CHAPTER NINE

TAMING THE ELECTRONIC FRONTIER

Overview

Taming the Electronic Frontier, the Paul Allen Virtual Education Foundation Outstanding Online Course Award winner, artfully combines theory and practice to prepare students for the challenges of the rapidly changing work world. The course is interdisciplinary and "…explicitly integrates: Technical skills in web publishing, Writing skills, Philosophy (What is Quality? Value?), Interpersonal skills (group dynamics)" (Vol. 9, p. 6). Students learn to "Use the right tool for the job philosophy" (Vol. 9, p. 6) by creating real-world products that must meet the test of Quality. Teams work on group projects that they develop for external customers and must meet the firm deadlines. A special "…web-based coordination tool" created by the course author and supplemented with "…email, chat rooms, web-crossing and telephones" assists students. All of these things are guided by the course philosophy of, "Use the right tool for the job philosophy" (Vol. 9, p. 18). Although the course uses television and videotape to deliver lectures, they are not key to its success but merely provide the background and direction for experiential activities. This course can successfully handle large enrollments of 50 to 100 students particularly because of its unique, technological automated features. Dr. Brad Cox, presently with Virtual Education and formerly at George Mason University (hereafter GMU), is the course designer, developer, and instructor.

Course Design

Every course has design—or lack of it—and good course design separates Taming the Electronic Frontier (hereafter TTEF) from a plethora of insipid online courses available on the web today. Although this course features learning technology, it is not a technology course per se because it goes far beyond merely learning HTML codes and CGI scripts. Cox describes the nature of the course:

> This course emphasizes dialog between producers and consumers of information age goods via television, telephones, and the internet; even face to face meetings when that's the right tool for the job. Organizational learning exercises, based on these technologies, will challenge power relationships between teachers and students, producers and consumers, universities and customers, broadcasters and listeners. These new relationships, in turn, provide further chances for learning and collaboration. (Vol. 9, p. 80)

People¾ not technology¾ are at the center of this unique course, and this unexpected fact sometimes throws students off when they begin the course because they want to bury themselves in the technical aspects rather than deal with ethical issues, philosophy, human relationships, group dynamics, or quality.

The course is divided into two sections. The first five weeks emphasize technical skills while providing a beginning background of philosophy for the coming tasks and,

> …will bring us all to the point where we see telecomputing infrastructures as just plumbing. It will disappear into the woodwork to become an invisible window through which *people* communicate, cooperate, coordinate and complete as members of an advanced electronic community. (Vol. 9, p. 80)

The second section of the course starts integrating and applying philosophical principles to real tasks. Cox, explains, "The final ten weeks will concentrate on sociocentric skills of working effectively in virtual and/or physical teams, fluidly choosing and using the right tool for the collaborative jobs at hand" (Vol. 9, p. 80). One student described this artful balance in TTEF: "This course was like a well prepared meal

that has enough interesting things to eat – of the theory and practice dishes" (Vol. 9, p. 200). Cox sets up the course as a preparation for the new challenges of the work world in which students must survive and flourish.

Instructional Design

The instructional design of Taming the Electronic Frontier includes many unique features. First of all, it is an interdisciplinary course. Cox believes that theory and technical skills need to be integrated and that,

> …the ongoing disputes between 'academic rigor' versus 'relevance to industry' factions are fundamentally misguided and wrong. I've tried to show that both training and education can be delivered in a single course without diminishing either. For example, most students sign up expecting a course in html coding tricks. But they soon discover that the course spends as much time on philosophy (what is quality?) and on interpersonal relationships (group dynamics). Based on student feedback, this seems to be a winning formula that I'd love to see more widely adopted, both within academia and within industry. (Vol. 9, p. 20).

Active learning is a principle piece of the instructional design. "The primary teaching technique is experiential learning," Cox remarks (Vol. 9, p. 6). Regular instruction is given through lectures, required text readings, and web links. Then students almost immediately apply what they have learned to real tasks thus using new technical skills to work while applying theory to guide the development of those tasks.

Course Supports

Every course has supports that hold up the instructional design. This course has some special features that either are done very differently or are completely original such as the Student Lockers and Weekly Tasks.

Syllabus

TTEF's online syllabus does not fit the typical format yet includes everything that students need to know to be successful in the course. Before students can begin working, however, they need to set up a non-proprietary Internet account and configure their browser correctly. All the necessary information that a student needs is included within several introductory pages. The syllabus covers Television Requirements, Telecomputing Requirements, and Textbook Requirements.

