

AC 2010-1273: USING TECHNOLOGY-MEDIATED COLLABORATION IN THE TEACHING OF ETHICS & GLOBALIZATION

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Introduction

The Engineer of 2020 makes clear that enhancing engineering students' understanding of ethics and globalization is increasingly important. As engineers practice their trade in an ever more global business environment, the need for global experience and an understanding of engineering's role in the larger cultural context becomes more essential. While fundamental engineering and analytical skills remain the foundation of professional preparation for today's students, the ability to work in multicultural environments, understand the business context of engineering, and adapt to changing conditions have become requirements for engineers in our global environment [1].

Teaching ethics is increasingly a component of science and engineering professional education, reflected in the growing attention paid to ethics courses by accrediting agencies, particularly in engineering as reflected by requirements such as those in the United States instituted by its national engineering accreditation organization, ABET. Ethics is increasingly being integrated into engineering curricula, in recognition of the complex professional and personal issues facing scientists and engineers in modern workplace [2, 3]. It is essential that students understand that science and technology can be used for positive and negative purposes, and thus are not value-neutral. Developing the analytical skills necessary to recognize ethical issues is essential for students entering professional settings. Further, students majoring in scientific and technical fields must understand that they will be the decision makers for technology and science - it is not the autonomous force [4] that we usually assume - and that they need ethical reasoning skills in order to successfully navigate the modern world, whether as practicing scientists and engineers or merely as informed citizens. Ethics education, then, should offer students the opportunity to practice making and defending decisions about ethical issues and provide students with tools to help them develop their skills in formulating sophisticated ethical positions.

Global technology issues like industrialization, environmental degradation, and the rapidly changing nature of the workforce, involve ethical issues at a national and international scale [1]. Safety, privacy, the environment, accessibility, and the implications of the continued advances of technology are issues that every nation must address, both individually and as part of the world community. These challenges offer a highly relevant stage on which to examine the complex ethical issues currently facing those involved in the science and technology industry.

Course Descriptions

The courses, *Globalization, Technology & Ethics* and *Ethics & the Design of Technology*, are provided by the Penn State Program in Science, Technology and Society in association with the Leonhard Center for the Enhancement of Engineering Education. The courses explore topics of critical international and economic importance: global manufacturing and technology use, off-shoring, outsourcing, international debt financing,

and restructuring of world economies based upon different models of globalism. Ethical issues related to these topics include corporate and personal responsibility as well as personal rights, whistle blowing, conflicts of interest, professional autonomy, risk assessment, the ethics of design choices for both use and societal impact, sustainable development and the place and purpose of engineering codes of ethics.

The courses were taught simultaneously at four campus locations via video conferencing tools. Lectures were held synchronously two times per week for 75 minutes each period; the instructor and the majority of the students attended the class in person at Penn State's University Park location, while the remainder of the students attended remotely from three Penn State campuses: Berks campus in Reading, Pennsylvania., about 150 miles from University Park; and New Kensington campus, about 130 miles from University Park; and York campus, 115 miles from University Park. The video conferencing system allowed for real-time video and audio, and students at the remote location had access to technical support personnel.

Communication barriers are inherent in geographically distributed courses. The loss of in-person conversations and non-verbal cues can be a challenge for students to overcome. However, hand-in-hand with these disadvantages are a host of opportunities for students to improve their skills in working within and leading distributed (or virtual) work teams. Ongoing changes in globalization and technology are necessitating corresponding changes among work organizations requiring more flexible approaches that are less bound by physical offices and time zones [5]. As such, the distributed nature of the courses offered students a chance to develop skills in: working collaboratively using technology tools; leading a team from afar; and learning strategies dividing work and building trusting within a distributed team, all skills that are likely to be requirements for engineers in the future workplace [5].

Enrollments for the courses were 18 students in spring semester 2008; 28 students in fall semester 2008; 20 students in spring semester 2009; and 32 students in the spring semester 2010. The students enrolled in the courses represented a wide variety of academic majors, with half of the students coming from the College of Engineering, most as pre-declared general engineering students, and the remaining half from a number of different colleges across the University. Among the non-engineering students, half were pursuing studies within the College of Information Sciences and Technologies. The majority of the students were male; only 10 students of the total 98 enrolled in the courses were female.

