

Web-Enhanced Instruction in Engineering Technology: Advantages and Limitations

B. S. Sridhara

Middle Tennessee State University (MTSU)

Abstract

Web-based and web-enhanced instruction is becoming more and more popular in Engineering Education with the advancement of Internet technology.^{1,2} In this abstract, the author's experience in using web-enhanced instruction to teach *Fluid Power (ET 485)* is briefly discussed. In the spring of 2000, MTSU obtained a site license from *Blackboard.com* and developed *CourseInfo* on our server for the use of faculty and students. This author attended an on-campus workshop about *CourseInfo* and learned several new tools and techniques. In the Fall of 2000, Fluid Power course site was developed using *CourseInfo*. Course syllabus, handouts, and staff information were posted on the course site with links to appropriate files and images. Announcements regarding guest speakers, tests, assignments, useful web sites, and lab groups and meeting times were posted and upgraded periodically. Homework assignments, projects and extra-credit problems were posted with necessary links. Lab instructions, lab quizzes and solutions to test problems were posted on the course site. Students communicated with each other using the discussion board and virtual chat. They submitted assignments using the digital drop box. All of these saved a lot of time and effort for both the instructor and students making learning fun. They minimized the need for hard copies and helped conserve natural resources. Many of our students who work full time and have families were able to discuss the subject using the course site. They could download the course information at their convenience. However, there are some limitations to using the web to teach Engineering Technology courses. Unlike liberal arts and humanities courses, Engineering Technology cannot be taught as web-based courses. Even web-enhanced instruction requires a lot of preparation time on the instructor's part and becomes an overload when released time is not available. It cannot replace interactive problem solving technique that we use to solve engineering problems. It is hard to develop on-line tests that are different from multiple choice or true/false type tests. Considering the fact that web-based and web-enhanced techniques are still in their early stages, these limitations may soon be overcome.

I. Introduction

This author attended a workshop³ on Blackboard.com, a web site for course development and instruction, in the Fall of 1999. This workshop was organized by the Tennessee Board of Regents (TBR) with the objective of selecting one common web site for all TBR schools. MTSU was one of the TBR schools that had not started web-based or web-enhanced instruction. Some schools were using WebCT which is another web site that is used for instruction. The Blackboard.com site appeared to be very useful considering the fact that many of the Engineering Technology students at MTSU worked full time and commuted to school from neighboring towns. This author developed a course site for Fluid Power on BlackBorard.com. Apparently, this course did not require registration and was available to any user. As it was already the middle of the semester, a few announcements and solution to test problems were posted on this course site. It took several days and attempts for both the instructor and students to use and communicate via the course site. But all of us liked the idea of web-enhanced instruction in Engineering Technology. There were some limitations to the use of our course site on Blackboard.com because of the limited memory of 5 MB and difficulty in locating the course site among approximately 100 free courses that were offered.

In the spring of 2000, MTSU obtained a site license from Blackboard.com and developed CourseInfo on our server for the use of faculty and students. This author attended an on-campus workshop⁴ about CourseInfo and learned several new tools and techniques. Courseinfo offered many new features including unlimited memory and easy access to the course from MTSU's home page at <http://www.mtsu.edu>. Students at MTSU are given an e-mail account as soon as they are enrolled. Instructor, students and guests (with some limitations) can access the Courseinfo login page from this site using their e-mail user name and password and select any course in which they have enrolled.

II. About CourseInfo

Some important features of CourseInfo are briefly discussed here. *My Blackboard* home page shown in Fig. 1 displays that particular day's announcement, calendar and tasks. One can also access a specific course site, for example, in our case it is either Fluid Power (ET 485) or Dynamics (to be offered in the Spring of 2001). The *Announcements* page for Fluid Power is shown in Fig. 2. Announcements are displayed automatically with the option of viewing all of them or those posted in the previous two weeks or four weeks. Links are provided on the left side of this page to other sites such as *Course Information*, *Staff Information*, *Course Documents*, *Assignments*, *Communication*, *External Links*, and *Student Tools*. Instructors and students can also access *Resources*, *Course Map*, and *My Blackboard* sites. There is also a search option provided on this page. The *Control Panel* (Fig. 3) allows the course instructor to post/modify announcements, course material including syllabi and lab instructions, quizzes, and solution to test problems.

