

An Interactive Lecture for Web-Based ET classes

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Abstract:

To some degree distance education (DE) students are at a disadvantage because they are unable to participate in class lectures. The purpose of this project was to create an animated lecture for distance education students providing them access to the benefits of a class lecture. Although many formats have been used to create digitized, online lectures (e.g.: PowerPoint, MPEG or QuickTime movies, etc.) there are several advantages to using Macromedia's Flash as an alternative.

The participants in this project were DE and on-campus junior level ET students with experience taking online and/or hybrid courses, and who were currently enrolled in an introductory Java class. The students had experience with several different presentation styles for online course materials and were very receptive to completing a survey.

Students were given assignments to read from the online texts, view the animated lectures, participate in online quizzes, and complete three simple programming assignments and three projects outside of class. The Flash lectures consisted of course content being presented in much the same way a PowerPoint presentation would be presented in a traditional classroom setting. The slides displayed written and pictorial information while the recorded voice of the instructor provided the audio information. Occasionally, as in a traditional classroom, the lecture was interrupted for several questions posed by the instructor to determine the students' level of understanding. If students answered the questions correctly, they were allowed to continue the lecture; otherwise students were diverted back to earlier slides for a review.

Surveys showed that students were very receptive to the course structure regardless of the additional workload outside of class. Overall, grades for the course improved and students seemed to have a better understanding of both object-oriented programming and the Java programming language.

Background:

This project was supported by funds provided by the University of North Carolina at Charlotte for curriculum and instructional development (CID). The CID Grants are awarded only to full-time faculty members on continuing appointments for the academic year. Requests for funding are considered for projects that specifically address improvement or extension of the instructional

program at UNC Charlotte. Proposals for this grant must address at least one of the following: (1) development of new curriculum; (2) improvement to existing curriculum; or (3) research that informs curriculum or teaching at the local (course, department, college, university) level. This project focused on the improvement to existing curriculum by developing a web-based course for Java programming.

The Engineering Technology Department at UNC Charlotte is a 2+2 program serving AAS graduates from ABET (Accreditation Board for Engineering and Technology) accredited engineering technology programs in the southeast United States. For many of these graduates, traveling to UNC Charlotte to continue their education at the bachelor's level is not a realistic option. The development of a web-based distance education program has provided an opportunity for many students who would otherwise be unable to pursue a Bachelor of Science degree.

To some degree distance education (DE) students are at a disadvantage because they are unable to participate in class lectures, they do not have ready access to their professors for consultation, advising, or questions, and sometimes have difficulty in obtaining course materials (texts, handouts, etc) [1]. The purpose of this project was to try to level the playing field for DE students and to make their experience as similar as possible to the traditional student experience. The course materials developed for this project include many features that will be discussed in this paper, but focused on the creation of animated lectures.

Although many formats have been used to create digitized, online lectures (e.g.: PowerPoint, MPEG or QuickTime movies, etc.) there are several advantages to using Macromedia's Flash as an alternative.

PowerPoint:

PowerPoint slides are an effective method for delivering lecture materials to students. Because many faculty have existing slides available, all that needs to be done is to record the professor's voice as he/she lectures to the class, digitize the recording, and apply the recordings to the slide show. This process is more difficult and time consuming than it sounds, as many faculty are aware. Additionally, the file size for PowerPoint slides shows is very large. Slide shows can easily grow to over 2 MB. The sound files are also very large (wav files can range from 100kB to over 2MB). A typical animated PowerPoint lecture with sound will range in size from 20 to 50 MB, prohibiting distribution over the Internet. CD distribution is the only method for students viewing PowerPoint lectures.

CD distribution poses another set of problems. The professor must place all of the files on a Master CD, make multiple recordings for distribution, mail the CDs out to students before the beginning of the semester, and typically provide training for students in how to access the files and in which order they should be accessed. Another problem exists when updates are made to the lecture. Faculty must be very careful to ensure that the proper slides are replaced, the Master CD is updated and all "old" copies of the CD are destroyed. Although PowerPoint may seem the easiest way to create and distribute animated lectures for DE students, file maintenance and distribution make this method less than ideal.