Once all the technical items are covered, then comes the meat of the course which includes Learning Objectives and Competencies both Practical and Conceptual. Brief philosophical explanations of where the course is going and why are given to prepare the student for some remarkable differences in this course as compared to many traditional courses either f2f or online. The Weekly Assignment schedule is included in the Syllabus, detailed descriptions of the tasks are reserved for the weekly pages. Nevertheless, the schedule gives the students a comprehensive overview of what to expect and when.

Student Lockers

The TTEF virtual student lockers are much more powerful than physical lockers at a f2f school. In f2f situations, students keep their texts, notebooks, assignments, gym clothes, and other personal items in the lockers. The virtual student lockers at TTEF, however, are somewhat similar yet also very different. TTEF lockers are created and set up by Cox who defines the locker as "simply a dynamically-generated web page which is the first page they encounter when they enter a course," (1998a, p. 3). He continues "…this page does not display everything they might ever need to know about the course (signal + noise) but just what they need to know to be successful this week." Further,

"…it shows only tasks that have been assigned but not yet accepted as complete." If students want to see the entire list of all the tasks and the complete schedule, they must access different pages from hotlinks on their locker pages. Additional resource communication hotlinks are provided as tools to be accessed when needed. They include web conferencing, chat, email, and telephone numbers. The Student Locker is an example of coordination technology that helps separate signal (timely and important content) from noise (not timely and important) and can help busy students focus better and manage the information overload that often accompanies students in online courses.

Lectures

Taming the Electronic Frontier includes weekly lectures as support for learners, as noted previously, and they are distributed in three ways: local cable TV, videotapes, and f2f in the GMU TV studio. Cox continues to use these methods until better technology comes out that successfully addresses bandwidth issues. Cox does not consider the lectures, however, to be the most important part of the course, as he points out:

> But television is the least important and most expendable and problematic part of our infrastructure. Its bandwidth requirements inhibit the potentially global reach of this course. But most of all, it perpetrates and reinforces the traditional stand and deliver approach to education. (Vol. 9, p. 22)

A student concurs with Cox on the value of the lectures, "I did not really get much out of the lectures because everything I needed was in the required tasks" (Vol. 9, p. 200).

Weekly Tasks

The Weekly Tasks provide experiential learning activities for students to develop budding skills and to apply philosophical principles. These activities are like training wheels for a new bike rider: they support the student while he learns to get his balance in

developing valuable technical skills and in applying key, theoretical principles. The tasks vary in content and style as Cox points out,

> Each task presents instruction, invites the student to put it into practice and report the results in the context of the material that preceded this task. Some tasks have students read web-based or paper-based material, summarize what it says, and demonstrate that they have applied each lesson to their web-based portfolio. Other tasks, such as the desert crash simulation, portfolio peer assessment, and web-based sociometric tasks, take a more quantitative approach. (Vol. 9, p. 19)

Individual Portfolio

Each student starts building a web-based portfolio right from the beginning of the course. Many of the Weekly Tasks set up an additional phase of construction concerning technical aspects and quality of content of the portfolio. The students can choose any topic they want for their portfolio, and they are told early in the course that they will need to make the portfolio desirable for their peers. Some do not fully understand why this counsel is given until the market-based assessment process begins, and then the reason becomes very clear. The activities take the students through a directed process of building the various parts of their web site. Cox relates,

> The apparent purpose is to demonstrate newly acquired technical skills. However students gradually become aware that there's a larger purpose, which is to raise the theoretical question, 'What is Quality', in connection with the practical question of what should be included in, and what excluded from, a published work. Since quality and value (particularly objective, subjective and intersubjective meanings) have been introduced in advance, students have a theoretical vocabulary to apply to a practically grounded task. (Cox, 1998a, p. 1)

The process of evaluating student portfolios will be described later in the Assessment and Evaluation section.

Team Project

Group projects are a tremendous undertaking at any time but especially when they are done virtually or largely so. The team project comprises the major part of the course

grade. It is the laboratory where students—in teams of five to eight—learn more about human group dynamics and the foibles of technology when under pressure. Cox describes the purpose of the team projects, "The goal is to foster cooperation between teammates, for example, by encouraging experts on each team to help their teammates to succeed" (Vol. 9, p. 19).

