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A Modular Approach to Teaching and Learning of Virtual Collaboration

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ABSTRACT

Virtual collaboration has become an essential part of how work gets done in organizations today and knowing how to collaborate virtually is an important skill for success. Courses with team projects may include a virtual component, but rarely is there any explicit education on how best to engage in virtual collaboration. The topic is a complex one that takes into account a wide variety of issues, including behavioral, social, and technological dimensions. Our research addresses this need by developing modules for teaching and learning of virtual collaboration. The modules are based on underlying theory in this field and have practical application in education and training. We describe an initial application of the modular approach to teaching and learning of virtual collaboration that took place during the Fall Semester 2008.

Keywords

Collaborative learning, virtual learning teams, distributed learning teams, virtual teams, computer-mediated groups, collaboration technology, Second Life, technology training.

INTRODUCTION

Virtual collaboration has become an essential part of how work gets done in organizations today and knowing how to collaborate virtually is an essential skill (Chen et al., 2008; Robey, Khoo and Powers, 2000). Virtual teams consist of people who work together from different geographic locations and often different organizations or cultures (Dubé and Paré, 2004; Lipnack and Stamps, 1997). Team members rely on a variety of collaboration technologies, including distributed project management software, electronic meeting systems, video conferencing, or e-rooms. The skill or comfort level with collaboration technologies can vary among team members and little guidance is available for how to use the tools in different virtual contexts (Zigurs and Khazanchi, 2008). Even when courses with team projects include a virtual component, rarely is there any explicit education on how best to engage in virtual collaboration (Chen et al., 2008; Davis and Zigurs, 2008). The topic is a complex one that takes into account a wide variety of issues, including behavioral, social, and technological dimensions.

Our goal is to address this need for guidance on how to do virtual collaboration by developing modules for teaching and learning of virtual collaboration. The modules are based on underlying theory in this field and have practical application in education and training. The following sections present the theory on which the modules are based, followed by a discussion of development and implementation of the modules. We describe an initial test of one of the modules and conclude with guidelines for how these modules might be used to help people learn to become effective members of virtual teams through appropriate use of tools and processes for different settings and tasks.

THEORETICAL FOUNDATION

The first step in developing a solution for the problem of how to work effectively in virtual teams is to understand what needs to be learned, that is, the content related to best practices for virtual teaming. We start with presenting the theoretical foundation for the modules in terms of both learning content and learning design.

Learning Content

A significant amount of existing research provides guidance for key issues related to virtual collaboration (Davis and Zigurs, 2008). Major issues in this area include group development (Gersick, 1988; Poole, 1983; Tuckman, 1965), team training (Beranek, 2000; Powell, Piccoli and Ives, 2004; Robey, Khoo and Powers, 2000), and best practices for virtual teams (Mittleman, Briggs and Nunamaker Jr., 2000; Staples and Webster, 2007). Several reviews of virtual team research have identified key issues (e.g., Martins, Gilson and Maynard, 2004; Pinsonneault and Caya, 2005; Powell, Piccoli and Ives, 2004). Based on this body of knowledge, we focus our learning content on the following six areas, which recur throughout

the literature as being important areas of concern: (1) team formation, (2) task-technology fit, (3) norm development, (4) shared understanding, (5) trust, and (6) leadership.

Team Formation

Early in a virtual team's life, team members need to understand the best practices necessary to start their work in a manner that leads to success. This idea relates to group development and specifically team formation (Gersick, 1988; Poole, 1983; Tuckman, 1965). Team kick-off meetings are an important method for team members to get to know one another socially before working on projects or tasks, and higher performance results from an effective start-up process (Jarvenpaa and Leidner, 1999). Therefore, team members need to learn the importance of social communication when they begin working together in order to have a successful experience and end result.

Task-Technology Fit

The second key issue for virtual team members to understand is the concept of task-technology fit (Goodhue and Thompson, 1995; Zigurs and Buckland, 1998). This concept is especially important considering that virtual teamwork is possible only through the use of collaboration technologies (Dubé and Paré, 2004; Lipnack and Stamps, 1997). With the growing and changing marketplace for collaboration technologies, team members may have trouble deciding which technologies or tools best suit their needs when working on different tasks (Zigurs and Khazanchi, 2008). Therefore, team members must learn which technologies support certain tasks for individuals working in different virtual contexts in order to be successful.