Digitized Movies:

MPEG, QuickTime, Real Media, and AVI, are some of the most common standard formats for digital movies that may also be used to distribute course lectures to DE students. Unless it is necessary for students to see video, this is not a good option. Files sizes are very large even with small viewing areas and do not offer a very clear picture.

In some cases, the only way to “get the point across” to students is to use short video segments. For example, discussing the fact that a capacitor can “blow up” when placed incorrectly in an electronic circuit is not nearly as convincing as showing a short video clip of the explosion. In these rare cases, QuickTime movies are the preferred format because they can be imported into a Flash animation. Flash will then automatically stream the video to the user when viewing the lecture.

Macromedia Flash:

Macromedia’s Flash offers some very good alternatives for the distribution of lectures (and other course materials) to DE students. Flash will automatically compress audio files, stream QuickTime movies, and allow easy to implement interactive learning components such as, multiple choice questions, fill in the blank questions, matching, etc.

For this project, lectures were developed using Macromedia’s Flash. For flexibility and quick download times, each slide is a separate file and ranges in size from 32 kB to approximately 400kB. Students with both dial up Internet connections and with high-speed Internet connections have tested the lectures for the course and have responded with positive remarks.

Separating each slide into individual files offers a number of advantages. The first is that files sizes are small enough so that distribution through the Internet is possible. To the user, the slide show appears to be one application. Students with slower Internet access commented that there was a short delay between slides, but that overall, the lecture worked fine and the delay was not distracting. By using this structure, faculty do not have to create Master CDs, make copies, and mail them out to students before the beginning of class.

The second advantage to structuring the slide show into separate files is that this structure facilitates file maintenance. If a slide needs to be revised, the professor can easily identify the slide, edit the file, and save it to the server. There is no need to update the Master CD and ensure that all “old” copies are destroyed (as in PowerPoint). There is no need to schedule studio time to re-tape that whole lecture (and possibly introduce new errors) for video lectures. Once the file is saved, the lecture is updated and all students accessing the lecture from that time forward are ensured of seeing the correct version.

The third advantage to separate files is that a small file size can be ensured. If a slide is beginning to get too large, due to a large sound file or too much animation, the slide can be separated into two or more files. The user will not notice any difference in the way the lecture functions, and smaller file sizes ensure that all DE students have a satisfying experience when viewing the lecture.

Another advantage of Macromedia Flash is that it will import many different sound files (WAV,

MPS, AIFF, and AU). For this project, the professor's voice was recorded using SoundEdit Pro so that sound files could be saved in MP3 format, reducing the size of both the sound files and the Flash file. SoundEdit Pro is available as shareware on the Internet with a very reasonable licensing cost (\$39.95 at the time of this printing).

Macromedia Flash also allows many different forms of animation, making the lecture more enjoyable and engaging than a typical PowerPoint presentation. Authors may specify a path for an object to take, animate resizing an object, or animate a shape change to an object.

Flash makes it easy to incorporate interactive components into a presentation. For instance, you can add multiple choice, true/false, or fill-in-the-blank questions. But, you may also add "hot spots" to a Flash animation that allows navigation through the application or Drag-and-Drop interactions as a form of test question. These interactive features are very easy to implement and make Macromedia's Flash an ideal format for animated class lectures for DE students.

Flash does have one disadvantage that should be mentioned. It requires more time to develop a slide show using Flash than it would using PowerPoint because of the extra features in Flash. This disadvantage is offset by the ease in which files can be maintained. In other words, more time is spent developing a Flash animation than a PowerPoint slide show, but less time is spent in distribution of files and in file and content maintenance.

