AC 2011-291: CREATION AND IMPLEMENTATION OF A BACKPACK COURSE TO TEACH CROSS-CULTURAL AND VIRTUAL COMMUNICATIONS SKILLS TO STUDENTS IN AN INTERNATIONAL CAPSTONE EXPERIENCE

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Creation and Implementation of a Principles of Global Virtual Teams Course Taught Concurrently with an International Capstone Experience

Abstract

As international engineering teams become more prevalent, universities need to adapt educational opportunities to prepare students to work in a global environment. As part of an NSF grant to study global, virtual, engineering teams, a backpack course designed to teach cross-cultural competencies and virtual communication skills to engineering students was created. The course is taught concurrently to students participating in a global, virtual, engineering capstone team experience. This educational experience mixes practical hands-on experience of working on a global virtual team with instruction designed to help facilitate global virtual team interactions. This paper discusses the creation, implementation and revisions of this course's first year of implementation. It will highlight course content as well as practical considerations in teaching such a course.

Keywords: Cross-cultural competence, virtual communication, global virtual teams, international engineering education, global engineering, international education.

Introduction

Over the past decade increases in international engineering have necessitated increased collaboration among culturally and globally diverse groups of people [1]. In response to this demand, universities have worked to teach and train students how to interact with culturally diverse groups in a positive and supportive manner. Traditional educational approaches provide students with a variety of cultural experiences and educational opportunities such as study abroad, international internships, or having students complete combined degrees with international universities [2, 3]. Many of these efforts place students on teams of internationally diverse students to learn engineering skills and gain a greater understanding of cultural interactions.

Brigham Young University (BYU), offers several study abroad opportunities in its engineering program designed to increase students' global competence and international engineering skills [4]. These competencies, make up the attitudes, knowledge and skills students will need to successfully complete engineering projects in a global job market. However, the cost in terms of time and money makes it difficult for large numbers of students to participate in these programs.

Advances in global communication using virtual communication technologies in the last decade have facilitated cross-cultural interactions in both a social and business setting. With recent economic downturns, many businesses have adopted a global virtual (GV) team model to save on travel expenses and to allow globally dispersed team members to interact in productive and successful ways. As part of a National Science Foundation (NSF) grant, BYU has undertaken efforts to provide opportunities for students to participate in a GV teams by pairing BYU engineering students with engineering students at other international universities. Initial efforts embedded GV team instruction within an advanced mechanical engineering design course.

While this effort continues to be refined, a second effort created a "backpack" course teaching the principles of GV teams concurrently with an international capstone experience. Both efforts are directed to providing students with a cross-cultural and virtual engineering team experience in a cost effective manner. This effort is not intended to replace study abroad experiences, but augment them and provide a global experience to more engineering students within the context of a GV team. This article discusses the creation and initial pilot of this course that is taught concurrently with an intensive, international engineering design course.

Literature Review

Virtual technologies (i.e. personal messaging, video conferencing, document sharing, etc.) developed in the last ten years have facilitated interactions between different groups of people across great distances without the expense of and lost time due to travel. Many advances have focused on allowing collaboration of culturally and globally diverse groups. These virtual technologies used in businesses and social networks, can also be used in educational settings to provide a cost effective and practical global, educational experience for engineering students.

Using virtual technologies to interact as a GV team does not guarantee successful completion of an international project [5, 6]. While virtual communication technologies connect individuals across vast distances, users must still learn to work effectively in a virtually connected, culturally rich environment. Several experts have voiced the need to include cultural and virtual communication technology instruction as part of one's engineering education [7, 8, 9].

While collocated engineering teams are instructed in team skills to facilitate successful team projects, a GV team, requires several changes in team interactions [10]. Students need to learn what virtual communication tools are available; how those tools may be used effectively to share knowledge, and interact in ways that builds relationships of trust [11, 12]. Commonly held office interactions, such as stopping by a colleague's office, visiting at the water cooler, or greeting one another in the hallway, need to be transferred to virtual communication equivalents. Effective means of sending and receiving or collaborating on documents need to be understood and practiced. Team members also need to establish protocols for interactions so one member is not waiting too long for a response or inundated with a constant stream of messages [10, 13]. Team leaders need to learn how to check in on team member progress and disseminate this information to team members and clients. Effective ways of building trust in team members at a distance need to be employed. Each of these normal team skills requires new methods when working on a GV team.

While virtual communication skills are important, they only facilitate communication on the GV team. Students need to learn how to interact on a social and cultural level with international teammates. This includes limiting or explaining slang, jargon, acronyms or colloquial expressions [15], understanding the history, social background and cultural mores of team members [4, 15], and practicing the interactions that foster open communication and knowledge sharing [13]. This increases communication and understanding, while avoiding awkward social and cultural missteps. Team members share their own identity and recognize other team member's identity through the sharing of social and emotional information as well as task related information [16].