Norm Development

When teams are coping or dealing with technical uncertainty (as is often the case in a virtual environment), they must develop norms or guidelines for team practices (Beranek, 2000; Jarvenpaa and Leidner, 1999). For example, when virtual team members are sharing files and frequently uploading new versions of a file, it may help to develop a norm about a version numbering scheme (Jarvenpaa and Leidner, 1999). Other norms might relate to protocols for communication for predictable communication patterns (Jarvenpaa and Leidner, 1998). For example, virtual team members might promise to check into a collaboration technology workspace a certain number of times a day or week (Beranek, 2000). These are simple examples, but it is through agreement on such basic work practices that a shared culture and understanding can develop.

Shared Understanding

The fourth key area of learning that is necessary for virtual team members is the concept of shared understanding. Previous research has argued that teams that work together must have a shared understanding of various aspects of their project and tasks, specifically the goals toward which the team is working (Qureshi, Liu and Vogel, 2006). However, in a virtual team, non-verbal communication and mutual knowledge are often lacking, which can make it difficult to establish a shared understanding (Cramton, 2001; Powell, Piccoli and Ives, 2004).

Trust

Trust has been a popular topic of study for virtual team researchers, specifically the concept of swift trust (Davis and Zigurs, forthcoming). Research has argued that teams who trust one another perform better than teams that do not (Jarvenpaa and Leidner, 1999; Sarker, Valacich and Sarker, 2000). Therefore, team members need to learn how to use technology to create a trusting team environment.

Leadership

The final key area of learning that is necessary for virtual team members is the concept of leadership. Research has suggested that it is easy to identify leaders in traditional teams based on such things as where individuals sit, their body language, or their style of dress (Zigurs, 2003). Virtual settings make it more difficult to establish leadership because of the absence of these traditional cues. At the same time, leaders may be even more important in virtual settings, e.g., for handling behavioral or technology issues that may arise in a team project. Therefore, leadership is a key concept that virtual team members must learn how to express. Lessons in leadership should focus on team coordination in a virtual setting (Powell, Piccoli and Ives, 2004).

In sum, these six areas provide the foundational content for what virtual team members need to learn. The next section discusses briefly the conceptual approach for the design of that content.

Learning Design

A considerable body of research exists on the design of collaborative learning and teaching in online environments (e.g., Alavi, 1994; Hiltz, 1997; Leidner and Jarvenpaa, 1995; Shen, Hiltz and Bieber, 2006; Sloffer, Dueber and Duffy, 1999). The work of Chen et al. (2008) is particularly relevant here because it focuses on how to train students to learn in such environments, using a model of virtual teamwork training that is based on Kolb's learning cycle. The model has three phases: (1) the abstraction/conceptualization phase, in which students learn the difference between face-to-face and virtual collaboration from a theoretical perspective; (2) the active experimentation and concrete experience phase, in which students work in virtual teams; and (3) the observational reflection phase, in which students discuss effective and ineffective practices in their team experience. We incorporated the basic philosophy of this approach in the design of our modules.

MODULE DEVELOPMENT

We developed six modules for teaching students how to work in virtual teams, based on the underlying behavioral, social, and technological theories discussed above. The content of each module is briefly described, followed by the template for module design.

Module Content

The learning modules cover the six areas discussed in the previous section. Each module was developed based on previous research and best practices. Appendix A shows a completely developed example of the contents of the first module. Due to space constraints, we summarize below brief examples for the other areas.