Lecture Format:

Below (in Figure 1) is a screen capture of the animated lecture. Figure 2 shows many of the

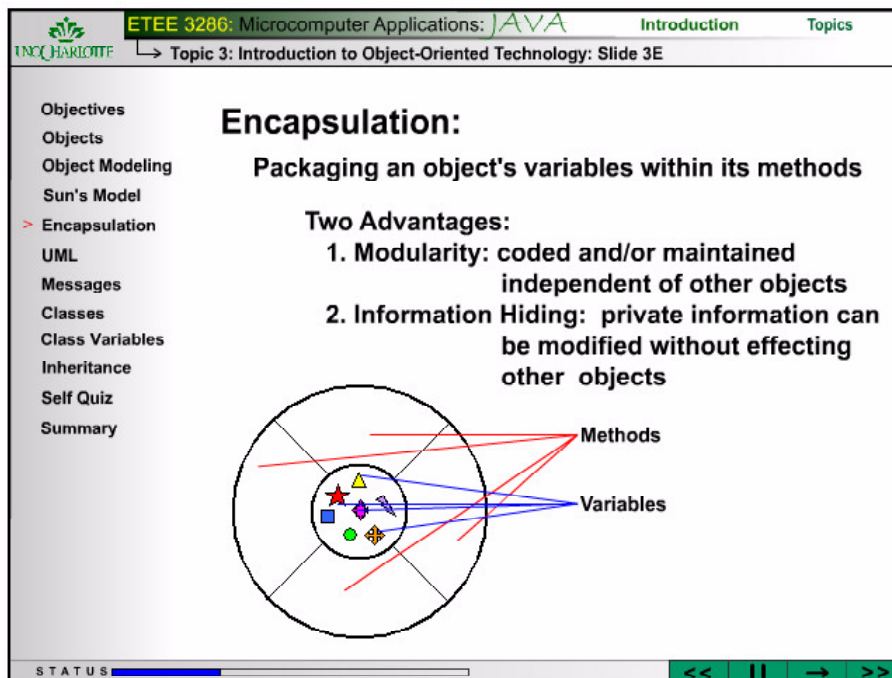


Figure 1: Screen Capture of Animated Lecture using Flash

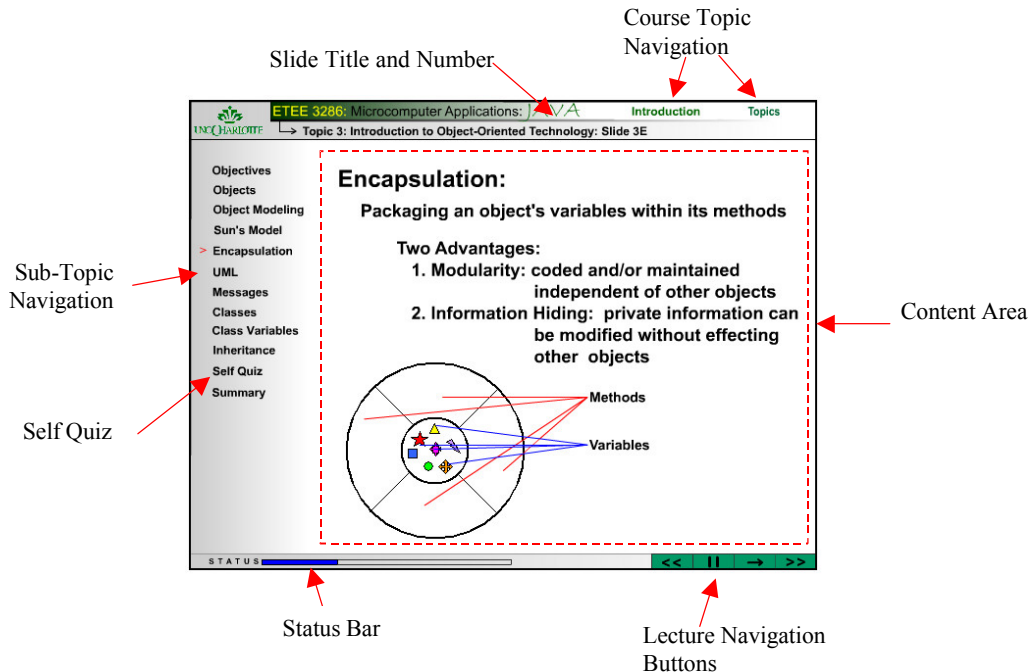


Figure 2: Features of this format

features of this format including the Slide Title and Number, Course Topic Navigation, Sub-Topic navigation, the Status Bar, the Self Quizzes, the Lecture Navigation Buttons, and the Content Area. The slide title and number are present for two reasons. It gives the students a slide reference for asking questions, such as: “On slide number 17 in Topic 5”. The professor may then quickly identify this slide to see what the question is about. The slide title and number also give the professor a file name. For example, the above slide has three files associated with it:

1. Ch3-3e.html: The html files containing this slide. This file is used for positioning the flash animation, background color, title, etc.
2. Ch3-3e.swf: The “executable” flash file loaded by the html file
3. Ch3-3e fla: The editable flash file

Depending on the numbering system chosen the file name could carry a variety of information to the professor. This slide refers to the 3rd topic in the course, the 3rd sub-topic in the lecture and 5th (e) slide in the sub-topic.

The Sub-Topic navigation provides a way for students to quickly skip from one sub-topic to another. This feature is particularly useful when the student is reviewing for a test, or when one of the Self-Quiz questions was answered incorrectly and the student wishes to review only this specific information. The carat, next to the “Encapsulation” sub-topic, gives the student an idea of his progress through the lecture, and how much remains in this lecture. The status bar in the bottom left portion of the screen also gives an indication of progress in the lecture. The difference in the status bar on the bottom and the sub-topic navigation bar on the left is that the status bar gives a “percentage” of the completed lecture, whereas the sub-topic navigation area gives an

indication by topic.