Much of ethics teaching revolves around asking students to take positions on complex issues and defend those positions against critique. The hope is that students, with experience, are able to apply the ethical frameworks they have learned in class to the cases that they are discussing. These frameworks include such ones that consider consequences of an action (utilitarian), ask about societal norms (relativism), or consider the context of a situation (situational), as well as contracting self-interest (egoism) and absolute rights and wrongs (deontological ethics). These are provided to make students realize that there is not always one 'obvious' ethical answer to problems and that often

ethical frameworks can collide over the solution to a problem. Throughout the semester, students were asked to individually analyze examples of international technologies and identify the ethical dimensions involved in the examples. At the end of the semester, students were placed into small groups and asked to collaboratively analyze an ethical case study that included global and technological aspects. Given the parameters of the course assignments, the decision was made to utilize collaborative technologies for the courses: student blogs, student-created video, and project Wikis.

Student blog entries were pulled together into one webpage for ease of reading by the community. In addition to aggregating the various student blogs, the group page, or “course hub” as it was called, allowed students to vote on the blog entries that their peers had written. Essentially, this voting capability allowed the group to promote entries that they found compelling or well-formed. Students could utilize both positive and negative votes, and leave comments to their peers explaining what they thought about entries.

The purpose of allowing for student voting was two-fold: to build more of a sense of community by providing students with another way of interacting with one another; and to prompt students to make evaluations about the arguments that their peers put forth.

In the Spring 2008 & spring 2009 offerings of the course, students were assigned to teams and asked to create a 5-7 minute documentary-style film addressing a technological issue from an ethical perspective. Groups were required to present statistical data about their topics within the documentary. This requirement necessitated group research into the chosen topic, in addition to the crafting of a narrative stating ethical stances on issues related to the technology.

In the fall 2008 offering of the course, the instructor made the decision to shift to a Wiki platform for group projects. To analyze case studies of ethical challenges in the design process, students created Wikis on the University’s Wikispace platform that they used in groups of three. After the groups posted their analysis of global technology case studies, their peers evaluated their Wiki sites and students proceeded to modify their Wikis based on this feedback. Projects were analyzed by students using specific ethical principles with extensive links to existing sources of information and their own analysis about where ethical challenges existed in these cases. For example, students examined the challenges behind technology transfer to developing countries – the quest for technological solutions that would also work economically and socially in Bangladesh where digging drinking water wells resulted in ground water contaminated with arsenic.

Teaching Tools to Promote Reflection and Collaboration

Blogs

Because the nature of choosing a moral stance is a personal one, the decision was made to employ blogs as a means for students to write reflectively about issues related to globalization and ethics. Weblogs, or “blogs” as they are commonly known, are essentially web pages in a diary format, centered on a particular topic. Blogging has

grown at a rapid pace in both number of blogs and influence, and some consider blogs to be the signature technology that represents the “collaborative web” ethos [6].

Blog posts, relative to other written works, are typically concise and frequently updated with new content. In addition, most information shared via blogs is mostly subjective in nature. Although facts and events are commonly referenced, editorial analysis of and reflection on such information is common in blog writing [7]. Despite the increasing availability of blogging tools for a number of years, only recently has educational research regarding the use of blogs begun in earnest. The use of blogs as a writing platform has been shown to contribute positively to students’ engagement with course materials [8] as well as to offer benefits in the areas of personal reflection, knowledge sharing and debate [9].

In addition to motivation and reflection, blogs can enhance student competence in making and defending judgments. By challenging students to develop a clear voice of their own, subjective blog posts ask students not only to formulate and stand by their opinions but also to ground them in contemporary (or historical) knowledge. Students are forced to confront their own opinions and contemplate how their views might be interpreted and reflected upon by others [10].