1. Getting To Know Virtual Team Members. As presented in the previous section, 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 do so (Jarvenpaa and Leidner, 1999). Therefore, in this module, students use a collaboration technology (Second Life) and learn how to get to know team members through the use of technology. Students are asked to meet as many people as possible in the virtual workspace during the assigned time, and to find out one interesting fact about each person. Second Life was chosen as the technology for this module because of the cutting-edge metaverse technology capabilities that are offered. The technology allows for students to learn about anonymity and representation in an online environment in relation to the concepts of communication, interaction, rendering, and team process (Davis et al., 2009). The complete module is presented in Appendix A.
2. Choosing, Using, and Matching Technologies. Due to the growing and changing marketplace for collaboration technologies, virtual team members may have trouble deciding which technologies or tools best suit their needs when working together. In this module, students use a collaboration technology (Blackboard) and learn how a team can negotiate and work together to make technology choices. Students are presented with different task scenarios and must make decisions as a team regarding which technology would best suit their needs for each scenario. Blackboard was chosen as the technology for this module because of the familiarity that students have with this learning management system and its available capabilities. However, it is the intention of all of the modules that they can be used with different collaboration technologies.
3. Developing Norms. Norms are helpful for virtual team members to cope or deal with technical uncertainty. Students use a collaboration technology (Groove) and learn how team members can develop norms or guidelines for best practices through the use of technology. Students are presented with a challenge (e.g., complications with sharing files, lack of participation) and must develop one or two ways to address that challenge through the development of standard practices. Groove was chosen as the collaboration technology for this module due to the numerous technology capabilities and features that it offers which can help with developing norms (e.g., file sharing, calendar, chat, and email).
4. Developing Shared Understanding. Teams must work together to have a shared understanding of various aspects of team projects and tasks, specifically the goals the team is working toward. For this module, students use a collaboration technology (Blackboard) and learn to share information with one another and store and search that information. Each student is provided with a piece of information and the team must work together to complete the entire puzzle. This exercise helps students learn the importance of developing a shared understanding as well as how to use technology to do so. Blackboard was chosen, again, due to its familiarity.
5. Developing Trust. Teams who trust one another perform better than teams who do not (Jarvenpaa and Leidner, 1999; Sarker, Valacich and Sarker, 2000). Therefore, it is necessary for team members to learn how to use technology to create a trusting team environment. Students use a collaboration technology (Second Life) to learn how to enhance trust

development through participation in trust-building exercises. Students learn the importance of trust as well as some ways to form trust through technology. Second Life was chosen for this module, again, because of the technology capabilities for team member representation and the lessons learned in relation to virtual representation.

6. **Leadership.** Virtual team leaders must step up and address both behavioral and technology issues that arise during virtual team work. In this module, students learn how to lead a team using a collaboration technology (Groove). Each student experiences how technology can be used to make managerial and leadership decisions and how to present direction to a team. Students also learn how leadership roles can be filled by anyone in the team, or by the technology itself. Groove was chosen as the collaboration technology for this module due to the numerous technology capabilities and features that it offers which support virtual project leadership (e.g., project timeline, calendar, chat, email, and meetings).

Module Design

The modules are designed to be combined with each other in a mix-and-match way that provides a flexible approach to learning design. Each module includes the following components: (1) a description, (2) objectives, (3) materials needed, (4) technology capabilities used, (5) instructions or procedures, (6) discussion and assessment questions, (7) a rubric for assessment and evaluation, (8) vocabulary, and (9) related readings and links. The description is a short statement about the activity, while the objectives specifically identify what students should take away from the completion of a module. The materials needed describe a specific technology that could be used to complete the module, and the technology capabilities used cover the capabilities needed in case another collaboration technology should be used. The instructions section of the module includes the actual steps that should be taken to complete the activity. Discussion and assessment questions are provided for instructors who want to hold a discussion or pass out a questionnaire following each activity. These questions encourage a collaborative learning process. A rubric for assessment and evaluation is also included for grading or evaluating a student's completion of the activity. Vocabulary words, related readings, and links of interest are included at the end of each module for additional assignment and learning.

MODULE IMPLEMENTATION

We implemented and tested the first module (Appendix A) in two different settings: 1) two sessions of undergraduate students enrolled in a Foundations of Information Science and Technology course and 2) three sessions of a workshop for high school girls. In both tests, we used a case study approach in order to observe students' actions and learning, and to assess whether the modules could be used successfully (Lee, 1989). We report critical incidents and outcomes from the two cases.

Case 1: Undergraduate Students

During Fall Semester of 2008, we tested the first module in two sections of a Foundations of Information Science and Technology course, with a mixed group of undergraduate students. There were 48 total participants (38 males, 6 females, 4 not reported), with 25 students in the first session and 23 students in the second session. Overall, only 13 of the 48 students had used Second Life previously, the collaboration technology chosen to execute this module.

The objective of the first module is for team members to learn how to use a collaboration technology to get to know one another. Students were instructed to meet as many people as they could through the collaboration technology. At the end of the activity, most students reported meeting one to four individuals and getting to know some social information about each one, while two students reported meeting twenty other individuals in the workspace. Fifteen students reported learning information about other students' skills or hobbies, such as what they were learning to do in Second Life (e.g., fly or build) or what games they liked to play (e.g., one pair talked about playing Call of Duty). It was also common for students to discuss their majors, jobs, or class topics (13 comments reported this type of topic). Five other comments focused on appearances and what avatars were wearing, while two people mentioned learning about others' personalities (e.g., sense of humour).

