A Hybrid Approach to Web Based Course Delivery for the Fire Safety Engineering Technology Program at UNC Charlotte

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Abstract:

The Fire Safety Engineering Technology program (FSET) at UNC Charlotte had several obstacles to overcome with the implementation of the distance education components of the program. The FSET program was created in direct response to lobbying from the state of North Carolina Fire Chief's and Firemen's Associations because of pressure for chief officers to have a Bachelors degree. The closest fire related programs were several states away, precluding the prospective fire chiefs from seeking a degree. This ultimately led to the state of North Carolina hiring several fire chiefs from outside the state, rather than promoting from within the ranks. As a result the FSET program at UNC Charlotte was created to meet this need. A stipulation in the creation of the program was that it had to be made available to firefighters across the state. An advisory council made up of fire chiefs from across the state had several other requests including:

- No canned classes (video tapes, audio tapes, pre recorded media)
- No site-based classes (no traveling to remote locations)
- Adaptable to the firefighters unique work schedule (24 hours on/48 hours off)
- Firefighters could participate while at work.

Several different methods were explored and ultimately a "hybrid approach" was deemed acceptable. The hybrid approach consisted of an individual access program in which two-thirds of the course was placed on-line for the students to access asynchronously via WebCT, while the remaining one-third would be delivered live over the world wide web. The live portion was accomplished by using Centra Symposium, which effectively created a virtual classroom. Centra Symposium operates efficiently on a 28.8kbps connection allowing participation of the high-speed access underprivileged. With a connection of 56.6 kbps or higher, video can be passed in almost real time. Students have purchased cameras and with a mouse click, the instructor can pass the video to students who have questions or comments, allowing other students to see his/her virtual classmates. In addition, the "live" sessions are recorded for access at a later time.

This hybrid format allows students to attend class from anywhere an Internet connection is available and be able to participate in a classroom type setting. The delivery format has been an overwhelming success, allowing flexibility for the student through the asynchronous portions while giving them classroom experiences in spite of being hundreds of miles away.

History of the Program:

The initial idea for the program was brought to UNC Charlotte in the 1990s by Luther Fincher, Chief for the city of Charlotte, NC Fire Department. However, in the initial presentation to the University, the program was perceived to be more of a training program rather than education so

the University stated it was not interested. Then the idea was brought back to the University in the mid 1990's by Chiefs Holloway and Proctor of the Concord, NC Fire Department. The initial contact was to the College of Business Administration as the Concord chiefs felt that the program should be primarily an administrative program. The College of Business Administration also expressed no interest in taking on a program of this nature. Not willing to drop the idea of creating a program, Chief Proctor and Chief Holloway considered another option. Although the program was envisioned to be an administrative one, it did contain some technical aspects. Because of this, the fire chiefs contacted the Chair of the Department of Engineering Technology, Ed Braun. After some discussions, it was decided that the program was a perfect fit for Engineering Technology. At that time, Engineering Technology at UNC Charlotte had four programs, Civil Engineering Technology, Mechanical Engineering Technology, Electrical Engineering Technology, and Manufacturing Engineering Technology. Each of these programs was a two plus two program, meaning that the students complete an Associate degree at a community college then transfer to UNC Charlotte for the last two years to complete the Bachelors degree. In 1999, North Carolina had eight schools that were offering Associate degrees in Fire Protection, and it was only logical to extend this two plus two arrangement to the existing degree programs. Chairman Braun then made contact with the coordinator of the two-year fire protection programs to see how a partnership could be agreed upon. As it happens, the two-year programs were just beginning to make the shift from a quarter-based schedule to a semester-based schedule. This pending change not only fit the University's semester based system better, but it also provided an opportunity to develop a uniform curriculum for all the Associate degree programs and put in place the prerequisites for the baccalaureate program.

Chairman Braun then surveyed similar programs at four other institutions. (To the author's knowledge, only six such programs are in place at this time in the United States.) Braun also established an advisory council made up of local fire chiefs. (This advisory council was expanded in the fall of 1999 to include chiefs from across the sate as well as representatives tasked with safety supervision in industry.) With information gleaned from the surveys and input from the advisory council, a curriculum proposal was drafted. The proposed curriculum included both technical and non-technical content. The technical content was of the rigor to make for a good Engineering Technology program, and the non-technical content included several Political Science, Psychology and Management oriented classes to round out the administrative needs of the program. Chairman Braun stepped down from the position as Department Chair but remained committed to the creation of the new program. Fortunately, the new Department Chair, Cheng Liu, was also in favor of the new program. In January of 1999, the advisory council of fire chiefs, met with the Deans of the College of Engineering and the College of Arts and Sciences and with the University's Chancellor to discuss the proposal. The proposal was presented with two main components, a traditional on-campus component and a distance-learning component so that the program would be accessible to fire service personnel all across the state of North Carolina. The Deans and the University's Chancellor were in favor if funding outside of the University's current budget could be secured for the program. The North Carolina Fire Chief's Association and the North Carolina Firemen's Association had also taken an interest in the program, and the program was being promoting through these organizations. These particular associations were successful in lobbying the North Carolina State Legislature in the spring of 1999 for funding of this program. The curriculum was finalized, reviewed, and