Many of these benefits related to taking and defending positions rely on blogs’ enabling of comments to posts. Comments allow readers to leave their opinions and perspectives on the blog’s pages, providing an element of feedback to blog authors. This dialogic element of commentary can then enable discursive knowledge construction due to the natural tendency for reflection and analysis such feedback triggers [11]. The result can be an increase in the level of meaningful intellectual exchange among students [12].

Research has also found benefits beyond writing blog posts for students; the act of reading peer blogs provides benefits in and of itself. Reading without interacting, or “lurking,” can be seen as passive or vicarious participation; however, this behavior can still help to increase understanding and may provide a sense of belonging or community within the group [13].

The public nature of blogs has resulted in some interesting findings as well. Typically, blogs are openly posted on the World Wide Web, ostensibly accessible to anyone with an Internet connection and a web browser. Public blog post writing has been found to be more concise and focused, due in part to students’ desires to appear competent and articulate to a public audience [14]. This effect is thought to be related to elevated expectations that students have for the quality of their posts when they are aware that others may view their materials [15]. Students who navigate outside of the traditional student-teacher relationship and choose to share their work with a wider audience see a greater potential for collaboration and feedback from others, promoting a more active form of learning [16]. This “performing” for potential readership may be in the minds of students as they create an argument or posit a theory. This, in turn, helps to develop skills among students in critical thinking and argument creation [12].

Inherent in any new approach are risks that students will not respond well to the innovation. This is true of blogs as well, as research literature points to examples of courses that saw no benefits from blogs in terms of engagement or student motivation [17]. The public nature of blogging can carry risks as well, in that students may feel an increased level of uncertainty about the public nature of their writing because the potential audience is unknown and diffuse [18]. As with all instructional technologies, it is important to be aware of the possible hurdles that may come along with implementing a chosen approach.

Student-Created Video

The tools available for the assembling and editing of video have seen a rapid development in recent years, with the availability of free or very low-cost software tools lowering the barriers for entry into video production [19]. This level of access has had an impact on education, making it possible to assign projects that were once too resource- and time-intensive for students to complete in an average semester.

Pedagogically, the creation of videos requires a depth of involvement with the materials through several project stages: idea brainstorming, scripting the narrative, storyboards that lay out the narrative, recording video footage, and finally distilling the information and assembling footage into a finished product [19]. Depending on the requirements of the assignment, the video projects might then leave the formal learning environment for broadcast to the outside world through video sharing sites. This production process, and the varied skills it requires, is as important as the finished product itself [20].

For many students, course-based video assignments may be their first foray into digital production of non-static content. For these students, the risk of failure in a new creative endeavor can be intimidating [21]. At the outset, students are likely to have serious questions about the exact expectations of such an assignment [20]. The benefit of a production-based assignment, however, can be a class that is actively involved, stimulated, and enthusiastic about the approach and its ability to bring course topics into focus [20, 21]. This motivation can also be buoyed by the freedom and responsibility that a complex video assignment provides [22].