The lecture navigation buttons provide a method for the student to move through the lecture. The double arrow on the left allows the student to move back to the previous slide. The pause button allows the student to pause the lecture. This feature was added because it was assumed that the student would be viewing the lecture at home or at work during a break. Because many interruptions can occur in either location, this button was added for the student's convenience. The single arrow button allows the student to re-start the current slide in the case of the pause button being clicked or in the event the student wants to review that slide. The right double arrow allows the student to advance to the next slide or to the next topic if the current slide is the last slide in the topic.

The Course Topic Navigation area allows the student to review the course introduction, syllabus, grading policy, etc (Introduction Button) or select a course topic (Topic Button). The course topic slide is shown below. All of the course topics are included so that the student can select any topic he wishes. All course topics are hyperlinked to call the proper html page.



Figure 3: Course Topic Slide

The content area is large enough to hold the same amount of information that any PowerPoint slide can hold. It will allow text, animations, imported images, or imported QuickTime movies.

The self-quiz is a very important section of the lecture. During the lecture an occasional question pops up to ensure that the student is paying attention and understands the current sub-topic. But, at the end of each lecture is a self-quiz with about ten to twenty questions (depending on the length of the topic and its complexity) that tests the student's mastery of the topic. The questions provide feedback so that the student can immediately see if the question was answered correctly and allows the student to evaluate their own performance. The students are told, in advance, that

these questions may appear on graded quizzes and tests, so that there is an incentive for them to try to do their best and to pay attention to the feedback provided. Students also use this section to review and study for graded quizzes and tests.

Learning Interactions:

Quiz components such as, true/false questions, multiple choice questions, etc. are called Learning Interactions by Flash. Inserting and using learning interactions is a simple process. The author begins by opening the learning interactions library (shown in Figure 4).