approved in record time. The money became available July 1,1999 and the program began in the fall of 1999. Jeff Kimble was hired as the first faculty member in July of 1999. Professor Kimble came to the program having been a firefighter for almost twenty years. The search committee felt incoming students would relate well to someone with a similar background. In addition, Professor Kimble also had Bachelors degree in Fire Safety Engineering Technology, a Masters degree in Industrial Training, and had just completed the course work on an Education Doctorate in Instructional Design. All of these factors would be vital in getting a new program going. Twenty-eight students were enrolled in the first two classes in the fall of 1999.

Curriculum Development:

While a curriculum had been developed for the program proposal, the Engineering Technology Department felt that someone with expertise in the fire service arena should revise the curriculum so that it would be as beneficial as possible to the students. Professor Kimble began the revision in the spring of 2000. Interviews for the second faculty member were ongoing and it was decided to wait until the second faculty member was on board to finalize the curriculum revision. Dr. Marc Janssens was hired in the summer of 2000. Marc came to UNC Charlotte with an extensive background in fire research and testing. Most recently, Marc was the Manager of the Material Flammability Section at Southwest Research Institute in San Antonio, Texas. Professor Kimble and Professor Janssens decided to base the curriculum revision on the Model Curriculum for Fire A Safety Engineering program developed by the International Association of Fire Safety Science[1] (IAFSS). The IAFSS model consists of the following components:

Background Course - 4 Modules (17 credit hours)

1. Fluid Mechanics (5 credits)
2. Heat and Mass Transfer in Fire (4 credits)
3. Classical Thermodynamics (3 credits)
4. Solid Mechanics (5 credits)

Fundamental Course – 5 Modules (23 credit hours)

1. Fire Fundamentals (5 credits plus 1 lab)
2. Enclosure Fire Dynamics (5 credits plus 1 lab)
3. Active Fire Protection (6 credits)
4. Passive Fire Protection (1 credit)
5. Interaction Between Fire and People (4 credits)

Applied Course - 2 Modules (3 credit hours)

1. Risk Management for Fire and Explosions; Design Based on Performance (3 credits)
2. Industrial Fire Protection and Explosion Protection (3 hours)

With this model curriculum to serve as a guideline, Professors Kimble and Janssens decided to re-survey all of the community colleges in North Carolina with two-year Fire Protection programs to see how much of the model curriculum was being covered in the lower division. With this information, Kimble and Janssens would incorporate the remaining modules into the upper division of the program at UNC Charlotte. However, there was another concern that had to be factored in. The first issue was that the program had to maintain some administrative "flavor". There still had to be some management and administrative type classes in the program. It was decided to strike a balance between technical and non-technical classes and hopefully provide a program that would prepare the Fire Safety Engineering Technologists of the 21st century.

Revised FSET Curriculum

Technical Courses

FSET3103	Principles of Fire Behavior	3 hrs
FSET3113	Building Fire Safety	3 hrs
FSET3123	Industrial Hazards & Electricity	3 hrs
FSET3144	Active Fire Protection	3 hrs
FSET3183	Fire Safety Engineering Problem Analysis	3 hrs
FSET3233	Applied Fire Engineering Design & Analysis	3 hrs

Non -Technical Courses

FSET3124	Risk Management for Emergency Services	3 hrs
FSET3611	Professional Leadership Seminar	1 hrs
FSET4123	Command & Control of Major Disasters	3 hrs
FSET4323	Advanced Fire Service Administration	3 hrs
FSET4243	Research Investigation	3 hrs
EGET3222	Engineering Economics	2 hrs
POLS3119	State Politics	3 hrs
POLS3121	Urban Politics	3 hrs
POLS3126	Administrative Behavior	3 hrs
PSYC2171	Introduction to Organizational Psychology	3 hrs
PSYC3174	Organizational Psychology	3 hrs
General Education		12 hrs