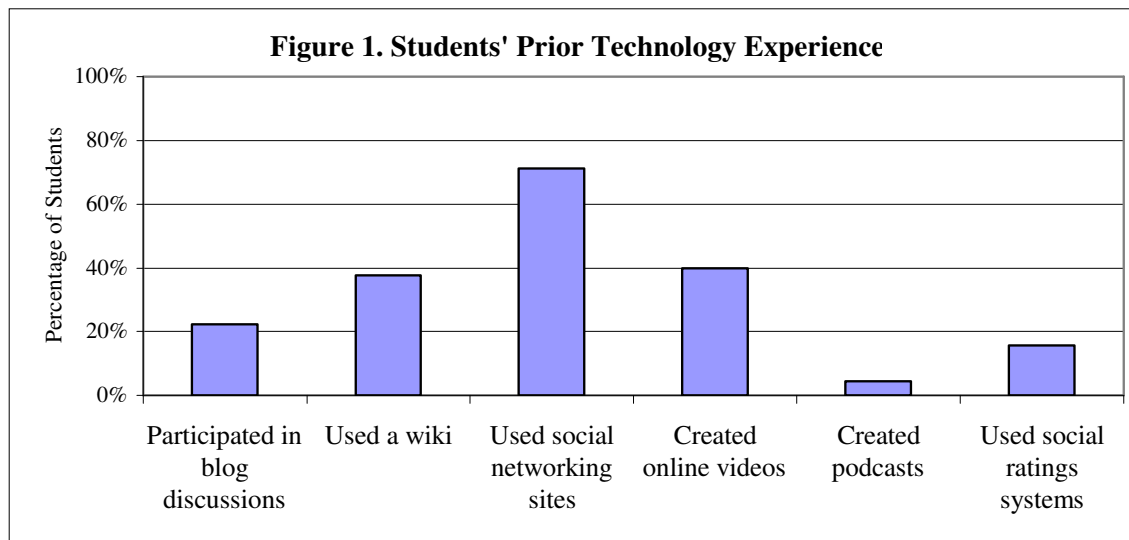
Wikis

Wiki platforms, in which students collaboratively authored materials, were identified as potentially useful in evaluating ethical cases. Wikis are web-based tools provide collaborative tools for writing. The primary advantages of Wikis as an authoring environment are ease of use and tracking of student work [23]. Wikis are in essence web pages that students can easily create and edit. They allow for the embedding of media elements such as pictures, video, animations, and links to additional resources. Given the visual nature of the technology cases the students were assigned, the ability to add media was seen as a benefit over traditional report writing.

Assessment Instruments and Analysis of Results

Students enrolled in the courses were asked to complete three online surveys throughout the semester. In accordance with the university policy, study approval was obtained from the human subjects review board. Participants completed an informed consent document providing permission to use their data in the research project. An initial course survey was administered during the first week of the course to gather information about student backgrounds, previous experiences with technology to be used in the course, and possible concerns of the course plan and assignments. A second survey was offered mid-semester to ask students their perceptions of the course including thoughts on blogging and group experiences. The final survey was administered during the last week of the course and focused on students' preferred methods of assessment, perceptions of the assignments, and suggestions for improving the courses. The response rates for the surveys were 68% over the first three semesters (the fourth semester is currently ongoing; initial and mid-semester surveys have been collected, with final data collection to take place at the end of the semester).

Based on the responses to the survey, many of the students enrolled in the course had previous experiences with collaborative technologies. Figure 1 displays the frequency and percentage of students who stated having various technology experiences before participating in the class. Though a proportion of the students were experienced with technology, the majority (82%) of responders had never published any content to the Internet.



In terms of specific technologies, the majority of responders felt that their blog writing skills had improved over the course of the semester (54%), though many (39%) were neutral regarding its impact.

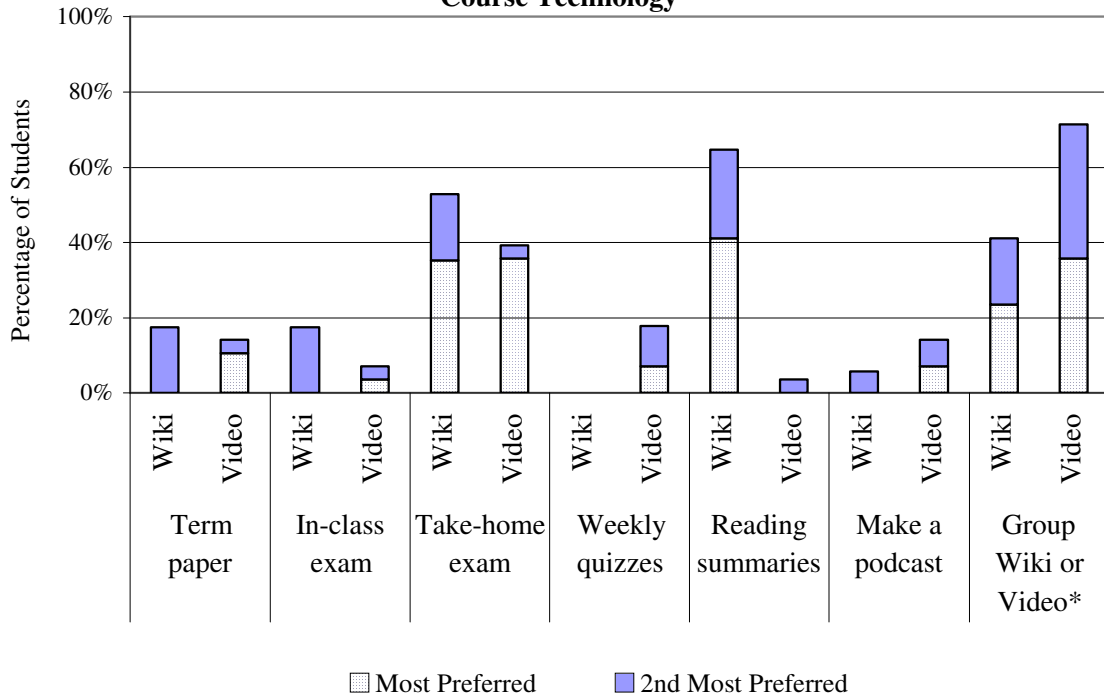
End-of-semester survey results indicated that the “course hub” approach of aggregating student work and allowing students to vote on peer posts did not appear to increase student interest in blogging for most responders. Only 29% of students felt that

