shelf life of new technologies. Fourteen undergraduate students were enrolled.

- Designing instruction for digital age learners (Instructional Technology Department/College of Education) teaches instructional techniques for today's digital learners. Twenty-six graduate students were enrolled.

Faculty members developed two projects for students to complete in virtual teams. The teams were required to interact and collaborate entirely in an online modality. The two projects were titled the Coinsurance project (Group A) and the Twitter project (Group B):

(1) The Coinsurance project (see Appendix 1) included students from Professional Writing (UG), Commercial Insurance (UG), and Information Sources and Services (G) courses. All students enrolled in these courses were required to participate in the assignment. Students were charged with developing and presenting an infographic that explained the coinsurance clause, a complex insurance provision that is used to insure commercial buildings. Students were divided into 12 interdisciplinary groups with each group comprising one to two students from each class.
Student expectations varied depending on the class: The **Professional Writing (UG)** students were charged with designing a visual tutorial and writing a professional summary explaining the concept and application of coinsurance. The **Commercial Insurance (UG)** students were charged with serving as subject matter experts and expected to deliver accurate and clear information about the concept of coinsurance to the other group members. Students in the **Information Sources and Services (G)** class were expected to provide research support for the group and serve as technology consultants for the virtual environment platform.
The main deliverable for this project was an instructional product (visual tutorial) to be presented in the AET Zone. Each group also turned in a summary of team norms and goals and a one-page summary of the information being covered in the visual tutorial. In addition, each individual student was required to turn in a project reflection and peer evaluation.

(2) The Twitter project (see Appendix 2) included students from Globalization (UG), Emerging Technologies (UG), and Designing Instruction for Digital Age Learners (G) courses. Students were charged with analyzing a social movement that utilized Twitter, and presenting: (1) why Twitter was chosen as a means of communication and (2) the pros and cons of using Twitter to communicate ideas in the selected instance. Students in the Twitter project were distributed across 14 virtual teams with one to three students from each class. All students enrolled in the three courses were required to participate in the assignment.
Expectations of the students varied depending on the class: Students enrolled in the **Globalization (UG)** course were expected to lead the team in identifying social movements and Twitter usage, and knowledge on globalization and social media. **Emerging Technologies (UG)** students were expected to provide the team with knowledge regarding collaboration technology usage and best practices, knowledge about globalization and Twitter usage, and knowledge about team norms and strategies for working together virtually. Students enrolled in the course on **Digital Age Learners (G)** were expected to lead the team regarding collaboration technology usage as well as team norms and strategies for working together virtually. They were also expected to provide knowledge on social media, information literacy, and network literacy.
The main deliverable for this assignment was a collaborative write-up of four to six pages. Teams had to present a summary poster of their write-up in the virtual environment (AET Zone). In addition, each individual student was required to turn in a project reflection and peer evaluation.

Regarding both projects, students were given a task flow with specific deadlines for the various tasks. Each instructor prepared his or her students to work in virtual teams at the start of the project, which was supported by the creation of a podcast on virtual teaming available to all of the participating students. In addition, the Emerging Technologies students spent a couple of weeks devoted to learning about working in a virtual team as well as virtual worlds. The Information Sources and Services students, another example, were already prepared to work virtually as a part of their online program; however, they were still provided with additional information for success in a virtual environment. As part of this preparation, students were exposed to the concept of metacommunication (communicating about communication), and were required to establish communication expectations for their teams. Individual instructors in each

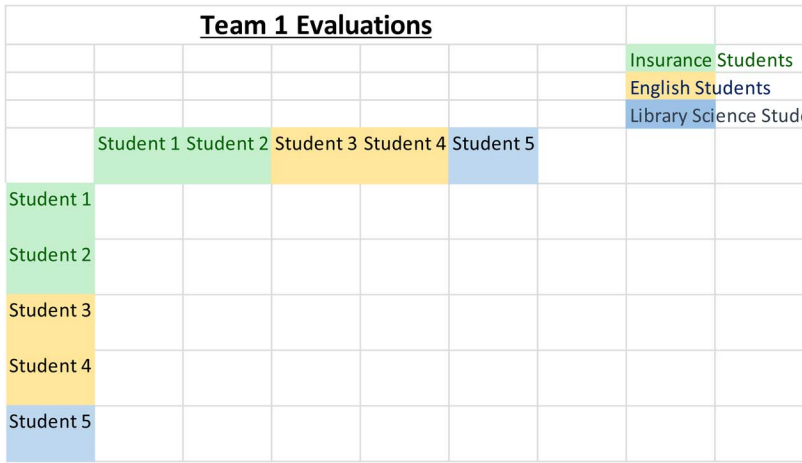

Fig. 3. Example data matrix.

TABLE I
QUICK FACTS ABOUT THE SOLUTION

Budget	$ 0
Length of time given to complete the project	5 weeks
Technology needed	A common collaboration workspace: AET Zone, Google docs, Skype
Student skills used in the project	Written and oral communication, collaboration, project management, graphic design, respective professional skills relevant to the disciplines represented
Other resources used	Students were free to use any technology resources; faculty members know of no other resources

class announced group assignments, described the project, gave directions, and discussed the progress of the projects throughout the project period. The groups were required to interact and collaborate entirely in an online modality. The project was assigned one week prior to midterm and the teams had just over one month to complete the project according to the timetable incorporated in the project instructions.

The project was comprised between 10% and 15% of students' final grades depending on their class, and the professor who taught that class graded students from that class. This simulated a real-world environment where each group member takes directions and is evaluated by someone other than the one directing and evaluating the other group members. Table I presents some additional quick facts regarding the case solution.