This blending of global competency acquisition and virtual communication skill development enables GV team members to interact with greater success. It provides a basis for sharing knowledge, establishing and building trust while aiding successful resolution of conflicts as they arise. However, no one experience will provide all of the possible opportunities to learn and develop these needed GV team competencies and skills. Similarly, if the opportunity presents itself, there is no guarantee that one experiences a long-lasting, positive learning experience from the situation. Blending instruction on the principles of GV teams with an actual experience provides the highest likelihood for students to learn and practice skills needed for successful GV team projects.

Blending of Instruction and International Experience

Teaching global competencies and virtual communication skills is important but it is not enough. A practical opportunity needs to be in place for students to implement and practice these competencies and skills. Students need to be engaged in solving an actual engineering problem while practicing these global competencies needed for cross-cultural interactions. A course that teaches these competencies to local and international students at the same time allows students to interact both at the team and classroom level. As the course is taught, all students become aware of the global competencies and recognize where they may be used during team interactions.

Such a course would identify how current engineering processes (i.e. team skills) are influenced as they interact with virtual communication technologies and cross-cultural skills. Each of these interactions creates a new type of team. However as all three skills are combined, a new type of team is created - the GV team. The new course instruction helps students to modify current skills by working on GV teams while introducing skills specific to a GV team. The blending of these skills and competencies is illustrated in figure 1.

First Attempt: Embedding GV Team Instruction

Prior to the start of this study, one of the engineering professors at BYU, Dr. J, led PACE Global Vehicle Projects for several years. During this time he recognized it took approximately eight weeks before the global teams were working and collaborating effectively. As a consequence he began considering how to incorporate collaborative tools and instruction into an existing advanced engineering design course. His hope was that students exposed to these tools could more effectively participate in future PACE Global Vehicle Projects.

Starting in the Fall of 2009, the Computer-aided Engineering Applications (CEA) course was modified to include a semester-long, global-teaming, design project. Originally the focus of this course was on the theory and use of CAx tools to model, analyze and prototype mechanical systems. Students at BYU were organized into teams of 3-5 students and challenged to work collaboratively to accomplish their project. When the course added the global aspect two major changes occurred: 1) Students from a number of remote locations were linked to the lectures and labs via video conferencing, and 2) Teams comprised of a mixture of BYU and international students connected virtually via collaborative CAx tools and VoIP.

The initial global class offering had some problems. The GV team components added more materials and expectations into an already demanding curriculum. These additions over

burdened students as course instructors struggled to maintain the high quality engineering instruction while adding cultural and virtual instruction.

After an evaluation of this combined course pilot project, the research team began developing a course that would focus on the global and cross-cultural aspects necessary for students to be successful participating in a global design project regardless the class or subject being covered. A two-pronged effort developed from the research. The CEA course would continue to be offered in its new global collaborative format with adjustments and modifications to explore an embedded design. At the same time an independent course was developed to be taken concurrently with any engineering class participating globally with international students. Initial efforts would focus on an international capstone experience. This effort led to the creation of the principles of global virtual teams course.
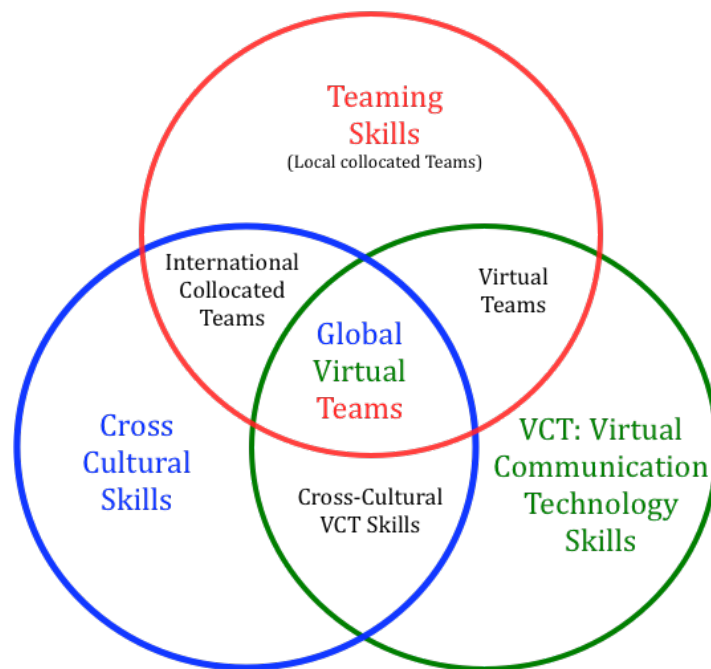

Figure 1: The interactions between teaming, cross-cultural and virtual communication skills to create new engineering interactions.