commenting and/or voting on peer posts had any impact on their interest in blogging or understanding of course material.

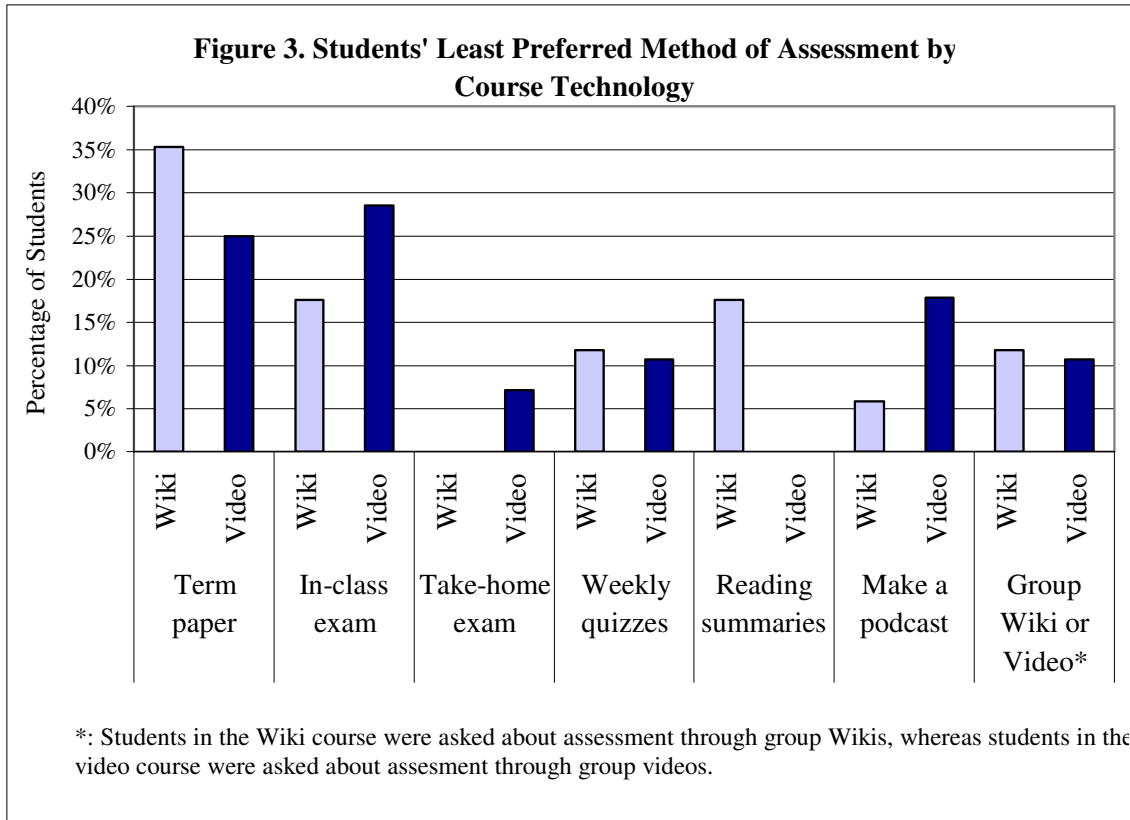
Student responses to the group Wiki assignment in the final course survey indicated an overall preference for the Wiki-based project when compared to a more traditional written report; 53% of students stated a preference for the Wiki assignment over “more traditional class assessments.” When asked to rank their assessment type preferences as “most preferred, second, and least-preferred, the Wiki assignment was somewhat favorably received (Figure 2).