Process for Developing the Solution: Both projects followed the guidance of Kolb's experiential learning cycle [2]. Students were first introduced to the idea of working in virtual teams, then engaged in projects as members of a real virtual team, and, finally, reflected on the experience. However, the instructional strategies differed for the two projects. The Coinsurance project allowed much more self-direction from the students than did the Twitter project. The professors introduced the Coinsurance project in each of their respective classes, established the interdisciplinary teams, and instructed students on success strategies for working in virtual teams. A task flow included in the project assignment contained deadlines for teams to: (1) meet online, establish communication norms, and develop a schedule to review progress; (2) turn in a draft infographic and summary; and (3) prepare the final product for presentation. Professors monitored the Coinsurance project team's progress and answered questions throughout the project, but did not meet formally with the student groups either in class or online prior to the completion date for final product presentations. The Coinsurance students had the freedom to use whatever online modality they preferred. The AET Zone was made available, but none of the groups chose to use it for organizational or collaborative means. Instead, they chose to use technologies with which team members were more familiar, such as email, Google Docs, and Skype.

Furthermore, student teams met according to the schedules they developed for themselves.

Team members worked together to develop a team deliverable; however, team members were graded by their individual professors based on varying characteristics of the deliverable. This created conflicting objectives that had to be resolved by the team members from the different programs since they assumed that everyone would be graded in the same way. For example, some team members were graded on accuracy while others were graded on clarity of the deliverable.

Allowing students to self-direct the Coinsurance Project was problematic in two ways. First, task flow dates had to be pushed back because some group members argued that deadlines did not apply to them even though each class was presented with the same set of directions for the assignment. Apparently, there was confusion over which directions applied to everyone and which had varying expectations for group members depending on the class they were taking. Second, allowing the freedom to avoid immediate use of the AET Zone resulted in students not being comfortable in that environment during their final presentations.

The instructional strategy for the Twitter project was more directed by the faculty in group settings. Faculty members met with the student groups virtually and introduced them to the AET Zone. Once familiar with the workspace, students then got to know their team members using the AET Zone modality. Team members who get to know one another before working on virtual projects or tasks often perform better than those who do not. Therefore, faculty members taught students how to utilize the collaboration technology in AET Zone to get to know one another and customize their avatars with a personal photo.

Once teams had introduced themselves, each team outlined its team goals. The next action was a brainstorming activity regarding possible responses to the assignment questions. A draft was produced and reviewed by all of the team members, with the main deliverable for this assignment being a paper of approximately four to six pages. The final paper was a collaborative effort of the virtual team. The groups held a week-long asynchronous presentation period to share the summary posters they prepared for the project. Finally, each student produced an individual report about the virtual team experience. The additional faculty-led activities seemed to help the Twitter Project students complete the assignment with less angst than was experienced by the Coinsurance Project students.

Results With this research, we were interested in not only teaching students how to work in a virtual team, but also researching whether or not students could learn successfully about their own disciplines while working in cross-disciplinary virtual teams. Overall, the project was deemed successful in terms of interdisciplinary collaboration, considering that: (1) six faculty representing six departments in three different colleges were involved throughout, (2) the faculty developed two distinct project assignments that drew undergraduate and graduate students together from six departments (three for each group), (3) students engaged in authentic collaboration that directly addressed course objectives, (4) students utilized technologies to effectively facilitate interaction and collaboration, (5) students produced products of their learning that aligned with the project objectives for each project, and (6) faculty received generally positive reflections from students on the value and success of the projects.

As discussed before, data collected from student reflections were analyzed and sorted in a data matrix (one per project) in order to highlight the themes across the projects. In relation to our first research question, data analysis revealed that students were indeed able to learn about their respective disciplines in their cross-disciplinary teams. Each instructor incorporated the project as a learning tool for the subject matter of each course and assessed the projects presented in terms of student-learning outcomes established for each respective course. For example, with Group B, the insurance instructor used the project to help students learn about the coinsurance provision. The students had to provide that information to their team members. Having to explain or lead that aspect of the project led to better understanding from these students. (For example, teaching a concept helps to increase understanding.) The professional writing instructor used the project to teach professional writing, the instructional technology instructor used the project to teach about social media, and the information sources and services instructor used the project to teach research guidance. In addition, each faculty member compared the average grades of students involved in the virtual team projects to average grades of previous classes which did not incorporate the virtual team project and found little to no difference. The key for this positive result was due to task dependency; team members had to depend on all parts of their teams in order to be successful. For example, one of the professional writing

students from the Coinsurance project explained how communication among the group members resulted in a greater collective understanding of the team and the project:

> Off the bat, I imagined I would learn nothing new about group projects; rather, it would be a reiteration of what I already knew. After the first meeting, I was under the impression I would be shouldering the majority of the workload. The finance students sent me links as their "research," leaving me to flounder in one of the most confusing topics of insurance put on earth.

Despite this initial frustration and confusion, this student confronted her team about their assigned roles and was successful in moving forward in their understanding of the project:

> The surprising part came after I sent them an email explaining my job was not to do the research. Immediately some members of the group responded apologetically and with 'trimmed down' explanations of what exactly coinsurance is. The fact that they responded in a timely manner because they wanted to succeed was something I am not accustomed to seeing in group work.

Our research suggests that it was a benefit to have each student/class assigned to a specific objective of each project. This required students to depend on one another to accomplish the entire task. Both projects could only have happened with this type of arrangement. For example, none of the students in the Coinsurance project could have done this project alone (that is, the business students provided valuable knowledge regarding coinsurance that their team members did not). The same can be said for the Twitter project. This type of arrangement also makes it possible to grade the students on different aspects of each project/deliverable.

A secondary research question from this work addressed whether or not faculty can learn anything from a cross-disciplinary teaching model that can be applied to virtual teams. The data analysis revealed some key findings in relation to this question. Not only were students able to learn about their respective disciplines through this work, the data analysis also revealed that students learned how to work in a virtual team and learned the value of this virtual team knowledge. For example, one business student shared the following:

> This can easily demonstrate how it will be with working with others in the real world, so I can take from this project and use what I learned to make future projects run more smoothly.