Many of the above mentioned sites have menus that can be accessed by all users. As an example Communication Center menus are shown in Fig. 4. The instructor can access the class roster and optionally send e-mail messages to all students or selected individuals or groups. This task is made easy because the class roster is created automatically when the students enroll for the course. However, the instructor can modify the class roster using the Control Panel.

Students can create their individual or group pages using the appropriate menus. Students can use the *Discussion Board* to post their queries, comments and suggestions for each other or for the instructor. They can also use the *Virtual Chat* site for interactive communication. Students can drop their homework assignments and reports using the *Digital Drop Box* located under the Student Tools site (Fig. 5). They can check their test or lab grades on this site and perform several other tasks. However, the instructor should make the grades available either immediately or after a certain date by setting appropriate options on the Control Panel. The instructor can access the Digital Drop Box using the *Assignments Editor* on the Control Panel, grade the submitted material, and return files electronically with corrections, comments and/or grades.

III. Web-Enhanced Instruction in Engineering Technology (Fluid Power – ET 485)

The Engineering Technology and Industrial Studies Department (ET&IS) at MTSU offers Bachelors degrees in Engineering Technology (ET) and Industrial Technology (IT). Computer, Electro-Mechanical, and Manufacturing are the three concentrations under the ET program. Fluid Power is a required course for all Electro-Mechanical and Manufacturing majors. This course is offered every Fall semester and this author started teaching it from the Fall of 1999. Fluid Power was taught in a master classroom and an effort was made to adapt web-enhanced instruction during that semester. However, CourseInfo was used more effectively in the Fall of 2000 and was better utilized by the students.

A welcome statement with a note to look for new announcements regularly was posted under Announcements. Course syllabus was posted under Course Information providing a link to appropriate MS Word files. Creating and modifying announcements and folders, uploading files, and providing links were done using the Control Panel. In the first one or two classes, this author gave a virtual tour of CourseInfo and briefly described how it would be utilized in Fluid Power. Students were helped with setting up their user name and password, and login and logout procedure. As the semester progressed, many new announcements were posted which included lab groups, lab days and time, test dates and time, solutions to test problems, and grade distributions. Announcements regarding guest lectures, useful web sites related to Fluid Power, design project topics, and student presentation dates were also posted. Some of these announcements were modified to serve as reminders to students as the announcements are displayed chronologically. Details of instructional videotapes on Fluid Power that are available at MTSU's Learning Resources Center (LRC) were posted under Course Information and a note in this regard was posted under Announcements. This author's office location, phone and fax numbers, and e-mail address were provided under Staff Information.

Folders were created for lab assignments under Assignments and links were provided to files containing instructions and quizzes. Students were instructed to answer the multiple-choice and true/false type questions and submit their answers using the Digital Drop Box. Design project assignment for each student was posted in this section. The course textbook did not have any problem on turbulent flow in pipes. This author could find a problem from another source and post it as a scanned image. Students could access homework assignments under Assignments which had links to particular MS Word files. Solutions to test problems were posted under Course Documents providing links to appropriate folders and files. Extra-credit problems that required writing a computer program or using a software package to solve problems and performing a cost analysis were posted in this section. The *Send E-mail* and

Student Roster tools under Communication were very useful. The author could send e-mail to all students with a click of a button reminding them of guest lectures or ensuing tests. Many of our majors work full time and attend classes only in the evening and they found these reminders helpful. Also, we wanted full attendance for our guest speakers particularly when one of them was enrolled in Fluid Power. This student worked on fluid power controllers at his work place and shared his hands-on experience with others. This author sent e-mail to individual students answering their questions on tests, labs or homework, sometimes providing missing data or correcting typographical errors. Our students seemed to like the Student Tools site. Many of them used it to send e-mail to this author whenever they had questions and submitted their assignments and lab quizzes using the Drop Box. Several students checked their test grades using the *Check Your Grades* tool. This author registered as a student under an alias and used the Student Tools site to get a first hand experience of what the students could view. However, different features and tools of CourseInfo were discussed periodically in the class as well as with individual students.