Responses to the group-based documentary video assignment were somewhat more positive. When asked to rate preferred methods of assessment, students indicated a strong preference (82%) to the video-based assignment over more traditional alternatives. When asked to rate assessment preferences as “most preferred, second, and least preferred” from a list of options, the vast majority of the students expressed a preference for the approach with 94.1% stating that making a video would be either their first or second most preferred method of classroom assessment (Figure 3). When asked to explain their answers, reasons for the majority preference of the video assignment included difficulty or anxiety with taking traditional tests, ability to work in teams, incorporation of creativity and critical thinking, ability to apply learning to a tangible product, and familiarity with creating videos.

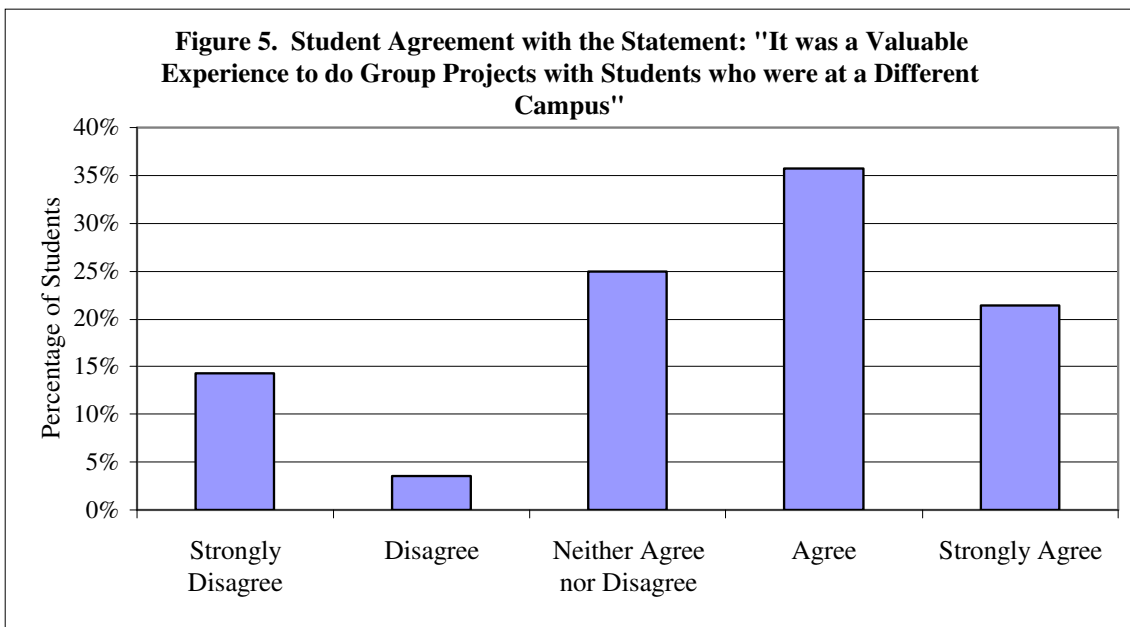
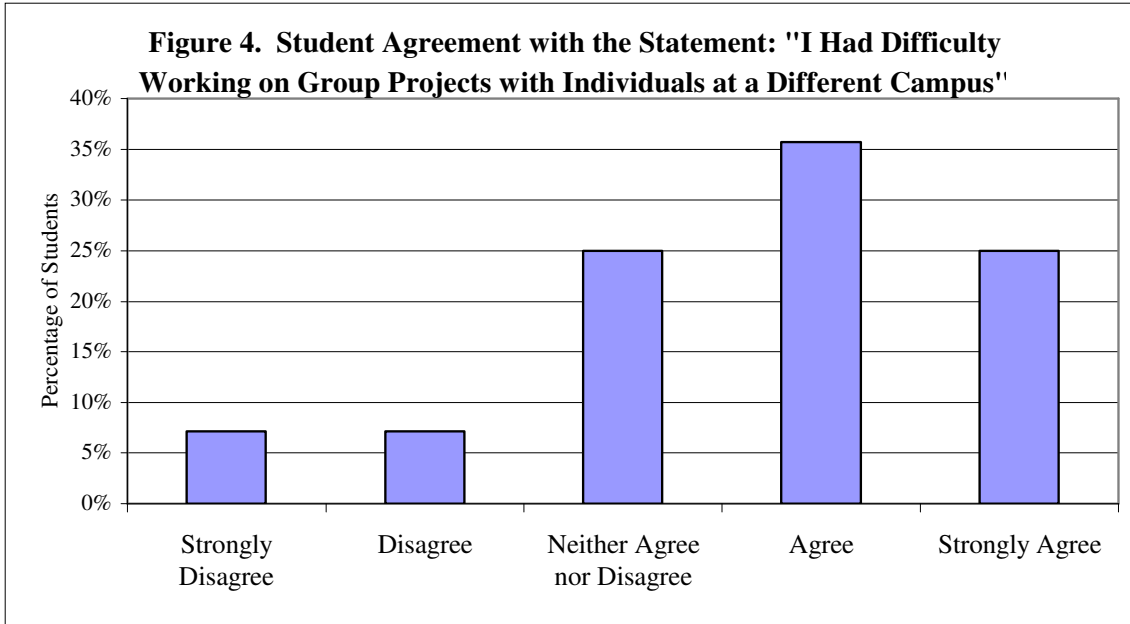
Figure 2. Students' Most Preferred Methods of Assessment by Course Technology