First of all, the virtual teams in this case who spent time using the technology to get to know one another at the start of the project had better team communication. This finding would certainly make sense in any type of virtual team. For example, a common concern of students in both projects focused on task uncertainty regarding the project. Students needed time to get to know one another, to build trust among their team members, and to develop a common understanding of the project. One of the business students from the Coinsurance project stated:

> No one knew their intended duties. This led to misunderstandings and ultimately the finished product was not up to my standards.

While the writing students from the Coinsurance project had little to say on this issue, several library science students suggested an initial team meeting might have prevented or at least minimized the confusion around assigned roles and duties. One library science student suggested that

> All students [need] to meet one night together with all professors before they start working on the project. I feel this would cut down on the confusion and we could meet the students all at the same time, so we would know who was who.

Similar concerns were made by the students from the Twitter project. One technology student explained:

> My group members were very nice and cooperative, but never really seemed to know what was going on. The project seemed to be very ambiguous, and the barrier of AET not working at all times, threw our team off.

Going forward, task uncertainty could have been addressed had the instructors provided instructions for a project kickoff, perhaps allowing students to spend some time together virtually, getting to know one another in the collaboration space prior to the projects. In addition, instructors could have provided some specific goals during this kickoff period to get the students to interact (such as team-building exercises). This experience in the project can help students to see, vividly, how they should manage such projects in their future places of work.

Those groups that reported greater success in collaboration cited the need for structure and process for communication and collaboration, and clear goals to guide their work.

According to one library science student:

> This experience reinforced my belief in the value of establishing a clear structure for collaboration at the beginning of the process. Because we had a very organized place to collaborate in the Google doc, the beginning stages of our work went very smoothly. Although it was not always perfectly smooth sailing, we were able to work through all of our obstacles successfully.

Students from the Twitter project expressed similar collaboration complaints. However, the Twitter project students also expressed a number of concerns related to collaboration scheduling that point to the needs of virtual teams both in this project and in the workplace. In fact, one technology student stated:

> The hardest part of this project was not the work itself, but defining a meeting time. We are all on such different schedules, and finding a specific meeting time was difficult.

One of the globalization students in the Twitter project didn't expect the scheduling issues to happen due to the nature of virtual work. She stated:

> I thought the virtual team Twitter project was interesting, to say the least. I didn't know what to expect going into it, and thought the virtual world would be really cool. However, I don't particularly like group projects, because it's hard for me to fit meeting times into my busy schedule; I thought the virtual world would make this easier to handle. Unfortunately, I wasn't able to make it to the first virtual team meeting because of internet issues. I wish I had known in advance that my internet connection at home couldn't really handle avatar world, especially when there was a bunch of other student teams meeting there.

Going forward, instructors should try to provide additional information to their students about the nature of collaborative work; however, great value exists in allowing students to encounter some challenges and benefits just as they would in the workplace. Of course, it is interesting that there was such a focus on synchronous collaboration from so many of the teams when the projects were virtual in nature and, therefore, accommodating of asynchronous work. Either way, students need to be as prepared as possible for handling synchronous collaboration challenges.

The interdisciplinary nature of these teams allowed students to learn about their disciplines in a safe environment. For example, the team arrangement allowed for team members from different backgrounds to come together in a collaborative environment that resembles authentic work environments (such as different people working together virtually from different backgrounds). However, if an issue occurs, the educational learning environment is a safe space. For example, the Twitter project was valuable for the students to recognize that if something had gone wrong and it had been in the work world (nonsafe place), they would have been in trouble. Many of these student comments were related to the interdisciplinary nature of the teams. A technology student from the Twitter project stated:

> The most positive aspect of the experience I just had was being able to see different people with different backgrounds of knowledge had different points of view about pros and cons of using Twitter as a means of communication and it made the task a lot easier and faster than working it alone.

Another student offered a similar opinion:

> It was good to work with people who knew a lot of different topics. It helped develop a well-researched project.

If instructors are able to tie together interdisciplinary teams, it becomes an easy way to allow students with different backgrounds to learn how to work together. It also allows for the tasks to be set up with task-dependency.

Finally, the data-analysis confirms the value of reflection in understanding these types of experiences. This finding, which relates to Kolb's learning cycle [2], could also be applied to all virtual teamwork, not only cross-disciplinary teams. The student reflections illustrated an overall consensus across disciplines that the Coinsurance project provided a valuable, worthwhile experience that related to the respective programs from which the students came. Insurance students from the Coinsurance project noted that deciding early on what technologies would be used, what was expected of each student, and how that work was to be done, was essential to their success. In fact, one student stated:

> All in all, I believe that our group was successful in completing the project and presentation through everyone's commitment and staying connected through email taking the assignment step by step. The most positive aspects included having a facilitator to help us in areas as needed, having different perspectives going into the project, and having members who contributed and did their part.

Another insurance student added:

> Our group did not have as much trouble with scheduling a time for us to meet in the virtual workroom as others and I think that was vital to our success in the project. We met early, established a time that worked for everyone to meet once a week and divided our responsibilities during our first meeting thereby creating the opportunity to get a head start on the project. It was an advantage because the first time around explaining the concept was frustrating, and coming up with made-up problems that made sense to the other group members proved difficult.

Students from the Twitter project were able to identify similar successes in their individual reflections. In fact, a number of students identified this project as a valuable learning experience. One technology student stated:

> During this project, I learned that a task can be accomplished efficiently even though there are no face-to-face meetings. I had a fantastic team so successfully working on the project was easy. Everyone was highly motivated to get this project done quickly and to make an A…I really wanted to say that this was the best group project I have ever been in. I cannot say that it was because of the virtual aspect. I can say that no matter how you collaborate, if you have a highly motivated team, things get done efficiently and quickly! These were some of the best people I have ever worked with! I enjoyed this project!