Ongoing at the same time was the initiative of the National Fire Academy (NFA) in Emmitsburg MD, to develop a model for baccalaureate programs for the fire service. The National Fire Academy is looked to as the definitive source for fire service training and education in the United Sates. It is funded by the United States Fire Administration, a branch of the Federal Emergency Management Agency and holds a highly regarded status in the fire service. Work on the proposal takes place at the Fire and Emergency Services Higher Education conference held each June at the National Fire Academy. (UNC Charlotte takes part each year in this conference.) Thus far, the NFA proposed model has divided the fire-related curriculums into two categories depending on where they are housed at their respective college or university. The models are for a program either in a business or administrative college or a technical or engineering college. The two models are labeled as either Management Focus or Technology Focus. The influence of UNC Charlotte's revised FSET curriculum is evident in the technology focus model being considered by the NFA. The technology focus model consists of the following components:

Safety and Risk Reduction
Management of Large Scale Emergencies
Fire Dynamics
Active Protection

Building and Fire Safety Codes
Industrial Hazard Control
Analytical Approach to Fire Protection
Independent or Applied Research (Capstone Experience)
Areas of Specialization
Budget and Finance
Organizational Management and Theory
Intergovernmental
Business/Technical Communications
Social Science
-Political Science
-Psychology

Accommodation of Unique Work Schedules for On Campus Students

Firefighters are faced with a unique challenge as far as class attendance goes. Their schedules tend to be different from those of almost any other profession. The standard shift for a firefighter is twenty-four hours on duty and forty-eight hours off duty. The majority of departments work this schedule or some variant of this schedule. Also most departments work with three shifts, usually called A, B, and C, shift, respectively. In each FSET class there would be members from each shift. This presents a problem because there is never a specific night when all firefighters could be there. For example if Shift A works Monday, the next Monday B Shift works, then the next week C Shift works Monday. So in a 16-week semester, each shift could miss as many as five classes. One shift/schedule variant could cause a single shift to miss as many as ten times per semester. Since regular class attendance is necessary for successful completion of the courses, a way to accommodate this rotating work schedule had to be devised. The solution arrived at is called a flip-flop schedule. Each class is repeated on the following day and kept in lock step sequence. The same material is covered and at the same pace. So, either day that students come, they get the same information. Since all of our students are part-time and take from two to four classes, the flip-flop seems to work fine. For example, Class A is taught Monday afternoon from 2:00 pm – 5:00 pm, and then Class B is taught from 6:00 pm – 9:00 pm. On the following day, Class B is taught in the afternoon from 2:00 pm – 5:00 pm and Class A is taught from 6:00 pm – 9:00 pm. Students can come either day for both classes, or come for two consecutive days at the same time. See Table 1 below.

	2:00 – 5:00	6:00 – 9:00
Monday	Class A	Class B
Tuesday	Class B	Class A

Table 1 Flip-Flop class Schedule

Development of the Hybrid Delivery Format:

The development of the hybrid delivery format was a result of the requests made by the advisory council of fire chiefs. The first request was that the courses were not to be "canned" or "talking head" videotapes. If at all possible, the chiefs wanted a live class via some existing method. The second request was that they did not want the students to have to travel to site classes. Next, the advisory council asked that the courses be delivered in a manner that would accommodate the rotating work schedules of the firemen. And finally, the courses needed to be made avavilable to firefighters all across the state. Each of these requests will be discussed individually.

The request that the program not contain "canned" courses was the most difficult to accommodate. Two options were initially considered. Several universities have programs that currently use satellite for live delivery. Some problems with this particular delivery method is that the "air time" for satellite delivery is extremely expensive. Also, for the classes to truly be live, the capability must be in place for the students at their particular location to participate and transmit back via the satellite system. This limits the number of places for holding class down to a few locales, thus violating the request for classes not to be held at particular sites. The number of sites with this capability was so low; it would also greatly reduce the number of students who would be able to particpate. Also, since the FSET program was just beginning, its position in the pecking order for usage or "air time" on the satellite system was at the bottom. All of these factors seemed to indicate that the use of satellite delivery would be impractical for the needs of the program.

The next option taken under consideration was the use of the North Carolina Information Highway (NCIH). The NCIH consists of a network of high speed data lines through which classes are delivered using a compressed data format. The NCIH system was in use by many distance education programs across the state at the time. The NCIH delivery looked promising, but there were still a couple of obstacles. Foremost, as was with the satellite format, the NCIH was avaliable at only a limited number of sites across the state. While the NCIH system was available at more places than those with satellite it was still a small enough number to again limit the number of students who would have access to the program. NCIH was available at several community colleges in various parts of the state; however, many instructors using the NCIH system complained that the technical support was not of the level to handle many problems the system commonly encountered. After initial investigation, NCIH was also removed from the list of possible delivery methods.