*: Students in the Wiki course were asked about assessment through group Wikis, whereas students in the video course were asked about assesment through group videos.



Though students indicated that working in distributed work teams was a struggle (Figure 4). The challenges of working on a group project with team members who may be one hundred miles away introduced an additional layer of difficulty to the assignments. However, despite these challenges students did perceive value in the experience of participating in the distributed teams (Figure 5).



Assessment of Technology Use

The video projects seemed to help students' understanding of the main course concepts in how globalization and ethics relate to technology. One student said, "Ethical issues are more important than I realized. Doing this assignment helped me learn about the ethical issues in distracting technologies." (Distracting technologies are those technologies which are not created to fill any demand, but rather literally or figuratively turn our attention away from more important concerns.) Another student said that the benefits of

the assignment included “being able to create ideas and themes that other persons can relate to and to express the ethics of a situation tastefully and non-controversially.”

In terms of video projects as an assessment tool, student comments related to the synthesis of information and possible retention of that information were encouraging. As one student remarked, “I learned a ton more than I would have if I was to do just an examination. So the valuable thing that I got was the information that our group learned, and I believe that we will remember this video more so than if we were to take an exam that if I wouldn’t keep studying for I would forget by next week.”

As with the video projects, one of the goals of the Wiki-based assignment was to prompt students to think reflectively about the ethical cases. Ethics and technological design challenges can trigger questioning of assumptions and doubts that can lead to reflective thinking and deeper learning. There were a few examples of these within the Wiki assignments where students extensively revised and recreated content on their Wikis after discussing their case studies with peers.

Student comments about Wikis reflected the survey data in that the assignment was not uniformly well received. Comments ranged from “The Wiki allowed me to take what I learned from all 3 papers and make something I’ve never done before” and “I found it valuable to connect and work with others you never met,” to “Creating Wikis added no value what so ever. Working with groups over distance proved non productive, impossible to get a hold of group”. This wide range within the comments indicates that there are many dimensions of distance education and technology incorporation in classroom discussions that need further research. To the extent that there was some evidence of collaborative learning and sharing, the course achieved its learning goals, albeit modestly. The end of semester survey indicated that students felt they had gained career skills, some felt they had gained life skills and their work offered evidence that they had a good grasp of the academic content.