Another student identified the benefits of the anonymity of virtual work, stating:

> On the positive side, I found that working in a virtual environment like AET Zone actually helped our group to stay focused and on task when collaborating. Since we could not see each other's' faces, I feel like everyone was more open to discussion and not afraid of what others in the group might have to say. This created a very open atmosphere where we could all bounce ideas off of each other and come up with the best direction for the group to move.

One final reflection illustrates that some of the students developed a new perspective of virtual teamwork:

> The most positive aspect from this virtual team experience was at the end seeing that a quality product could be produced without meeting face to face. I am now much less skeptical of virtual teams, though the meeting spaces could still use some work.

Conclusions, Limitations, and Suggestions for Future Research

This section presents the conclusions of this research with a focus on six lessons learned. In addition, limitations and suggestions for future research are presented.

Conclusions The instructors were able to learn from this experience and identify both challenges and successes for future projects. Student reflections, as well as face-to-face faculty reflections and anecdotal data collected through email, provide an emerging picture of the collective experience and understanding of this case and answers to the two research questions stated at the beginning of this research:

> **RQ1.** Can cross-disciplinary student team projects successfully support learning in virtual team communication as well as address the learning objectives of specific courses?
>
> **RQ2.** What can faculty learn from a cross-disciplinary teaching model that can be applied to virtual teams?

We can conclude that cross-disciplinary student teams did support learning in multiple disciplines while preparing students to communicate more effectively in virtual teams. This is discussed thoroughly in the preceding *Results* section. Furthermore, the cross-disciplinary lessons learned and presented in this section, can be applied to many different types of virtual teams and can be used by other faculty interested in developing virtual teamwork skills in their classes.

Overall, our analysis of the student reflections on the project generated a variety of faculty observations and suggestions regarding changes or modifications related to future iterations of this project. These conclusions are summarized in the following six lessons learned by the faculty collaborating on this case:

Lesson 1: Technical Challenges Will Occur: Many of the students reported technical issues that interfered with their ability to communicate and collaborate with one another during the project. Surprisingly, some of what they shared had more to do with challenges related to technology-mediated communication and virtual team dynamics than with the technologies themselves, which is consistent with what the literature [25], [26] says about the impact technology has on work flow and processes. For example, one of the business students from the Coinsurance project noted:

> Communicating through technology can be extremely difficult and taxing. Even though technology does make some things easier, it can also make communication between group members difficult. Emails were difficult to follow when there were multiple chains of emails regarding the project. I personally prefer face-to-face communication, so that information doesn't get skewed and questions can be asked and answered on the spot.

The use of the AET Zone added a complex dimension since some of the students were already familiar with this technology platform. College of Education students already familiar with the technology often had to deal with frustrations from the students who did not have prior experience with the technology. Specifically, one of the library science students from the Coinsurance project stated:

> It was very hard to work in this virtual team. I have worked with other teams in the AET Zone virtual world system, but that was with my own classmates who were accustomed to working in the system. This was my first time to work with people using our AET Zone virtual world that were not classmates and this proved really difficult. At each meeting none of the team members would use their microphones to talk. They preferred communicating by using text chat. This was irritating since they used their computers in the dorms where there is limited internet connection. Also, it was hard keeping up with who was talking in the text chat since they all typed in at the same time. I could not answer their questions since I was constantly bombarded and did not know which person was sending the question or making a comment.

Even the technology students from the Twitter project expressed technical concerns. One student noted:

> I didn't feel like I had enough knowledge about the AET Zone to get the full experience out of it though. . . I think if I had had more time to familiarize myself with the AET Zone, I would have enjoyed this project more.

Of course, there were technology-specific complaints as well. One technical student from the Twitter project stated:

> One of the negative aspects of using the AET Zone was the fact that navigating, viewing documents, scrolling, and many other critical aspects to the program that were needed to effectively collaborate were very hard to use. The AET Zone technology seemed very much undeveloped and I almost felt like I was beta testing it. Based on my experience with the AET Zone and my teammates, I would definitely be willing to use virtual collaboration in the future, just not with the AET Zone.

There appears to be some need for the instructors to rethink how the students use the technology to conduct their work. The campus-based undergraduate students appeared to have more problems with the technologies than their off-campus, graduate team members. We suspect that part of the problem had to do with the throttled bandwidth available to these students in their dorms. This issue has since been resolved. Furthermore, the technical issues noted could also be attributed to the students' unfamiliarity with one particular collaborative tool used, the AET Zone. While this tool was used on a regular basis by the graduate students, it was unfamiliar to the undergraduate students and little time was provided to prepare them for its use. Participating faculty should consider using either a different platform that is more accessible to all of the students participating or provide the students more guidance, support, and time to acclimate to this new environment. As noted in the literature review, clear channels of communication between and among the team members are essential to building trust among the members [11], [13]–[18]. Utilizing tools that in many cases inhibited communication severely limited the extent to which team members developed trusting relationships.

Lesson 2: Instructors Need to Make Every Effort to Ensure That Students From All Disciplines are Receiving the Same Information: A common concern of students focused on their uncertainty about the Coinsurance project and the expectations that their respective instructors had for student participation on the interdisciplinary teams. Several students

from the Coinsurance project reported that they felt their groups had received different instructions about the project. One business student noted:

> One of the frequent occurrences in this project was that the different group members had conflicting instructions from their instructors, such as due dates, requirements, etc.

This concern was shared by students from the Twitter project who were also concerned that the instructors were asking for different things. One technology student stated:

> Another part that was aggravating in completing this project was that it seemed that each professor wanted a different final presentation format. Whether it was a poster, a Prezi, or a PowerPoint, it would be helpful that work on the project would all result in one final product.