The *Assessment Manager* (Fig. 6) on the Control Panel is an efficient tool for creating tests and quizzes, posting grades and viewing course statistics. The *Online Gradebook* was used to post or modify grades by student or by item such as test, quiz, lab, homework, and presentation. The spreadsheet shows all entries and allows individual grades be entered and/or modified. It has a built-in feature that automatically adds each student's scores and also gives the class mean based on the total possible points. Optionally, the spreadsheet can be exported to MS Excel for further processing of the data. *Course Statistics* can be used to obtain feedback on how well the students have used the course site. A report can be generated with the click of a button to view the overall course statistics (Fig. 7), number of accesses over time (Fig. 8), user accesses by hour of the day, user accesses by day of the week, and total accesses by user (Fig. 9). This author could access the Digital Drop Box (Fig. 10) using the Communication Editor and grade lab quizzes and extra-credit problems submitted by the students. In Figs. 9 and 10, student names have been abbreviated intentionally in order to maintain confidentiality. The *User Management* tool permits the instructor to add, remove or modify users and it was used to add graduate students and remove those who dropped out after a few weeks.

IV. Advantages and Limitations

Web-enhanced instruction saved a considerable amount of time and effort for the instructor as assignments, solution to tests, and lab instructions and quizzes were posted on the course site eliminating the need for hard copies. However, such a course can only be taught in a master classroom with sufficient number of good computers and printers with appropriate Internet access. Currently, we have two master classrooms in our department and Fluid Power was taught in one of those with sixteen 486 DX50 computers. These computers are very slow and we had twenty-two students enrolled in the course. Many of our students used Pentium III computers either at work and/or at home and they were naturally reluctant to use a slow computer in the classroom. However, there are other well-equipped computer labs on campus which the students could use outside the class. There were some students who did not have the aptitude for or interest in using CourseInfo although they were computer literate. Initially, it took a lot of time and effort for the instructor to make these students download information from the course site. No hard copies were handed out in the class with exception of the course

syllabus and two tests. This strategy and different submission deadlines yielded some good results although course statistics showed that two students never used the course site.

In this author's opinion, web-based instruction is possible in areas such as humanities and liberal arts. Web-enhanced instruction can be adopted in Engineering Technology although it cannot replace interactive problem solving in the classroom and laboratory activities. Fluid Power course site was developed while teaching a full load of ET courses and therefore, this article gives only the salient features of web-enhanced instruction using CourseInfo.

V. Conclusions

Features such as Discussion Board, Virtual Chat, Student Pages and Group Pages were not used effectively in the Fall of 2000. This was due to lack of time required to train and involve our students in these activities and also because of the absence of incentives to use these tools. It was mentioned in the two workshops^{1,2} that besides the multiple choice type, essay and problem-solving type tests and quizzes could be created and administered on line with some additional training and effort. This author could not attempt any of these in the Fall of 2000 due to time constraints but intends to include them in the tasks for the Fall of 2001. In a few months, our department will have two new master classrooms with forty Pentium III, 400 and 850 MHz computers and HP DesignJet printers with the Internet access. These will definitely improve the quality of web-enhanced instruction in Fluid Power as well as in other ET courses in the department. In summary, web-enhanced instruction is a powerful tool in teaching Engineering Technology courses considering what has been accomplished and what can be achieved keeping in mind the tremendous growth rate of the Internet technology.