Participants had split opinions on whether or not a collaboration technology could be used for getting to know people. For example, 26 of the students commented that the technology would be useful for getting to know others. Table 1 shows examples of these positive comments.

Team Member Comments (Excerpts)	
1	<i>"With more experience you can meet various kinds of different people in a nonstressful environment."</i>
2	<i>"I do believe Second Life is useful in that it lets people be individuals and meet each other; also it is semi-addictive."</i>
3	<i>"If you took the time to talk to them because you could find people with same interests."</i>
4	<i>"It allows you to meet people in a fun environment with the same interests as you."</i>

Table 1. Positive Results from Open-Ended Question Relating to the Experience

However, 17 students reported that they did not think getting to know someone online would work and they preferred face-to-face interaction. Table 2 shows examples.

Team Member Comments (Excerpts)	
1	<i>"It's about as useful as an online chat room. You can still meet people, but you don't know if it's really them. They could be lying to you."</i>
2	<i>"I'm not fond of it; it comes off as a creepy AIM system to me."</i>
3	<i>"It's fake; people can become whoever they want to be."</i>
4	<i>"There are certain things like mannerisms that can be learned much easier in person."</i>
5	<i>"It is a good way to meet people you may not know, but real life interaction is a must."</i>
6	<i>"It's too artificial."</i>
7	<i>"You don't get that face to face feeling."</i>
8	<i>"It could be, I don't know how factual someone might be in this type of environment."</i>
9	<i>"I don't think it is a true way to get to know someone."</i>
10	<i>"I don't think this is useful to get to know people, because its easy to lie in a virtual world."</i>

Table 2. Negative Results from Open-Ended Question Relating to the Experience

Four comments made the argument both for and against using the technology for getting to know individuals. For example, one student commented *"seems like there may be less hesitation to talk to a stranger, but it is still uncomfortable; perhaps a more structured task would make it easier to jump in; for example, find three people and ask them where they were born."*

In both sessions, the groups were led by an outside instructor, enabling us to test whether the module could be run by an individual who was not familiar with the process. The independent instructor had no trouble following the guidelines of the module and was, in fact, able to successfully lead the activity and the post-activity discussion.

Case 2: High School Students

Thirty-one high school girls in three sessions participated in the second study – eight girls in the first session, seventeen in the second, and six in the third session. Only one of the girls involved reported having any exposure to Second Life.

The module was tested in exactly the same way as the first case; interestingly, the high-school girls met more individuals during the activity than in the first case. The girls reported meeting anywhere from one to eight individuals online. Similar to the previous study, eight girls learned about others’ jobs or interests (e.g., where they went to school or worked, or what their interests were). Topics also focused on hobbies or skills. For example, ten girls discussed what they liked to eat, where they liked to travel, or what instrument they played. Three girls discussed such things as what countries produce donuts or where they were born or lived. Only one student commented on learning about appearance. This group reported much more interest than the first case in using a virtual meeting space to get to know other individuals. Table 3 shows selected examples from the 20 positive comments.

Team Member Comments (Excerpts)	
1	<i>"Once you get past the whole "OMG this is cool I want to play with it!" thing, this would have been awesome way to socialize. Maybe not for anything serious, but still."</i>
2	<i>"You can tell by their clothes and the way that they act."</i>
3	<i>"You have to be willing to talk to people that you have no idea who they are."</i>
4	<i>"You can talk from different places."</i>
5	<i>"You can get to know them, even from far away."</i>
6	<i>"For shy people, it will be much easier to express yourself."</i>
7	<i>"If someone is shy SL could be helpful."</i>
8	<i>"It's easier to talk to people."</i>

Table 3. Positive Results from Open-Ended Question Relating to the Experience

Only four girls made negative comments (Table 4). Seven girls made comments that the technology had both positive and negative aspects.

Team Member Comments (Excerpts)	
1	<i>"You can meet a lot of new people but could be lying a lot."</i>
2	<i>"As long as people realize that not everyone is what they seem."</i>
3	<i>"It's only good if you're not talking to creepers."</i>
4	<i>"I think its ok, but it is too hard to know someone without meeting them."</i>

Table 4. Negative Results from Open-Ended Question Relating to the Experience

Our findings suggest that the girls were able to meet and learn about different individuals through the use of a collaboration technology and through the discussion that followed the activity. The girls all interacted through the technology to meet other individuals and were able to think through the topic of the activity and justify their ideas regarding the importance and benefits of virtual work. This case shows that the first module can indeed be used for teaching students how to get to know one another in a virtual setting and the importance of doing so.