The project varies from semester to semester but is usually open-ended such as, "Use what you've learned to make the world a better place" (Vol. 9, p. 19). One year he used a deceptively simple project: "1) Organize into teams and choose a team leader and a librarian, 2) Pick any breakdown that has annoyed you this semester, 3) **Eliminate it** for 30% of your grade in this course" (Vol. 9, p. 23). Normally students are adept at complaining about university problems and shortcomings, but Cox turned his students into "active change agents" (Vol. 9, p. 23). He adds, "Although bureaucracies can easily intimidate individual students, this doesn't work with scores of eager students applying what they've learned to make things better for everyone" (Vol. 9, p. 23). At other times he had Digital Product projects which he describes,

> The requirement for these is to build a web site with enough real value that other people will pay money to acquire it. These have been remarkably successful at turning unskilled strangers into cohesive (and usually profitable, at least on a small scale) virtual enterprises in just 15 weeks. (Cox, 1998a, p. 2)

Students have done some remarkable web projects for the GMU departments and projects, such as the Career Center, for outside non-profits, such as Pet Centers, and for government entities, such as Department of Agriculture and the U.S. Marine Corps. In addition, students have also developed projects for industry.

Interactions

Most people expect that the remarkable features of this course are technological, and, in fact, there are many wonderful technical aspects of Taming the Electronic Frontier. Cox, however, explains the unique value of this course:

> Although the innovations are usually perceived as technological, the actual innovations are technology-enabled pedagogical approaches such as experiential learning in collaborative learning communities. Technology is only the enabler, and no single technology is sufficient on its own. Diverse technologies can be deployed in combination to achieve more than any one can do on its own. (Vol. 9, p. 24)

In order to create an experiential learning environment, Cox set up certain interactions or multi-way learning channels. His goal was "…to put most of our emphasis on internet's compensating ability to weld students into experiential learning communities" (Vol. 9, p. 22). The technology was used to support a productive community that could not have existed as well—or at all—without it. Yet there are some cautions in developing a virtual community. Students can be overwhelmed with the volume of email they must read. Cox claims an original solution to this dilemma:

> Most web-based education provides exploration-style interfaces: typically a syllabus, web-based readings, and a chat or discussion tool. I tried this early in this course and discovered that busy students do not have the time for unstructured exploration and reading what other students have to say about a topic. This led to the far more structure approach that I use now. The coordination technology simply compares what each student has accomplished with the course agenda and presents only they must do next to succeed. (Vol. 9, p. 20)

The goal of any course is to help all students to learn. Yet often there are some students in traditional courses who do poorly. TTEF, however, improves student success by showing them only what they need to see individually, so that,

> …even 'poor' students will do well because it shows them what they must do to succeed. Grades are almost all A's with a few B's with very few C's and below. Considering the 'Why can't Johnny learn' angst in the media, an approach that keeps even marginal students on track deserves very close scrutiny indeed. (Vol. 19)

The Student Lockers show students only what they have not completed for the week. This automatically updated individualized list of activities with their due dates and times simplifies life for students. It is a powerful feature that helps students not to be as overwhelmed with too many kinds of supporting information. A common complaint of online courses is that students tend to see everything as required rather than as enriching or optional even, if these things are noted as such. Thus, it can be difficult for some students to figure out what they really need to do and what is optional so they can ignore, if needed.

Teacher/Student

Cox explains his function in Taming the Electronic Frontier, "I see my role as a teacher as coach, mentor and facilitator, 'the guide on the side, not the sage on the stage'" (Vol. 9, p. 18). His function is partly given through,

> …a sequence of 14 web pages, one for each week of the course. These weekly pages provides announcements, a synopsis of the material to be covered in the lecture, required readings, optional references, and the task assignments for that week. (Vol. 9, p. 22).

Cox coaches or facilitates the students through new content by providing them with the needed materials and links, and often follows up with individual or group messages through the class web site. All this information connects with the lectures.

Email, phone calls, fax, chat rooms are additional ways that the instructor uses as a learning channel for his students as he responds to their individual needs.

Student/Computer

There are about 20 tasks that get the student intensely involved with his/her computer in building web pages. These tasks require, "…student-computer interaction during which students learn by experiential immersion in the problem domain" (Vol. 9, p. 22). Everything in the course supports experiential learning.

Student/Student

Computers are known to cause even the most technologically proficient people to become frustrated and turn to others for help; this is even more true for those who are new to computers or to web technologies. Cox relates, "Although a certain amount of frustration is an inevitable and essential part of the experiential learning process, students regularly encounter difficulties that can only surmount by having someone to call for help" (Vol. 9, p. 22). This creates the perfect opportunity for students to turn to each other for assistance in solving problems. Because there are so many different computer set ups and potential causes for problems, no one person has all the answers—not even the instructor. Thus students are encouraged to share their problems and solutions by email, telephone, or newsgroup. Cox states that in the first versions of the course "…the primary channel has been a class-specific newsgroup [News] in which students describe problems, post solutions, and otherwise discuss common interests" (Vol. 9, p. 22).