A similar comment from another student expressed concerns about deliverable formatting:

> There was a very large difference in what the students believed were the expectations from their teachers. The poster aspect was the largest problem. The education students believe they needed a "commercial"-like Glog. I have never been familiar with Glogster. Our class was told to provide a poster with bullet points and pictures. I communicated this to the team, but they were pretty set in their ways and not as open to addressing the problem. They continued to make the Glog while I made a poster myself to go along with it.

In the face-to-face meetings of the instructors, we discovered a "telephone" effect taking place. In other words, what one instructor told his/her students and what was ultimately reported to the other students was often inconsistent with what the other students heard from their respective instructors. If we were to do this project again, we would want to make sure that we present a consistent message from all instructors. We thought at the time that we were giving out the same assignments (for example, directions and reflection documents). However, we now know we could have been even more thorough in the assignment, perhaps by providing an assignment package. As noted in the literature, a common and shared purpose that can be articulated by all members of the team is the key to success of virtual teams [11]. What our research suggests is that students need very explicit directions (such as what fonts to use, and where to be and when in the virtual world) as well as an explicit schedule with deadlines.

Interestingly, each class was presented with the exact same set of directions (Appendix A and B, available online) for the assignment but differed in their feelings about how structured the assignment actually was. Despite this common set of expectations, some students still cited a lack of structure and lack of clarity in what they were to do. Some of these differences in students' participation and affinity for collaboration likely had to do with differences in faculty instructions, level of maturity and experience of the students, and perhaps even their fields of study (for example, some fields may be inherently more collaborative than others). It was further interesting to see how some students, particularly some of the undergraduate students, didn't recognize the value of collaboration and noted a preference for working alone or, if in groups, exclusively with others in their field. That is in contrast with the goals of the assignment since the faculty attempted to create an authentic work environment where students would work in interdisciplinary teams similar to those they might actually experience in the workplace.

Lesson 3: Instructors Need to be Able to Balance Respect for Their Colleagues and Support for Their Students: This lesson relates to the previous lesson. As the projects were going on, many of the students were concerned about deliverable specifics. During the project conclusions, all six instructors met face-to-face to "wrap up" the projects. What we found during this meeting was a general consensus that as an instructor, it is often difficult to balance respect for one's colleagues and advocacy for one's own students. For example, as the students were questioning what their team members were reporting from their faculty leaders, an instructor certainly doesn't want to respond with, "that's not right" or "they're wrong." However, an instructor also doesn't want to disregard a student's question or concern, especially when it's clear that they received unclear or conflicting instructions. Perhaps in the future, instructors could include more interim steps where deliverables and materials are reviewed together. Instructors should also check in regularly with one another and with the student groups to make sure that everyone is on the same page and providing consistent information.

Lesson 4: Team Assignments Need to be Consistent and Fair: In both projects, team members were assigned to teams by their instructors. There were some concerns in the Twitter project that the team assignment was not even or fair. For example, one student from the Twitter project stated:

> It was also a bit off putting to be the only group with three members, whereas others had 5 to 6, to share the work load. I feel as if our product may have been better and there would have been less stress on the team if we were assigned the same amount of members as other groups.

This was an oversight of the instructors in the Twitter project. Team assignment was simply random and alphabetical. Going forward, faculty members need to make sure that the teams are evenly distributed so that teams aren't negatively impacted by unbalanced numbers and unfair workload. In addition to team assignments impacting perception of "fairness," there were other concerns from the students. In fact, it was interesting how issues of "fairness" and "equity" came up in all six classes. Students were frustrated that some members of the group worked harder than others (either because they chose to or were required to do so). No group could succeed (easily) without each member doing something. (For example, in the Coinsurance project, business students had to provide content, writing students had to create the product, and library science students had to organize and facilitate group meetings.) Even though each professor had different expectations and requirements for his/her respective students and no group grades were assigned, students still complained about having different expectations for their level of participation. It is likely that future efforts will need to address this perceived sense of fairness and equity more explicitly so future teams don't expect that all work is necessarily divided evenly.

Lesson 5: Instructors Need to Establish Appropriate and Fair Assessment Measures for Their Own Students: Professors graded their own students on the skills relevant to their own courses (different goals for different disciplines). Overall, this worked well despite the fact that these differences in assessment methods created some confusion among some students who didn't realize that they were all to be assessed differently. As described before, students in both projects were graded on different aspects of the final deliverables. Some were graded on the content they provided to the project. Others were graded on their contributions to the design of the final product and presentation. In addition, the instructors were able to use the reflections in both projects for an individual record of participation and understanding to help with the different grading and assessment needs. However, faculty who take this approach in future projects may wish to ensure that the task contribution is evenly distributed/expected from all students. While such equitable distribution is not the norm in the workplace, lack of equitable distribution in student teams may result in negative perceptions that affect learning.

Lesson 6: Projects Need to be Realistic in Order to Show the Students the Value of Virtual Work: Both projects in this research allowed the instructors to provide real-world examples to students that we would not have been able to provide otherwise. In fact, many of the challenges reflected in lessons one through five, reflect the nature of work in the workplace. This appreciation for real-world experience was expressed in an email from a Coinsurance project faculty member at the conclusion of the project. The email stated:

> Thank you both also. I know that I learned a lot as did my students. We had an insurance company executive on campus this afternoon and he reinforced the importance of being able to work in virtual groups; it was really rewarding for the students to first, see the real world applications of the project and second, for them to contribute knowingly to the discussion and hear comments that reinforced their experiences.