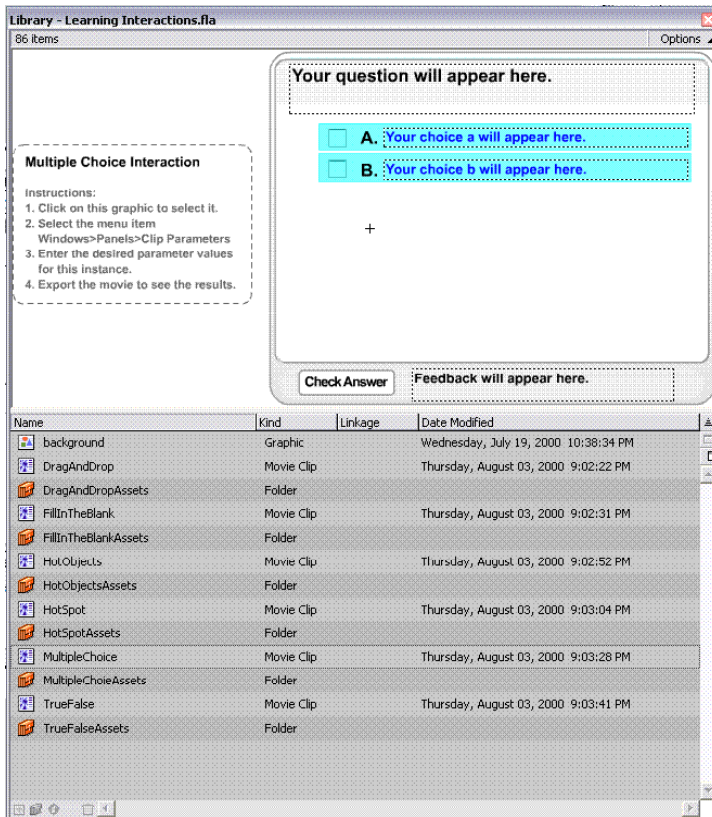


Figure 4: Learning Interactions Library

In this image, the multiple-choice learning interaction was selected so it is shown in the window. To insert this interaction into a slide, the author only needs to drag it onto the slide background. Note also that Flash includes a set of instructions for the author. The instructions remain in the editable file for the author's reference but do not show in the user's version.

To edit the question and setup other question parameters, the author opens the Clip Parameters window shown in Figure 5. Here the author inserts his question, possible answers, identifies correct answers, and indicates if feedback should be shown and if so, what that feedback should be.

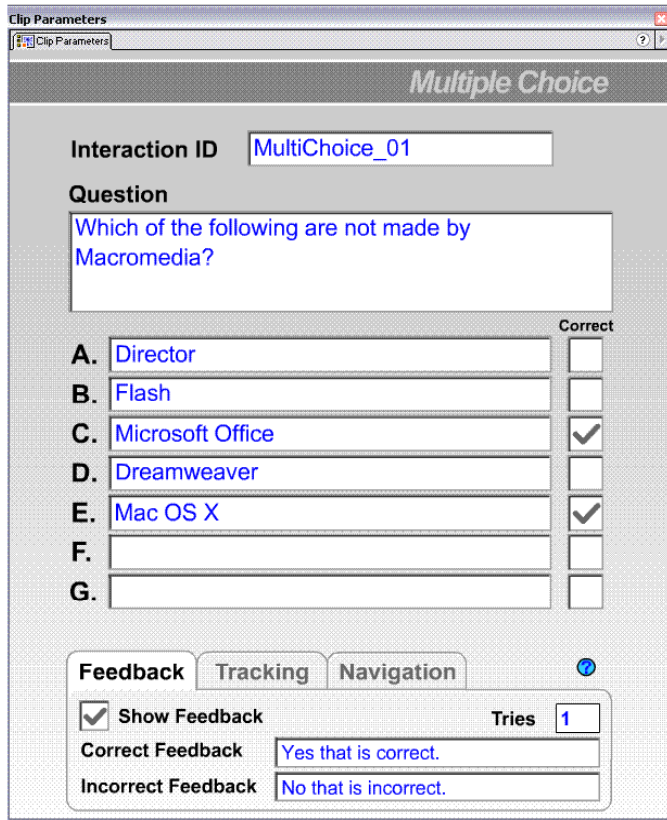


Figure 5: Clip Parameters Window

The final result of a multiple-choice question is shown in Figure 6.