Many fear that technology will destroy relationships as Cox confirms, "The popular myth is that computers isolate. In fact, networked computers multiply opportunities for relationships" (King, 1997, p. 18). Therefore, he works to promote a human centric view in the course to develop a sense of community. Since team community and group dynamics are often part of today's work environments, Cox designed the group project to maximize the development of these relationship skills. In

fact, “Electronically mediated community building and teamwork are crucial features,” of TTEF (Vol. 9, p. 49). Because Cox “…was interested in how teams functioned in order to improve the structure and directions he gave to teams,” (Vol. 9, p. 183) he teamed up with Thomasina Borkman, a Sociology professor at GMU. She and some of her students conducted some casual research on several of the virtual groups near the beginning of one of the early sessions. Borkman studied two poorly functioning teams and concluded with some observations and recommendations as summarized below:

- The course requirements are perceived to be extremely demanding in terms of time and difficulty by a number of team members.
- Multiple factors “caused” the poor functioning of these groups.
- People made assumptions that were unwarranted.
- The teams probably need more structure in the beginning in order to help them identify people who are not carrying their weight so that they can sanction them.
- Teams should be required to do a “contract” that is developed, agreed upon and signed by all persons as binding about one third of the way through the course.
- Conflict can be a serious problem in these groups; perhaps some specialized help in conflict recognition and resolution might be sought and taught to all the groups.
- A consultant who is not an authority could be made available to the group for help with problems of group dysfunction in order to catch some problems earlier. (Borkman, 1996, p. 6)

In fact, Borkman later volunteered to assist Cox as the consultant for virtual group dynamics in the course; the partnership worked well both for the students and for them. Afterward two of Borkman’s students, Fridley (1997) and Miller (1997), conducted further research on virtual teams in TTEF that functioned well. Fridley concludes with some cautionary advice,

> As video conferencing technology improves, people will likely become more comfortable with membership in virtual workgroups. However, members will have to be trained to work in this forum. And it still may be vital to hold an initial f2f meeting to charter the group’s purpose, business objectives, roles, responsibilities, and operating ground rules. (Fridley, 1997, p. 5)

Student/Teacher

Taming the Electronic Frontier has several ways that the students interact with the teacher. Cox details,

> Students return each week's task results electronically by exercising tools as they learn them. As each week's results filter in, I use special-purpose programs, written in Perl, to publish their results back to the web so that they can be accessed via a hotlink in the page that assigned each task. (Vol. 9, p. 22)

Since the task results of each student are automatically published at the class web site, all the students can view each other's work as soon as it is turned in. Cox sees this as good thing maintains that,

> The public nature of the results pages makes them an unusually powerful channel for teacher/student interaction. For example, I've written my programs to mark incorrect information with an ugly flasher. Since all work is public, singling out incorrect answers, even without explanation, is an powerful way of directing students attention towards problems I want them to fix. (Vol. 9, p. 22)

Student/Environment

Because of the types of projects that teams and individuals produce, students make an impact on their environment in many powerful and sometimes unexpected ways. Teams who were given the charge to find something at their university that was not functioning well and fix it, did just that. They found problematic situations, analyzed them with a fresh perspective, then designed and developed appropriate solutions. This caused many ripples at George Mason University. Cox points out the effect these students had on the GMU establishment,

> The initial mind set soon crumbled before the onslaught. A few of the old bureaucracy even left. The rest adopted a customer-oriented attitude that views student initiatives as the solution, not the problem. The university as a whole is beginning to consider how students can address breakdowns in other areas. We've even started aiming this powerhouse outside in search of more effective relationships between academia, industry and government.

Assessment and Evaluation

Cox believes that courses should evolve rather than be designed from the beginning but never changed. Because he comes from an industry frame of mind, he views the students as customers. He puts this belief into action by having students give him feedback after each lesson in a web-based form called “Talk to Me” and he encourages them to give him frank and open feedback which they are usually happy to do. This ongoing form of evaluation allows the instructor to make necessary course adjustments or address common concerns to the entire class when needed.