DISCUSSION AND CONCLUSION

Our overall goal was to design and implement modules for teaching and learning virtual collaboration based on key issues identified from prior research (Davis and Zigurs, 2008). Each module consists of exercises with different collaboration technologies, with learning goals for team behavior and technology use based on previous research. Our tests of the first module show that students are able to use the technology and its capabilities to achieve the learning goals.

The contributions of the paper are several. First, the overview of research on virtual teams provides six key areas in which team members need to develop expertise in order to be effective team members. Second, brief examples of how to learn about each area were provided, along with a detailed description for the first area. Third, the template in Appendix A can be used for development and documentation of additional modules using a variety of technologies. For example, future modules might address processing work or providing feedback in virtual teams. The modules can also be tested in other technologies besides Second Life, Blackboard, and Groove.

The modules can be applied practically by both instructors and researchers to inform virtual team members of how best to engage in virtual collaboration. The learning modules can be extended and used in university courses or as a part of a class, training workshops, or in other settings, and they can be combined in a mix-and-match way to teach people how to deal with issues that create bottlenecks for effective functioning of virtual teams. Students of the modules will walk away with a better understanding of virtual collaboration concepts and an understanding of how to be a good virtual team member. The learning content and design that were developed here are just one step in the direction of enhancing the overall effectiveness of this important part of organizational life today.

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APPENDIX A: MODULE #1: GETTING TO KNOW YOU

Module Purpose/Summary

Many organizations today are using collaborative technologies for daily work, and team members who get to know one another before working on projects or tasks often perform better than those who do not do so. In this module, students will work with a collaboration technology (Second Life) to learn how to get to know team members through the use of the technology.

Objectives

Students will:

- work hands-on with a collaboration technology; and
- learn how a team can use collaboration technology so that team members can work together and get to know one another.

Materials

- Computer with Second Life client installed.
- Alternatively this exercise can be done with another online collaboration technology.

Technology Capabilities

There are several ways to communicate in Second Life. These include voice, text chat, or instant message (one-to-one, group, or ad-hoc).

Instructions/Procedures

1. Introduction and Background. Prior to the exercise, students should:
 - a. Complete a write-up where they explore a virtual world that is designed for gaming, business, or education.
 - b. Create a login for Second Life.
2. Activity.
 - a. Once together, students should login using their Second Life account. Students should then get through the Orientation Island and find their way to the [A Specific] Island in Second Life.
 - b. Students will be given a reference handout with the various control options to assist them in this activity.
 - c. Students should then use the collaboration tools to meet as many different avatars on the [A Specific] Island as they can in the allotted time and find out one interesting fact about each avatar.
3. Closing.
 - a. Students should complete the assessment questionnaire which asks them about their Second Life experiences and their perceptions on how useful the virtual world is for getting to know one another.

Discussion/Assessment Questions

Each question should be asked once the activity has been completed. Discussion will then expand to the whole group for collaborative learning.

1. Is this your first time using Second Life? If not, how long have you been experienced with Second Life?
2. How many people did you meet in this exercise?
3. What are some of the things that you learned about each of these individuals?

4. Do you think that Second Life is a useful way to get to know individuals? Why or why not?
5. Do you think that you would be able to successfully work on a project or task with the individuals you met today? Why or why not?
6. What technology capabilities did you use to get to know these individuals?
7. What technology capabilities did you not use that you think would have been helpful to have access to?
8. Describe the most positive aspects of the experience you just had, and the most negative aspects.
9. List three reasons why you chose the avatar representation that you did for this exercise.
10. How strong is your sense of presence, or of “being there”, in SL? (1 - Not at all; 5 - To a great extent) (Barfield and Weghorst, 1993).

Rubric for Assessment/Evaluation

Use the following three-point rubric to evaluate students' work during this lesson.

- Three points: Students interacted through the use of a collaboration technology to meet other individuals; they were able to think through this activity and justify their ideas regarding the importance and benefits of virtual work.
- Two points: Students interacted somewhat through the use of a collaboration technology to meet other individuals; they were able to think through most of this activity and justify their ideas regarding the importance and benefits of virtual work.
- One point: Students did not interact through the use of a collaboration technology to meet other individuals; they were able to think through only some of this activity and justify their ideas regarding the importance and benefits of virtual work.

Vocabulary

Collaboration Technology

Definition: a set of tools for the support of communication, information processing, and process structure within teams.

Related Readings and Links

This information was removed due to space constraints; please contact the first author for a complete list.