Students were able to experience what it is like to work in a virtual team with people from different backgrounds to achieve different task goals. This type of project is very realistic and can show students what their future work experiences may be like. From the instructor's perspective, this is a very difficult project to lead, as it requires much more work than an in-class exercise or assignment with fewer obstacles. However, having external recognition further illustrates the value to the students from this type of experience.

Limitations The overall success of these two projects was not without its limitations. One limitation had to do with the fact that it was difficult to perfectly align the projects with the respective courses in the three participating disciplines. Some adjustments had to be made by the faculty in terms of how they timed and coordinated this project with other course activities in their respective courses. At times, the project felt and/or was perceived by the students as an "add on" project rather than as an integral component of their course, which likely resulted in varying levels of buy-in from faculty and students. This, in turn, may have resulted in varying levels of participation and the perceived value of the assignment by those involved.

Perhaps expecting two large projects, each comprised of three different groups of students, across three colleges, and at both the undergraduate and graduate levels may have been ambitious. Future efforts may include limiting the collaboration between two groups of students instead of trying to include so many disparate groups. Another suggestion would be to allow students to choose their own set of tools for collaboration and presentation, which did happen on these two projects to some extent. Doing so would ensure that students have appropriate access to and comfort level with the tools used. However, a lack of any shared tools or platforms across groups would have made it more difficult to present the final products developed. Use of the AET Zone provided that common platform, but the lack of familiarity, students waiting until deadlines loomed, and a few technological glitches caused some frustration that may have hindered collaboration and careful evaluation of the final presentations.

While instructors hoped to simulate a global virtual environment, having students participate on the same university campus provided a limitation. Despite our instructions for the groups to meet only in a virtual environment, a few of the students from the different classes knew each other and met separately. Conversely, many students felt like they did not have sufficient context for the assignment (why are they doing it? what is to be accomplished? and what role will each student play?). As one student suggested, a meeting of the combined group at the beginning of the project intended to share the common set of directions that would ensure that all students heard the same expectations up front. Finally, because this case was exploratory in nature, and instructors did not at first plan to conduct significant research, data-collection methods were limited to student reflections as well as instructor observation.

Suggestions for Future Research Questions for future research could continue exploring cross-disciplinary learning as well as taking the lessons learned from this cross-disciplinary work and expanding their application to global, virtual teams. Possible questions might include: How can faculty ensure that their expectations for the project are better communicated to their students, in particular, in projects that include multiple faculty and students from multiple disciplines? How directive is too directive in terms of these expectations? What technology platforms are best for the style of collaboration expected of the student participants? How can collaborative projects like these better address inherent differences among students that result from issues such as different disciplines, faculty, time zones, and cultures? Should such issues be addressed or simply be allowed to emerge as part of an authentic experience? This study was exploratory and qualitative and, therefore, we would recommend that our research questions be looked at in a more quantitative manner. For example, we might suggest a future study that compares the learning of one class that works in virtual teams versus another that does not have a virtual project in order to test the learning in a more quantitative way, perhaps using a survey or questionnaire.

Going forward, we know that we need to prepare students with virtual team skills and that such a goal is best accomplished in authentic situations. These multidisciplinary projects have moved us a step further in understanding how multidisciplinary teams can support authentic learning and how best to construct virtual team-learning environments.

Appendix A

Coinsurance Assignment Virtual Coinsurance Tutorial Project

Virtual Team Collaborative Project with ENG 3090, FIN 3073, and LIB 5020 Classes

This project will be a virtual collaboration of members from three different classes. One to two students from each class will work together in virtual teams. Teams will communicate via technology to successfully produce a comprehensive explanation of the commercial property coinsurance provision that can be used as a teaching tool. The audience for this project is business owners who are interested in buying insurance.

Each student team will produce and turn in: (1) a summary of team norms and goals, (2) an instructional product (visual tutorial) which will be played or presented, and (3) a one-page summary of the information being covered in the visual tutorial. In addition, each individual will turn in a project reflection and peer evaluation. Each product is

explained in detail below. The type of instructional media is open-ended; students may put together a PowerPoint, video, or any other media approved by the instructors.

Additional Background Global virtual teams are the present and future for successful organizations—whether those teams are as small as two people with a temporary assignment or as large as a decades-long project within a Fortune 500 company. These teams work across boundaries of space of time; they depend on technology to facilitate communication. The use of technology both facilitates communication and challenges it. Needless to say, there is much room for miscommunication, and all miscommunication is costly to organizations. This project will help students increase their proficiency working online in teams.

Team Structure Each group will be made up of approximately five to six students: two to three students from FIN 3073 Commercial Insurance, one to two students from ENG 3090 Professional Writing, and one student from LIB 5020 Information Sources and Services. (Note: Students in LIB 5020 are working professionals whose availability may be limited to evenings.) Teams are responsible for scheduling and logging virtual meetings on a group-management site where collaboration can take place and where questions and concerns can be centrally addressed. Students should assist each other with various aspects of the assignments and review ongoing progress to ensure a quality outcome.

Individual Project Roles

Commercial Insurance: Deliver accurate information about coinsurance and successfully relay the main points of importance, process, and application. Review drafts for accuracy and clarity. These students will act as the industry equivalent of subject matter experts (SMEs).

Information Sources and Services: Provide research support to commercial insurance students in the development of their subject matter and to professional writing students in the creation of the tutorial and professional summary of the concept and application of coinsurance. These students will also serve as technology consultants for the AET Zone.

Professional Writing: Write and design the visual tutorial. Produce a professional summary (one page) that will supplement the visual tutorial by explaining the concept and application of coinsurance. These students will act as the industry equivalent of technical communicators.

Technology Students may assemble technology tools as determined by their teams; however, the 3-D world AET Zone is highly recommended for collaboration and is required for the final project presentation. Each team will have its own room in the AET Zone.