Perfection-based Grading

Perfection-based grading is an unusual feature of Taming the Electronic Frontier. Cox describes how he evolved into this type of assessment, “When I started delivering tasks and accepting student responses via web forms instead of on paper, I realized that an entirely new approach to grading was possible that I call perfection-based grading. I use this for parts, but not all, of the student assessment process” (Vol. 9, p. 90). Perfection-based grading is just what the term implies¾only perfect work is accepted. Students are encouraged to submit their work early so if it is less than perfect, they will have time to revise it and resubmit before the due date. “Tasks that are imperfect in any way simply get returned to the student for rework with instructions on what’s wrong and how to fix it. For simple problems, the instructions are web-based. For complex ones, the instructions simply say ‘Call me on the phone so we can discuss this’” (Vol. 9, p. 90), Cox further defines his assessment procedures adding that, “using telephones in this manner adds a high-touch option to the otherwise high-tech tone of the course” (Vol. 9, p. 90). He posts his telephone number on the web site along with the generous hours of

being available by phone: 10 a.m. to 10 p.m. 7 days a week. The only way students can loose points is be being late, since only perfect work is accepted. This type of grading may seem tough and arbitrary at first glance. S. J. King (1997), a student in one of the first classes expressed her feelings on Cox's implementation of perfection-based grading,

> How many professors post their home phone number all over the coursework, welcoming phone calls 10am-10pm 7 days/week? How many professors consistently require perfection from their students—*but not on the first attempt at completing a task, and after receiving professor feedback and advice.* These are examples of adding care to the Quality formula, with Quality in this case referring to the learning process. (p. 17)

In traditional grading a student turns in her work and gets back a grade that she is stuck with; whereas, TTEF students make sure that they submit their work early enough so they can make appropriate changes, if needed and resubmit their work. The only way to lose points by turning in the tasks and projects late. Cox's special programs are designed to "enforce due dates to the second" (Vol. 9, p. 39) which takes the pressure off the instructor. Students do not argue with the him to get deadline extensions because they realize it is the "program" that keeps track of their grades and determines when something is either on time or late; in addition, they accept that their work must be turned in by the deadline or ten points will be taken off per each week late. Cox expands,

> Travel obligations and minor medical emergencies do not excuse late work in these courses because you can easily submit work from home and anywhere else around the globe. Although I'll occasionally extend deadlines for the class as a whole, I cannot make exceptions for individuals. I'm not just being mean here; the slightest exception means changing the computer programs that manage your grades. (Vol. 9, p. 39)

Students understand that no work will be accepted at all after the end-of the-semester deadline. Again this is part of the custom-designed computer program function,

therefore individual exceptions cannot be made as he would have to reprogram the software.

Importance of Deadlines

Cox learned early that it is deadly in online courses to have only a couple of student assessments required at the end of the course. He reminisced, "Based on one (disastrous) experiment one semester, I strongly believe time limits on the order of once per week or so are indispensable. One end-of-semester deadline for everything is a recipe for disaster…people tend to procrastinate until so much work piles up that quality suffers" (Vol. 9, p. 92). This strong belief led Cox to develop a much more structured course than he originally made in the beginning.

Although the special computer programs that Cox developed automatically organize, record, and post student tasks and projects as they turn them in, he still has plenty of work to do. He describes how he handles student work: "The evaluation process itself is no different. I still have to read it and make comments" (Vol. 9, p. 92). Students appreciate this personal feedback as Beth, one of his students, expressed, "…you get constant one on one feedback from the professor. I can't think of any other professors who would be willing to make this kind of commitment to their students" (Vol. 9, p. 9).

Innovative Assessment Strategies

There are additional unique features of TTEF student assessment including, "…professional assessment, peer assessment, and assessment by the external customer to which teams deliver a semester project" (Vol. 9, p. 93). These assessments do not fit into perfection grading. The professional assessment is his own way of implementing and extending his beliefs.

Further, there are also exams and quizzes that would first appear to be like any other course, yet these are different. Cox explains,

> Another component of your grade is from exams and quizzes. There is typically a midterm around the fifth week of the course and an exam at the end. Whereas the exercises focus on specific technical topics, the exams and quizzes are designed to demonstrate integrated knowledge of the skills covered in the course. These are all web-based, take-home, open-book exercises. Unlike the labs and projects, which emphasize teamwork and cooperation, exams and quizzes are solitary work and are governed by an explicit honor code. (Potter, 1998, p. 39)

"The grading policy changes each semester," Cox notes; Sometimes student participation counts for 10% while other times his own professional "…assessment of the quality of their work counts as 10%" (Vol. 9, p. 19). Sometimes the team projects count as 30% and at other times 50%. This changing policy reflects Cox's ability to learn from each class and to be flexible. Being flexible is important in his online teaching.