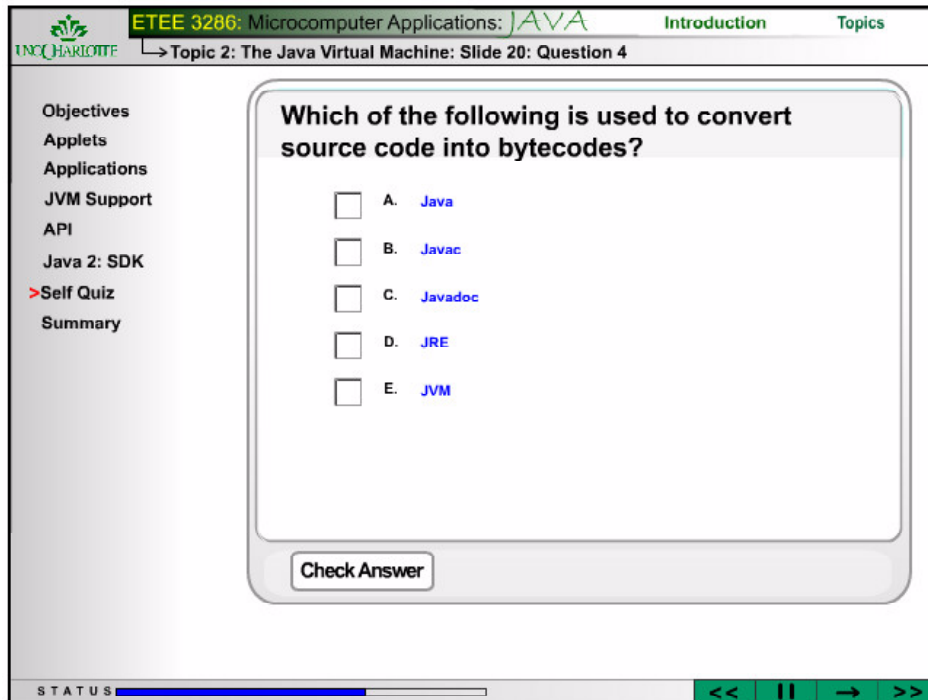


Figure 6: Multiple Choice Question in Flash

Other Class Features:

Online, animated lectures alone do not provide DE students with the same resources as traditional students. Students need to have access to their professor during office hours for discussions and questions and need to be able to meet and collaborate with other students. To accomplish this we, at UNC Charlotte, use either NetMeeting or Centra. Both software packages offer similar resources for students.

NetMeeting:

The author of this paper uses NetMeeting for office hours and discussions. Figure 7 shows the NetMeeting window and Notepad (the program used in this class to edit source files).