Grading Students in each class will be graded separately by their individual professors. The final product must be detailed, accurate, professional, clear, and usable with the potential for this material to be used in both college and professional instructional settings. Students' ability to resolve conflicting goals will be reflected in their grades. Each student will also submit an individual reflection and a peer-evaluation report. The reflection outlines what the student contributed and learned about producing the product and working in a virtual team.

Commercial Insurance students will be graded on the ability of the teaching tool and summary to correctly demonstrate the application of the coinsurance provision; emphasis will be on *accuracy*.

Information Sources and Services students will be graded on the reference support they provide to the other students in the team; emphasis will be on adherence to the RUSA guidelines for effective reference services.

Professional Writing students will be graded on the degree to which the visual tutorial and summary effectively provide content appropriate to this audience and purpose. Grading will include the three elements of content: text, design, and graphics.

Note: Though each instructor will grade his/her own students and roles among students vary, all students are responsible for producing products that are accurate, professional, clear, and usable by the audience.

Metacommunication Metacommunication is the process of communicating about communication. Research into virtual teams indicates that increasing the amount and quality of metacommunication improves the work of virtual teams and decreases communication problems.

In your first team meeting, set aside *at least* 1/2 hour for metacommunication. During this time, you can discuss any communication expectations you wish, but consider starting with the following:

- What technologies does your team prefer to use for different types of work, such as document control, day-to-day exchanges, urgent matters, etc.?

TABLE A-I
TASK FLOW FOR COINSURANCE ASSIGNMENT

Task	Products	Dates
Instructors provide an overview of the project for students including foundational elements of the required products and of virtual team communication. Emphasize metacommunication.	Class lectures/meetings.	Prior to March 4.
Instructors establish teams and any required technology structure.	List of teams with email addresses.	Week of March 4.
First student meeting (all meetings/communication must take place online) Goals for this meeting: (1) Use metacommunication to establish team communication norms—technology preferences, measures for resolving conflict, leadership, turn-around time, etc. (2) Obtain necessary contact information. (3) Assess schedules to plan next meeting time. (4) Decide on specific benchmark dates for review of progress.	Summary of this planning meeting. Provide one copy per team per instructor.	Week of March 18
Review.	Draft of instructional media and summary.	March 29
Final product and presentation in AET Zone. Details of the presentation session(s) in the AET Zone will be provided.	Visual tutorial and summary (one copy per team per instructor). Reflection and peer evaluation (one copy per student).	April 8

- What type of feedback time do you expect from one another? Do you expect an initial response within 6 hours? 12? Final resolutions in 24 hours? You decide.
- What will you do if someone misses a deadline? Can you fire them? Do you give them a second chance? How much time do you allow to elapse before taking action?
- What do you think of back-channel negotiations? Is it ok for several team members to make decisions without the full team? Is this limited to certain types of decisions?
- What other topics are important to your team?

Note: This metacommunication session should be very democratic, encouraging everyone to speak even though you will appoint a team leader. After this first meeting, record your team norms (expectations) as well as the other items listed in the "first student meeting" cell of Table A-I. Provide a copy of this in memo form to your instructors.

Research Notice Data from this project may be used in research and publication by the course instructors. These data may include reflections, comments, and/or observations regarding your experience with virtual teams. If this information is reported, it will be reported anonymously.

APPENDIX B

TWITTER PROJECT ASSIGNMENT (TWITTER PROJECT)

COLLABORATIVE VIRTUAL TEAM PROJECT INCLUDING THREE COURSES EMERGING TECHNOLOGIES GLOBALIZATION DESIGNING INSTRUCTION FOR DIGITAL-AGE LEARNERS

Purpose Global virtual teams are the present and the future for successful organizations—whether those teams are as small as two people with a temporary assignment or as large as a decade-long project within a Fortune 500 company. These teams work across boundaries of space and time and they depend on technology to facilitate communication. The use of technology both facilitates communication and challenges it. Needless to say, there is much room for miscommunication, and all miscommunication is costly to organizations. This project will help students increase their proficiency working online in teams.

The purpose of this assignment is the following:

- Give students the opportunity to work in a virtual team.

- Allow students to work hands-on with a collaboration technology they are unfamiliar with.
- Learn how a team can use collaboration technology to get to know one another and work together virtually.
- Reflect on what it is like to work virtually.

Overview This project will be a virtual collaboration of members from three different courses (four total classes). One to three students from each class will work together in virtual teams. Teams will communicate via a collaboration technology (specifically AET Zone) in order to successfully produce an analysis of the use of Twitter. Teams will select a group, agency, or movement that has utilized Twitter and identify:

(1) why Twitter was chosen as a means of communication and
(2) the pros and cons of using Twitter to communicate ideas in the selected instance.

Along with the collaborative paper, students will also turn in a summary of their goals and team norms in relation to communication and collaboration technology. At the project conclusion, each group will present a summary/poster of their final deliverable as well as comment on the other teams' work. Each individual will turn in a project reflection and peer evaluation.

Team Structure Each group will be made up of approximately five to six students: one student from CIS 3710/HON 3515, two to three students from PS 4220, and one to two students from ITC 5240. (Note: Students in ITC 5240 are working professionals whose availability may be limited to evenings.) Teams are responsible for scheduling and logging virtual meetings on the group-management site where collaboration can take place and where questions and concerns can be centrally addressed. The group-management site that will be used for all groups is AET Zone. More information can be found here: http://appedtech.net/systems/teleplace/tutorials/. Students should assist each other with the various aspects of the assignments and review ongoing progress to ensure a quality outcome.

Individual Project Roles

All Courses: Participate in identifying the team goals. Work on each of the assignment deliverables (the report and the summary of goals and norms).

Emerging Technologies: Provide the team with knowledge regarding collaboration technology usage and best practices. Provide knowledge about globalization and Twitter usage. Provide knowledge about team norms and strategies for working together virtually.