Principles of GV Teams Course

Prior to the development of the principles of GV teams course, the researchers conducted a literature review to determine a comprehensive list of global competencies. This search culminated in the development of a curriculum of descriptors indicating what would be needed for engineers to be globally competent [17]. Using these competencies, key descriptors within the competencies were identified in terms of importance and feasibility of teaching principles of GV teams course. Once the descriptors were chosen, a secondary search of the literature was conducted to connect the competency descriptor with the most recent and relevant research and literature on the subject. Each of the chosen descriptors was developed into a 1 to 2 hour lecture

including power point slides, notes and student assignments. As materials for each lecture were completed, they underwent a review process with engineering faculty. This ensured correct engineering principles and GV team principle links to engineering. Any revisions needed were made prior to the lecture being presented.

Student assignments and assessments reflected use of course content on the GV Team. For example, an initial assignment required students to create an On-line personal profile. This included a picture, student experience, expertise and other information that enabled students to get to know teammates. This was followed up with a five-minute phone call where students paired with international to talk about themselves and tell a joke. None of the conversation was to be about the project rather it was intended to begin to build a relationship and trust. Each assignment required students to journal and reflect on how the assignment was used and its importance in the team functioning.

A final exam was administered only to the BYU students since the NUS students had completed their semester and did not take the course for credit. The final exam focused on key concepts, terminology and examples of principle application on a GV team. Since no instructional counterpart was at NUS, all assignments, including the final exam, were administered, written, marked and returned in a virtual format.

The lectures and content are briefly described below.

Globalization of Engineering: The rational for developing global competence is presented. Key terms (i.e. global competence, ethnocentrism, cultural intelligence, etc.) are briefly introduced.

Virtual Communication Technology: Students are provided instruction and practice in using a variety of virtual communication technologies. Advantages and disadvantages of each are discussed. Emphasis is placed on virtual communication technologies that are readily available to students.

Team Start-up Processes: The unique features of establishing a GV team are discussed. The startup procedures for a GV team and collocated team are compared and contrasted.

Cultural Dimensions and Dispositions: Several cultural frameworks are reviewed and used to help team members understand how culture may influence GV team interactions. Ethnocentrism is discussed.

Cross Cultural Communication: Students are instructed in the challenges of intercultural communication. The major communication styles are reviewed and placed in the context of cultural communication rules. There is discussion on the challenges and possible solutions to the challenges of speaking with a person using a second language.

Virtual Communication: This lecture provides and understanding of the four major obstacles of virtual communication (isolation, confusion, time zones and technology) and how to overcome each of those obstacles. Strategies include making a team feel less isolated and more unified, establishing clear project and communication plans, working across multiple time zones, and overcoming challenges associated with technology.

Building and Maintaining Trust: Swift trust is identified and differentiated from personal trust. Strategies and examples are provided for building and maintaining trust through virtual social networks.

Leadership: Key skills and qualities of a GV team leader are identified and connected to the components of swift and personal trust building. Focus is shifted from interpersonal trust to trust between leaders and team members.

Conflict Resolution: A definition of and types of conflict are discussed. Sources of conflict on virtual and culturally diverse teams are identified and strategies are provided for preventing and resolving conflict. A virtual role-play is used to help student understand differences in resolving conflict via virtual communication media.

Cross-Cultural Engineering Practices: This lecture focuses on international standards and the need to adhere to given standards. It describes how standards affect design, development and commerce.

Cross-Cultural Product Design: This lecture defines cross-cultural design by providing examples of how culture influences product use, design and success. It identifies localized design differences in international products and describes a process for designing cross-cultural products.

Capstone Pilot of Principles of GV Teams: Observations

The Principles of GV Teams was piloted with a capstone project involving two teams with members from BYU and the National University of Singapore (NUS). The course was taught synchronously with BYU students meeting at 7:00 AM and NUS students meeting at 9:00 PM. Several key insights were gained during the first semester of this course.

First, students at both universities need to be awarded course credit. This commits the students to full participation in the course. It also commits both universities to finding a time where the course may be taught. In this particular example, the time zone difference in the second semester could have been over come with BYU moving to an afternoon time and NUS to an early morning (next day) schedule. Unfortunately, the NUS capstone course structure prevented synchronous instructions from happening in the second semester.

Second, when time zones require one team meeting early and another late, as in this case, it is good to plan two parallel schedules for the course. For example, BYU would have an early morning and late afternoon time slot for the course. Only one time slot would be used, but the course could be alternated from one time slot to the other. This simulates what happens in real life GV teams. It also provides a break from continually meeting early in the morning or late at night for the students.