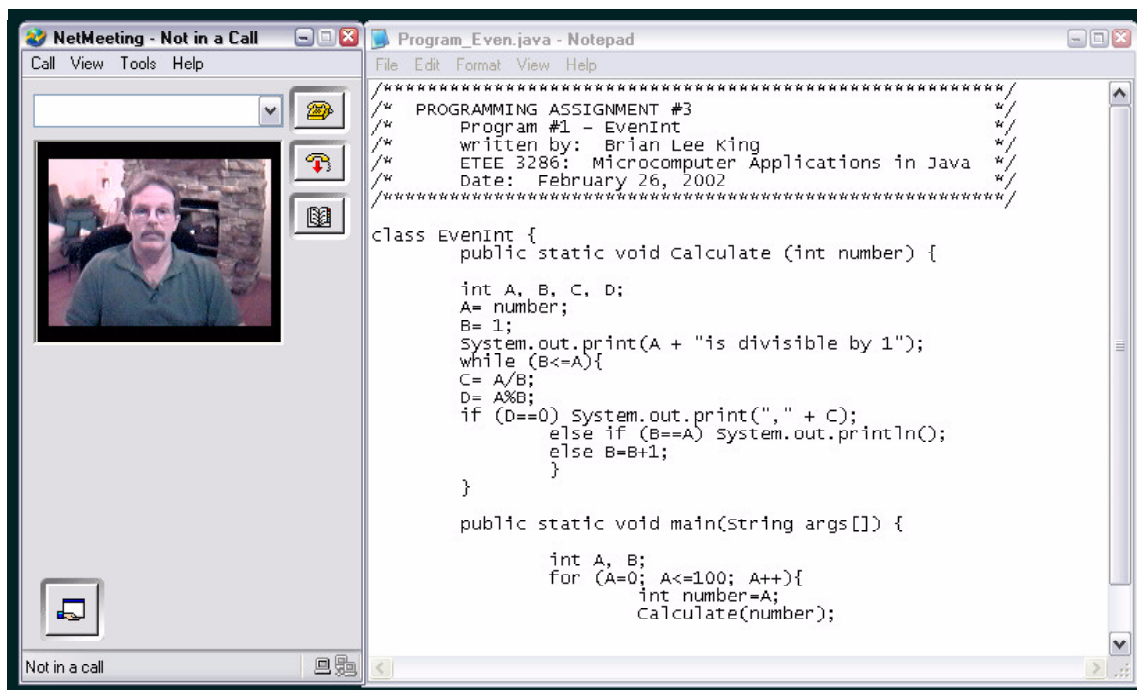


Figure 7: NetMeeting

NetMeeting allows the students to see their professor (much like they were in the same room), hear the professor talk, and see the application being shared. Students may also take control of the shared program; if the professor allows it (the professor must be hosting the meeting). For slower Internet connections, the students may wish to disable video transmissions thereby, allowing the audio feature and any shared programs to function more effectively.

Students have had a positive response to this method. Of course, many would prefer to meet with their professors in person [2], but in many cases this option is not realistic. NetMeeting and Centra offer a very good alternative.

Once students have become familiar with NetMeeting, they can begin to use it among themselves to collaborate on team projects [3]. The main advantage to NetMeeting over Centra is that NetMeeting is free download from Microsoft (if it was not preloaded on the computer when purchased). One of the comments received from students after learning to use NetMeeting is that

they continue to use it to communicate with family and friends outside of class.

Centra:

Centra is the live conferencing tool used by the Engineering Technology program in order to provide a synchronous virtual classroom experience while maintaining the convenience of individual web access. Centra allows the students to simultaneously view material presented online by the instructor, while both hearing and being able to interact live with both the instructor and other students. Traditional classroom interaction is simulated in that the instructor can control whether the students can speak in class and when. Computer applications, web cameras and whiteboards can also be utilized via the Centra medium, and the class sessions are recordable for later playback should a student miss class.

Summary:

There are several good methods available to provide DE students with lectures and advising or consultation so that they are not at a disadvantage because they are not traditional students [4]. The best method to deliver a lecture is Macromedia's Flash. Flash files can be small so that they download fast to the student's computer, even with dial-up Internet connections. Flash has better animation features than PowerPoint and because of the smaller file sizes can be distributed via the Internet as opposed to CD distribution. Students have been very receptive to this method of lecture delivery and appreciate the extra effort made by the faculty.

Centra or NetMeeting are two very good methods to provide advising and consultation to DE students. They can share programs with the instructor so that both have an opportunity to manipulate data within the application. Students and faculty can talk to each other as well as see each other as they share programs. Because more than one student can be in a NetMeeting or Centra session this is also a good method for delivering problem session or synchronous lectures to DE students.

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Biographical Information:

Stephen J Kuyath is an Assistant Professor of Engineering Technology at the University of North

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