Globalization: Be able to lead the team in identifying social movements and Twitter usage. Provide knowledge on globalization and social media.

Digital Age Learners: Be able to lead the team regarding collaboration technology usage as well as team norms and strategies for working together virtually. Provide knowledge on social media, information literacy, and network literacy.

Directions In order to work on this project, students must first begin using AET Zone. Once familiar with the workspace, students should then get to know their team members. We know that team members who get to know one another before working on virtual projects or tasks often perform better than those who do not. Therefore, students will use the collaboration technology to get to know one another. (Consider posting personal marketing statements, also known as a “two-minute pitch” or an “elevator pitch.”) Students should also consider including a photo.

Once teams have introduced themselves, they should begin outlining the team goals. What needs to be accomplished? By whom? By when?

The next activity will be a brainstorming activity. As a team, students will need to brainstorm about which group, agency, or movement is going to be researched for this assignment. In addition, team members will need to brainstorm about the answers to the assignment questions:

(1) Why was Twitter chosen as a means of communication for the group, agency, or movement of interest?
(2) What were the pros and cons of using Twitter to communicate in the selected instance?

A draft should be produced and reviewed by all of the team members. The main deliverable for this assignment is the write-up. The write-up should be around 4 to 6 pages, double-spaced, 1-inch margins, and 12-point font. The final write-up should be a collaborative effort of the virtual team.

Finally, each student will produce an individual report about the virtual team experience. The report should address the following and be delivered as a memorandum to your instructor (Fig. B-1):

- Report what you contributed to the project. List specific tasks.

Sample Memorandum Format

MEMORANDUM

Date: XXXXX

To: XXXX

From: XXXX

Subject: Virtual Team Reflection and Peer Evaluation Report

Begin report body here. Consider using subheadings to make the report more readable for your instructor.

Fig. B-1. Sample memorandum format.

TABLE B-I
TASK FLOW FOR TWITTER ASSIGNMENT

Task	Products	Dates
Instructors provide an overview of the project for students. Instructors establish teams.	Class lectures/meetings. List of teams with email addresses.	Week of March 25.
Students begin working together. Students must establish a shared workspace, introduce themselves, and establish goals. After these initial steps, students should begin working to produce an initial draft.	Summary of this planning meeting.	Week of April 1.
Final products submitted.	Final paper (Team). 1 page goals and norms summary (Team). Individual reflection and peer evaluation and reflection (Individual).	Week of April 8. All deliverables should be submitted to the respective faculty by April 13th by midnight.
Teams will asynchronously present a summary/poster of their final deliverable in AETZone. Each group will them be responsible for commenting at least once on the work of all teams.	Summary/poster of deliverable. Comments on other teamwork.	Poster due by April 13th. Review comments due by April 20th at midnight.

- Discuss what you learned from completing this project including what you learned about working in a virtual team. Do you think that you were able to successfully work on the assigned task with your virtual team members? Why or why not? Describe the most positive aspects of the experience you just had as well as the most negative aspects.
- Evaluate each of your team members, using specific examples and an accurate accounting of work contributed (Table B-I).

Grading Students in each class will be graded separately by their individual professors. The final product must be detailed, accurate, professional, and clear. Students' ability to resolve conflicting goals will be reflected in their grades. Each student will also submit an individual reflection and a peer-evaluation report. The reflection outlines what the student contributed and learned about producing the product and working in a virtual team.

Emerging Technology students will be graded on the collaboration technology usage, specifically the ability to use technology (individually and as a team) to produce final deliverables.

Globalization students will be graded on the reference support they provide to the other students in the team.

Digital Age Learners students will be graded on the degree to which the teams are able to use the technology to work together and produce final deliverables.

Note: Though each instructor will grade his/her own students, and roles among students vary, all students are responsible for producing products that are accurate, professional, clear, and usable by the audience.

Research Note: Data from this project may be used in research and publication by the course instructors. These data may include reflections, comments, and/or observations regarding your experience with virtual teams. If this information is reported, it will be reported anonymously.

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Pam Estes Brewer (M'08) is an Associate Professor in the Department of Technical Communication, School of Engineering at Mercer University. She has worked as a technical communicator and educator. Her book entitled *International Virtual Teams: Engineering Global Success* will be published in Spring 2015. She is an Associate Fellow in the Society for Technical Communication (STC), and a 2014 recipient of the Jay R. Gould and President's Awards. She is a member of the editorial staffs for IEEE TRANSACTIONS ON PROFESSIONAL COMMUNICATION and *Technical Communication*.

Alanah Mitchell is an Assistant Professor in the Department of Computer Information Systems and Supply Chain Management at Appalachian State University, Boone, NC, USA. Her research focuses on collaboration through the use of technology and best practices for managing and using collaboration technologies in virtual and face-to-face teams.

Robert Sanders is the Associate Dean of the School of Graduate Studies at Appalachian State and Professor of Library Science University, Boone, NC, USA. He has worked as a teacher, media specialist, administrator, and technology consultant. His research focuses on the use of Action Learning pedagogy in virtual worlds and the symbiotic relationship that exists in the convergence of these phenomena.

Paul Wallace is Associate Professor of Instructional Technology in the Reich College of Education at Appalachian State University, Boone, NC, USA. Some themes that run through his scholarship include internationalization and the role of technology in supporting collaboration. The focus of his research is the integration of technology into teaching and learning.

David D. Wood serves as the Joseph F. Freeman Distinguished Professor of Risk Management and Insurance, Department of Finance, Banking & Insurance, John A. Walker College of Business, Appalachian State University, Boone, NC, USA. He works with the insurance industry in the development of education programs and seminars. He collaborates with faculty and students internationally. His research interests include alternative risk financing, solvency issues, and agency/brokerage operations.