From the point of view of the instructors, the opportunities to teach a class using Web 2.0 technologies as well as tele-teaching a course to non-co-located students was both appealing and approached with some trepidation. Experimenting with both new modes concurrently did indeed make the courses a challenge, but one that began to clarify the role of distance education and emerging technologies in the classroom. In both cases, these novel approaches (for both instructors) required us to rethink our pedagogy both in terms of information delivery, student learning, and the facilitation of student interaction. The Web 2.0 technologies were more easily integrated into the class structure, though they demand different feedback from the instructor and can change the pace of that feedback. In particular, they do require more constant monitoring of discussion lists and blog comments (or seeding discussions to make comments occur) outside of class hours, which may be considerably different than the cyclical grading associated with more traditional homework sets or tests and essays. The perception from the instructor is therefore that this mode of instruction may take more of her or his time, or at least demand it more continuously in short bursts than they are used to.

The distance component of these courses opened exciting possibilities for interaction

between students on different campuses, though in the end it was found that the technologies chosen had certain limitations that added some frustration to the courses. Beyond discovering, to our surprise, that different campuses had different class timeslots (which made finding a common 75-minute block challenging), we found that the technologies installed in our video IP classrooms were better suited to ‘push’ teaching than to collaborative multi-site interaction. ‘Push’ teaching—that is, the more or less unidirectional delivery of information via video and sharing a view of the podium screen (i.e., for Power Point™ slides)—worked very well and can easily be used to deliver courses to multiple, distant locations. It is even possible for the feed to be viewed on any broadband connection, though with the loss of any return communication ability. Group interaction, however, was hindered by the system in that only one site could effectively have the microphone at a time: the video feed automatically switched to the dominant microphone and the desktop microphones were so sensitive that they needed to be muted lest they pick up every rustle, murmur, or under-the-breath comment at the remote sites (leading on occasion to the comment, “we heard that... your mike is on, you know”). In addition, although we specifically formed groups across the campuses to force students to experience working with non-co-located teams, we were surprised at how unable or unwilling these teams were to find a common meeting time or work asynchronously. The classroom technology only had one audiovisual channel so only one team could utilize it at a time, and that had to be during class time due to room scheduling difficulties, so we realized that the system would be excellent for two sites, but as the number of remote sites grew, the more the technology increasingly cornered us into ‘push’ teaching mode. In the end we needed to reconsider the delivery technology mechanism.

Conclusions and Directions

Based on the feedback collected from instructors and students, we are implementing several changes to future iterations of the courses. The most drastic change is the move to a completely online course format that will not rely on videoconferencing and instead utilize a more asynchronous approach. Course content will be presented in the form of web pages, with heavy use of rich media (graphics, audio & video) and interactive elements. This change is a result of two factors: problems with the logistics involved in teaching via teleconferencing equipment; and the potential of online interactive tools to present course materials in a way that may be more engaging and relevant to students.

As a part of the course overhaul, the video and Wiki projects will be replaced by an online collaborative presentation platform called VoiceThread. Developed by the University of North Carolina, VoiceThread allows instructors or students to build online presentations and narrate, annotate and share those presentation files online. Viewers of the presentations can then contribute comments or questions to the original file. Comments can be made in text, voice, or video formats, allowing viewers a rich set of options for making their opinions known. VoiceThread also allows for easy incorporation of media elements, like maps, photos, or video clips. VoiceThread will be the platform for student case studies in the course, allowing students to create media-rich cases that peer student groups can then evaluate. As mentioned previously, collection of data

regarding VoiceThread's effectiveness is currently ongoing for the spring semester of 2010. Early results are encouraging, with 83% of responders to the mid-semester survey claiming that VoiceThread presentations has had a positive impact on their understanding of the course materials. The remaining 17% felt VoiceThread had no impact on understanding the materials; none of the students indicated a negative impact. This information, along with the final data collected at the end of the semester and faculty evaluations of project quality, will inform future directions for the course.

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