Market-based Assessment of Portfolios

Yet another unique feature of TTEF is the method of assessing student portfolios. Cox explains that, "Quality of student portfolios is determined by peer assessment" (Vol. 9, p. 19) which is performed as market-based assessment. Each student designs and develops a portfolio that she must "sell" to her classmates who then critically examine it for quality and value. Here is the assignment as given to students:

> Good News!
>
> You have inherited 25.00 Trillion ElectroBux (TEB) from a wealthy electro aunt. They're in a checking account that this program will manage as your banker. The rules of this inheritance require that you spend it on portfolios that satisfy your Objective, Subjective and Intersubjective standards as Brad defined these terms in class. You may not keep it nor pay it to yourself. You must spend it all and earn what you can back from other students in your market. Everyone is bound by the same rules.
>
> Your role is that of consumer in this task. Producer-centric concerns should be submerged just as you aren't concerned about what the farmer must have gone

> through to produce groceries. Your evaluations must be based on your own Objective, Subjective and Intersubjective Quality standards, exactly as when choosing food to buy at the store.
>
> Pay each entrepreneur by using the menus to specify the number of TEB to pay to each entrepreneur. Use the text box to suggest how each entrepreneur could meet your expectations better next time. Provide constructive feedback of the sort you wish others would do unto you…helpful, thoughtful, honest, right from the heart, not pulling punches if punches are deserved, giving as much emphasis to what was done well as to what should be improved. (Potter, 1998, p. 6)

This authentic assessment plunges the students into a role that is traditionally the instructor's forcing a type of thinking that rarely occurs in typical courses. Cox's reflections on the results of this power and paradigm shift will be shared later in the Unexpected Discoveries section. Because this is such an uncomfortable situation for many students, Cox always limits the amount of points that the project receives so students cannot either knowingly or unknowingly seriously damage another student's overall grade because of a faulty assessment of the other's project. He clarifies that this is only worth about 2 percent of the students grade or about "…one task (out of about 20) is determined by a market-based peer assessment" (Vol. 9, p. 19).

Students are divided into "markets" to evaluate each other's portfolios. They perform their assessment on a web-based form that includes pull down menus for amounts to be paid. This web-form task also lists questions. These questions invite theoretical analysis of the portfolio as previously studied in the course with text boxes for narrative responses for each question. The total amount of money earned along with all the written comments for each portfolio are automatically compiled and posted. After analyzing the results, students are encouraged to improve their product with what they have learned from their peers, and then they participate in the final market-based peer assessment. Cox discloses, "Then the ranking process is repeated, this time knowing that

the revenue bell curve will be used to assign grade" (Cox, 1998a, p. 1). He adds that even though it is only a small percent of their grade, it "…is sufficient to cause considerable reflection on how quality relates to grades and their lot in life outside of academia" (Cox, 1998a, p. 1).

Cox suggests online students are more likely to be focused on examining the portfolio rather than on considering the personalities of people in the course. Thus, this type of peer-assessment works especially well with distance education students because they often have different types of relationships with each other than those found among students in f2f courses.

Team Projects

Since the team project is designed and built for a real customer who the team chooses, the customer determines the project grade. This strategy has worked well over the years for the team grade. But what about the individual team member's grade?

Even when instructors believe in the benefits of cooperative learning and group projects, they are often stymied on how to fairly determine individual grades. Since the teacher is not present with the group while they work, she cannot be completely aware of how well the group functioned or whether or not only a few people did the work while the others rode on the working team members' virtual coat tails. Cox devised an ingenious method of web-based, peer assessment that works well:

> Grades for individual team members are determined by flowing the team's grade to each member in proportion to the team's assessment of each member's contribution. This assessment is gathered during a project delivery task in which each member pulls down a menu to specify the contribution made by each teammate plus a narrative comment on their contribution. A custom end-of-semester grade reporting task provides this information to each student along with weekly averages, exam grades (if any), and so forth, including comments Thomasina and I make about their performance.