Third, technology plays a key role in teaching this course. Any virtual communication technology used in the course should have several trial runs from the location of the course and at the time the course is taught. This allows any bugs to be worked out prior to the course presentations. It ensures a smoother running and positive impression of using the virtual communication technology by students within the course.

Since students are in several locations, teacher to student and student-to-student interactions need to be structured differently. For the whole class experience, each university should be connected with technologies such as video conferencing or virtual meeting tools (i.e. Adobe Connect or WebX). This allows the instructor to provide common instruction to all students. It also allows students to make presentations, ask and answer questions to the entire class. For smaller group or paired group work, students should also be connected individual-to-individual with personal virtual communication tools (i.e. i-chat, Skype, etc.). Pairing students from a different universities and cultures provides the opportunity of interactions from different cultures and experience in using virtual communication technologies.

Fourth, an instructional counterpart is strongly recommended to assist in instruction, disseminate, proctor and return assignments and exams. If no instructional counterpart is provided at each university, the instructor must become comfortable in using virtual technologies to administer, mark and return assignments. Office hours will need to be open and varied as students from different cultures seek extra help from the instructor. The instructor needs to be familiar with a wide variety of technologies to help students troubleshoot. At minimum the instructor needs to be able to refer students to technical experts for help. In this type of course the instructor must be a strong facilitator.

Fifth, if a counterpart in international universities is provided, the instructor needs to keep communication open. This communication should also be established and maintained between instructors or coaches in the parallel design course. This provides strong co-ordination so the instructors are teaching from a similar position and stance in terms of assignments and course content. Partner instructors may also provide instruction that allows students to experience virtual and cultural instruction from one in another culture. This encourages examining issues from multiple perspectives and provides a stronger understanding of cultural differences.

Sixth, rules of contact and conduct need to be established and practiced by the instructor. Instruction filtered through virtual communication technology in a synchronous manner is less spontaneous. Students at distant locations need to be drawn into the class conversation. For example, instead of asking students questions spontaneously, instructors may need to invite students to respond to a question prior to class. This allows students with second language skills to better prepare and feel more comfortable in their response. In the case with NUS, there was a 4-5 second delay in communication interaction. This meant NUS would receive the communication 4-5 seconds after a question or comment from BYU. If NUS were to give a response, with no time to reflect, this creates a 8-10 second turn around. Students and instructors must accommodate their instruction to allow for this slower response time. It also prevents the students where the instruction originates from dominating the responses. If students are connecting virtually to discuss concepts presented in class, extra time must be allowed as virtual conversations tend to move at a slower pace depending on the medium used.

Finally, everyone involved, students and instructor, needs to adopt a tolerant, flexible attitude. Problems and issues will occur as the course proceeds. There needs to be flexibility as the course is conducted. Keeping the lines of communication open between student and instructors is of critical importance. In this case the instructor e-mailed all students with a summary e-mail (including assignments) following the lecture. A second e-mail, a day or so before the next lecture, was also sent to all participants reminding of assignments due and requesting responses

of given students. All course participants were asked to reply to specific e-mails within 24 hours. The instructor made response to e-mails a priority. The instructor also left communication mediums open on his computer so students could "drop by" virtually to ask a question on a given assignment.

Future Directions

Three key directions are identified for the further use of this course. First, the course needs to be developed so it may be presented in a synchronous or asynchronous manner. With time zones differences of 10-14 hours, synchronous instruction is difficult to provide. It would also allow comparison to determine if there is added value to the synchronous presentation over the asynchronous presentation.

Second, all engineering courses involving cross-cultural interactions need to be identified. In each case it should be determined if concurrent instruction in the principles of GV teams course would assist in class interactions with the other culture. In this way the course would be used across the entire engineering program.

Third, uses for the course outside of the School of Engineering should be identified and implemented. This would require the discipline specific engineering content be replaced by the other disciplines' cultural influences. For example, if the business school had several cross-cultural teams as part of a given course or program of instruction, the engineering specific lectures would be exchanged for those relating specifically to business. Otherwise the course would be taught and used in a similar manner.

Conclusion

The Principles of Global Virtual Teams course provides an opportunity for students to have an important and productive cross-cultural experience in a time and money effective manner. The course is not intended to replace models that require face-to-face interaction of different cultures and travel to different cultures, but it augments these interactions. It models real world GV teams and introduces students to the social interactions through virtual communication technologies needed to successfully use their engineering skills. It not only creates a greater understanding of other cultures, but presents the opportunities and tools to take full advantage of those opportunities.

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