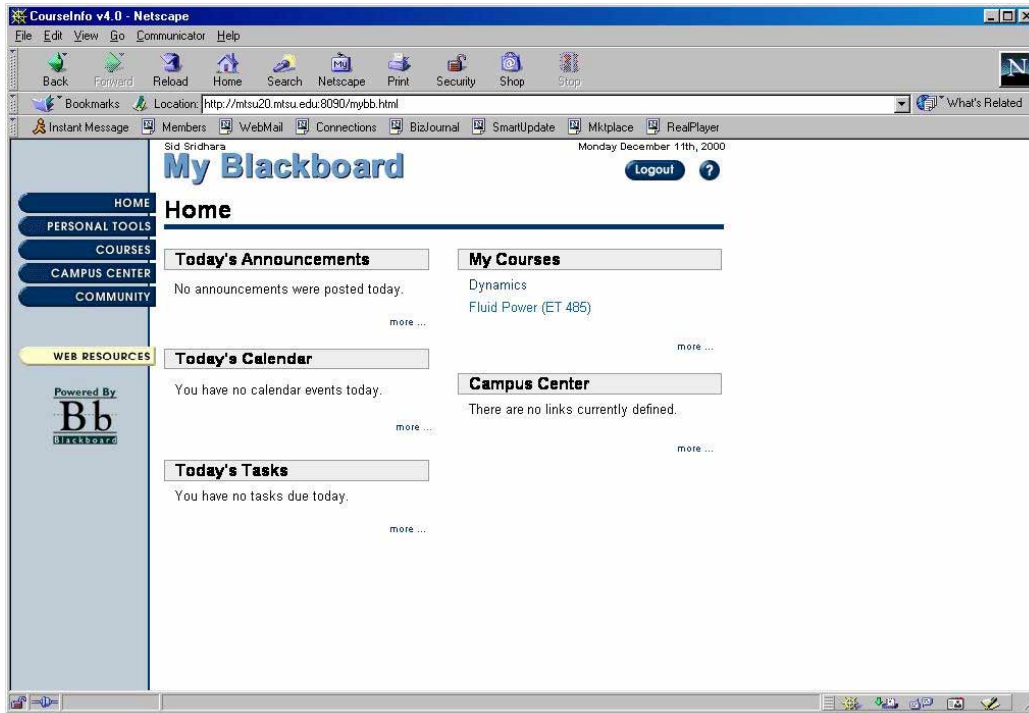
VI. Bibliography

1. Cooper, Linda, "Online Courses", T H E Journal, v27, i8, p86-92, March 2000.
2. Reena, Jana, "Getting the most out of online learning", Infoworld, v21, i37, p119, September 1999.
3. "A Workshop on Web-Based Instruction," Organized by the Tennessee Board of Regents, Dickson, Tennessee, October 1999.
4. "Introduction to CourseInfo," Organized by the Office of Information Technology, Middle Tennessee State University, Murfreesboro, Tennessee, June 2000.

B. S. SRIDHARA

Dr. B. S. Sridhara is an associate professor in the Department of Engineering Technology and Industrial Studies at Middle Tennessee State University. He received his B.S.M.E. and M.S.M.E. degrees from Bangalore University and Indian Institute of Science, Bangalore, India. He received his M.S.M.E. and Ph. D. degrees from Stevens Institute of Technology, Hoboken, New Jersey, and Auburn University, Alabama. Dr. Sridhara has published several peer-reviewed articles in the areas of Acoustics, Vibration, finite element methods, and Engineering Education.

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◦ Fig. 1. Blackboard Home Page as Viewed Under CourseInfo.