Team projects can be stressful to members particularly because there is a group grade and strict deadlines. As with f2f groups there are times when a member or two does not pull their fair share of the work. Since these projects are complex and the process for building them is intense, individuals need to know they will be evaluated by their peers on their performance in the group as part of the project grade. "I find that students respond better to pressure from their peers than from me, so I use this in my teaching," (Vol. 9, p. 19) Cox comments. This is not without its own challenges, however. The project grade is "…determined by a customer that each team chooses and specifies during this task" (Vol. 9, p. 19). One student reflected over this experience and on the course structure in regards to the balance between theory and practice:

> I believe that this course succeeds in this goal in that it has aspects that lead to a grade which incorporates outside results for work done, such as the Peer Evaluation and Client/Product, while also keeping academia involved with all of the other tasks. Somewhere in the middle, I walk away with some basic skills and understanding about Web publishing, and a broader liberal arts understanding of Quality. (Vol. 9, p. 202)

Course Evaluation

Most university courses have a standard course evaluation form that students are asked to anonymously fill out at the end of the semester. TTEF modified GMU's summative evaluation form that provided a positive twist by calling it, "Appreciative Inquiry." This promotes a constructive mindset rather than an invitation to "whine and complain." Students are encouraged to provide constructive criticism on a web-based form:

> Students complete the Appreciative Inquiry Form by selecting answers from drop down boxes or by typing constructive comments in text boxes. The web-based infrastructure allows the professor to immediately collate evaluation responses. This

> allows the students to view the information in histogram format. They can see where their responses fit in with the rest of the students' and the professor is given the opportunity to act on that information much more quickly than information from traditional evaluations.

The more quickly an instructor can get summative feedback, the sooner he can make the necessary changes in the course for the following semester.

Technological Aspects

Taming the Electronic Frontier is built on a custom-created Internet infrastructure that, "…relies heavily on cgi-scripting allowing the student to send and receive information. Information for each student is kept in a private course 'locker' accessed by password" (Vol. 9, p. 36) Students access their individual lockers for well-organized lists of the weekly activities along with their due dates and status.

Cox describes the technical underpinnings of the course:

> Each page of each task is not an ordinary static data file but a computer program that draws upon and updates an object-oriented database. This in turn relies on an underlying infrastructure that I developed from scratch, based on the Linux operating system, Apache web server, and Perl programming language. Developing the infrastructure and the tasks has been a full-time effort for the past five years" (Vol. 9, p. 18).

It takes much time to develop and maintain the web site and the system that supports it. Cox confesses that, "The time consuming part is developing the computer-based tasks, revising them each semester, developing the infrastructure they are based on, and ensuring that the system provides no-excuses reliability and transparency" (Vol. 9, p. 18). This is especially time consuming, he adds, because these things, "…are both technically and pedagogically complex" (Vol. 9, p. 18).

Although Cox originally used email, newsgroups, and listservs in the first versions of TTEF, he now uses, "Handmade web-based conferencing tools, built with

perl and cgi, that are technically superior. And since all required services are then provided over the web, a single name and password gives access to everything students may need" (Vol. 9, p. 25).

Changes in Course

Instructor/Developer

Dr. Brad Cox, formerly of George Mason University at the time of the Paul Allen Virtual Education Foundation Outstanding Online Course Award, created the instructional design and developed each of the technical aspects of the course including web site design and construction. He did this because, "…research goal is demonstrating that it is possible to provide a better learning experience in this way than I could ever do face to face in the classroom" (Vol. 9, p. 18). Cox is truly passionate about learning and improving the student's experience in online courses. He comes to the classroom from a non-typical background that includes,

> As co-founder of The Stepstone Corporation, a software development, training, and consulting firm specializing in object-oriented technology, Dr. Cox has both breadth and depth of experience, from executive management to hands-on software development. He has unusually strong credentials in public speaking, writing, consulting, teaching, and software research and development. (Vol. 9, p. 60)

His diverse experience and education include writing numerous books and articles, and founding a couple of national organizations. His doctoral work was in "…theoretical and experimental work in neurophysiology in an area that has since become known as neural networks" (Vol. 9, p. 59).

Unexpected Discoveries

Developing this course took much more time than Cox was accustomed to giving to on a regular course:

> I spend far more of my time on this course than my brick and mortar classes. However most of this time is spent as an investment in building a distributed learning community and infrastructure as part of my research goals. Now that the infrastructure is in place, routine preparation for each week's class is smaller since prior semester's task and weekly pages can generally be reused.

Cox shares another area that continues to be somewhat perplexing. The task where students "sell" their product to others in the class poses some problems, however, as he notes:

> Any shift in power from teachers towards students implies tension over differing ideas of quality. I regularly assign a task that instructs students to build an electronic 'product' (a web page) based on what they think their classmates might 'buy'. The grades for this task are assigned by 'selling' the products in an electronic market for peer assessment. I find it intriguing, but troubling, that students often assign high value to products that emphasize flash and glitter at the expense of academic substance. I look forward to refining this task to understand this better than I do now. But in the interim this is a clear caution that a careful balance of power between teacher and student is necessary instead of either extreme.