The two most promising methods for delivering live classes had now been ruled out. The remaining option was to use the Internet for program delivery. Internet technology is such that synchronous communication can be accomplished if the necessary bandwidth is available. Personal broadband connections were not very common in North Carolina at the time and cable modems, DSL and other similar connection modes were just starting to become available. Having narrowed down the delivery method to the Internet, and knowing broadband connections were limited; the people involved with the FSET program began to explore ideas of Internet delivery and how to trim the bandwidth demands down. The idea of making the program partly live, partly asynchronous was brought up. The final idea was to divide the class into thirds. Two-thirds of the class would be made avaiable on the Internet asynchronously and one-third of each

class would be delivered via the Internet synchronouslly. This, in concept, prevented the classes from being canned and still made it widely accessible. It was determined by making the program available dependant solely upon having an Internet connection, it could truly be an individual access program. The only stumbling block was getting a connection to the Internet that was capable of carrying live sessions. Knowing that broadband connections would make delivery over the internet much easier, and knowing satelite offered the most readily available broadband service to rural areas, a satellite dish internet system was purchased to experiment with. The particular system purchased did seem to deliver a fairly good connection, and we proceeded to develop the concept by evaluating live course delivery software. Many software companies had products that promised to do what the program needed, but these programs were either cost prohibitive or limited the number of concurrent users. The software system decided upon was Centra Symposium®. This particular software offered a very simple user interface and had synchronous audio that could run efficiently on a 28.8 kbps dial up connection. As a plus, Centra Systems promised the upcoming version of the software would have video capability. Centra also proved a recording function that operated as the program ran and could make playback available in a matter of seconds. This was a major benefit as it compensated for students who were on shift and could not attend the live portion while it was delivered. This information was presented to the advisory council who, while disappointed totally live classes were not going to happen, were satisifed that the hybrid format would be an acceptable compromise. Further experimentation with the satellite broadband deleveiry continued into July, one month before the classes were to begin August. The satellite connection had problems occur frequently that were felt to be beyond the scope of the users in the program. In addition, when the provider was told that we were expecting as many as 150 concurrent users per course, the satellite provider said they were no longer interested in working with us because that many users operating through the same site or program could consume their capabilities, and they could not guarantee performance. It was decided to go ahead with dial up connections at 28.8 kbps as the minimum connection speed for the particpation the program with higher speeds recommended.

The asynchronous portion of the course was handled initially with Topclass®, a course management software program which allows the instructor to place course work in HTML on the web in a "contained" format which allows the students to advance through he course in similar fashion to text book. The course management software also allows for other activities such as chat and on line quizzing. The asynchronous portions of the classes are typically posted, and the students have a specified time in which to view the materials and then complete the assignment. Then, one time per week the students meet via the virtual classroom provided by Centra Symposium®. With a mid-level computer, students can participate in the program, and have the ability to "pass" the audio and video among themselves (controlled by the instructor). This allows students to not only hear but also see their classmates who are at locations all across the state. The live sessions are recorded for students who are absent to view at a later time. The students and instructor have a very intuitive and easy to use interface that allow for a great deal of interaction. Application sharing is another unique feature, which again opens the door for more interaction between students. With cable modems, DSL, or other broadband, the video component is almost seamless. A written paper cannot do justice to the capability of the software. A more complete description of the product can be found at the web page (www.centra.com) and demonstration of the software can also be found there. There is also a one minute and thirty second news clip showing the software being used in the classroom available

from the UNC Charlotte Fire Safety web pages at (www.et.uncc.edu/fire_safety). While it is not the perfect substitution for a classroom, it is an acceptable alternative. The students and the advisory council have all had praise for the delivery method. The students illustrated their acceptance of this format by high marks in the evaluation at the completion of the class. One of the evaluation questions asked if the students thought, "the climate of this class is conducive to learning?" The student's ranked this question on a Likert scale with 5 being strongly agree and 1 being strongly disagree. The average rating was a 4.75, which put the class's perception of the method being conducive to learning between agree and strongly agree. This response was higher than both the Engineering Technology department mean of 4.10 and the College of Engineering mean of 4.11for the same question regarding classes administered in the traditional classroom setting. The author has to date, only taught one class using this delivery method. However, the other instructors in the FSET program have stated that they have similar responses in their evaluations in regards to this delivery format.

Conclusions

The Fire Safety Engineering Technology program at UNC Charlotte has a unique approach in delivering the courses. By having both synchronous and asycnchronous delivery for each class, firefighters who work rotating shift schedules and are located all across the state, can participate in a virtual classroom. The virtual classroom provides a reliable and valid way to learn in a distance education program.

Bibliographic Information
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Biographical Information
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