Challenges and Satisfactions

Being an innovative electronic pioneer has its drawbacks causing some major challenges for Cox. When asked what he would do to change the course, he simply replied: "Resign to get academia's lead foot off the brakes. Completed" (Vol. 9, p. 4). In fact, Cox resigned on January 1, 1999, to pursue his interests in "object technology, distance education, and superdistribution" (Vol. 9, p. 67). Faculty resistance was a definite discouragement and challenge as Cox wanted to push ahead with more innovations in online learning environments.

Administration provided further challenges in areas such as registration. One example is when the registrar's staff would tell students that there was a cap on enrollment when there really was none thus causing distress to the students who were

trying to get into the course. This also caused distress to Cox who was trying to get the students off to a good start in the course.

Another challenge occurred when students got so involved in the technical aspects of web page design and construction that they forgot all about content and quality. Cox laments the difficulty of "convincing students that it is content that matters, not glitzy graphics and fancy coding tricks. Nothing I do or say seems convince students that fancy animated graphics typically reduce quality as well as hearing this from their classmates" (Vol. 9, p. 19).

Despite the challenges, however, there were many positive experiences as well. "Student course evaluations" (Vol. 9, p. 4) were Cox's most satisfying aspect of the course. Many students consistently gave positive comments throughout the course on the weekly "Talk to Me" formative evaluation forms and also on the "Appreciative Inquiry" form at the end of the course. This is particularly remarkable since the course is truly rigorous for students. Here are a few samples of student comments:

> As I stated in my course critique there should be little if any change to the course structure and expected deliverables. I cannot think of a class that has challenged me as much as TTEF resulting in a fantastic feeling of accomplishment. I truly enjoyed every aspect of your course. (Vol. 9, p. 9)
>
> I actually found myself opening up to you, with my concerns as I went through this calss, and felt as though I had more direct communication with you than most of my other professors in more 'traditional' courses. I attribute this to your dedication, and your caring for this subject matter and your students. (Vol. 9, p. 10)
>
> I learned a lot, and am already applying most of it! (Vol. 9, p. 10)
>
> Brad, by far the most inovative course I've ever taken. There were times when I hated it and other times I saw the larger purpose. (Vol. 9, p. 12)
>
> This multidimentional/interdisciplinary course was a challenge for most of us. It was certainly relevant because of its focus on electronic frontier tools and issues. It was rigorous because of the heavy workload and sometimes difficult technical and

> intellectual (Persig) tasks. The best way to grow is to challenge your level of competance. Few courses are simultaneously rigorous and relevant as is this course. (Vol. 9, p. 203)

Reflections and Advice

Cox has many ideas on how higher education can address learning, "…that seamlessly integrates Rigor and Relevance, Education and Training, and Individual and Organizational Learning" (Cox, 1998b, p. 1). He has worked with a group on developing specific guidelines and recommendations for developing a new university but he also put into practice many of these thing in TTEF.

One of his recommendations is that universities should no longer expect content experts to develop and deliver online instruction by themselves, because usually they have neither the time nor the technical skills to do these things well. Teams of experts should be available to develop exemplary web-based instruction. Cox suggests the following roles: content experts, producers, developers, instructors, and reviewers. In addition, there are other needed roles to support instruction and learners: sales and marketing, product delivery, product development, administration, management, and research. All these roles are needed to provide excellent instruction and a robust support system.

Cox further recommends that higher education needs to rethink the length of courses especially when they are online. He observes, "If we expect to serve several diverse markets in a cost-effective manner, an alternative to the 'course' as the unit of reuse is crucial" (Cox, 1998a, p. 2). He continues,

> The traditional unit of granularity, the 3-credit course, is so large that reusing course materials within academia and externally within industry isn't possible. A solution is to define a smaller unit of reuse whose modules can be combined to create larger-granularity products tailored to the needs of each particular market.

Cox finally reflects over his experience in this course and with technology in higher education institutions and gives a solemn projection for the future of technology in education. He proclaims:

> Technology is merely an enabler. However what it enables is nothing less than human individuals, organizations and cultures, newly empowered to understand and misunderstand each other across time and space boundaries that have separated us since antiquity. The implications are too vast to be predicted, controlled or designed. Established institutions must either evolve to compete in this new global climate or be displaced by emergent new institutions who can. (Vol. 9, p. 24)

Chapter 8 References[1]

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[1] These references will be integrated with the regular dissertation references when all the chapters are put together.

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