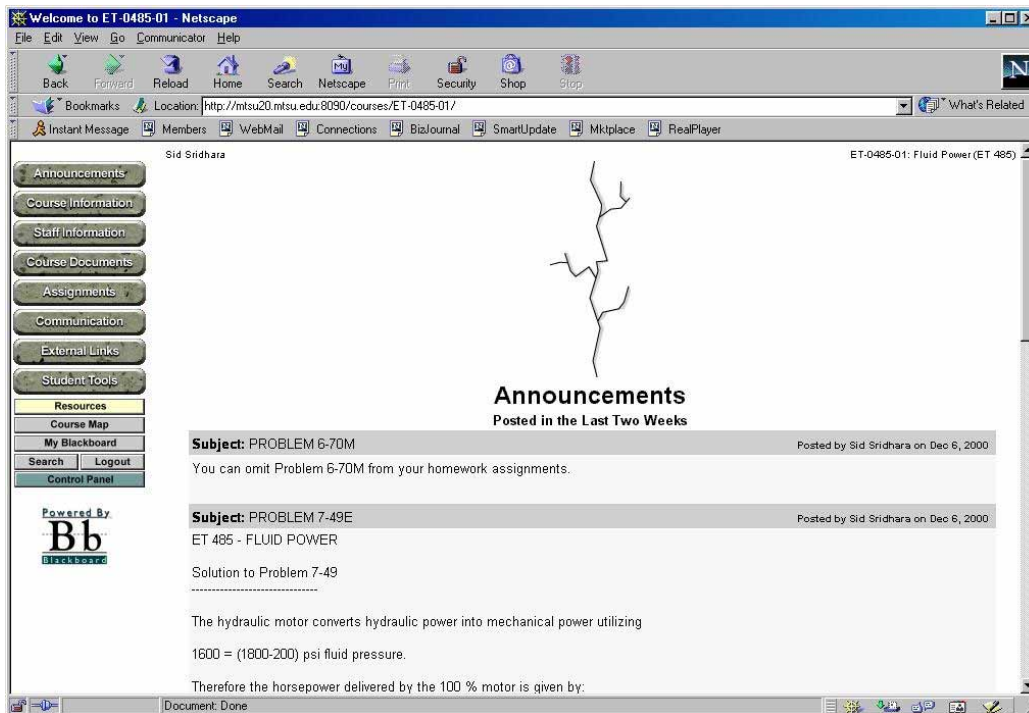
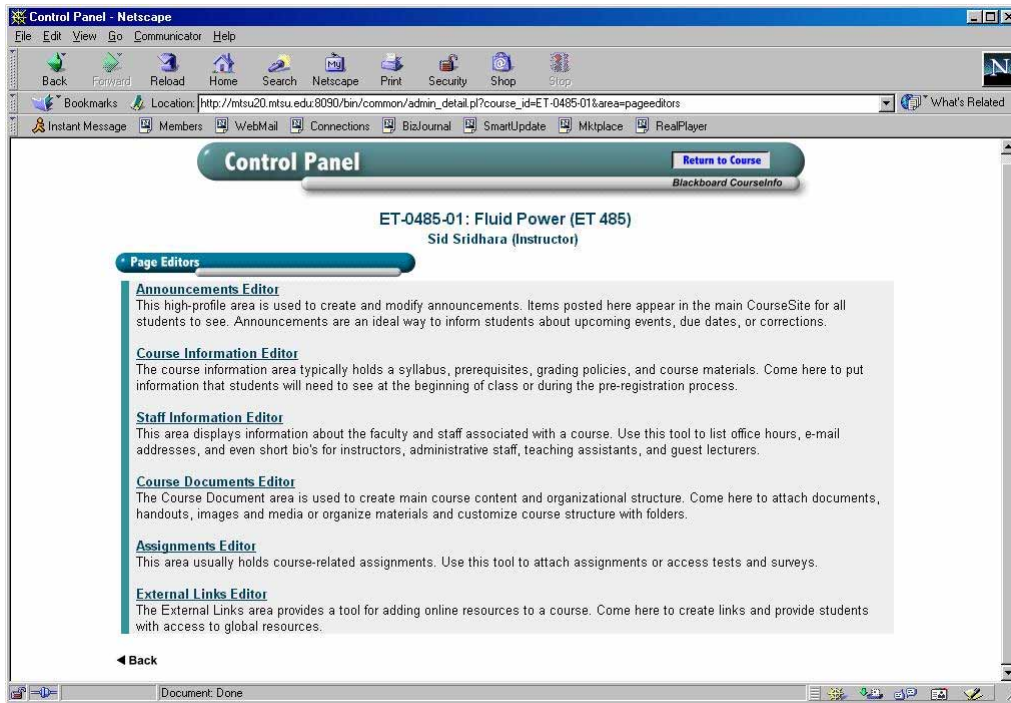


Fig. 2. Fluid Power Announcement Page with Links to Other Menus.



◦ Fig. 3. Control Panel with Different Edit Options.

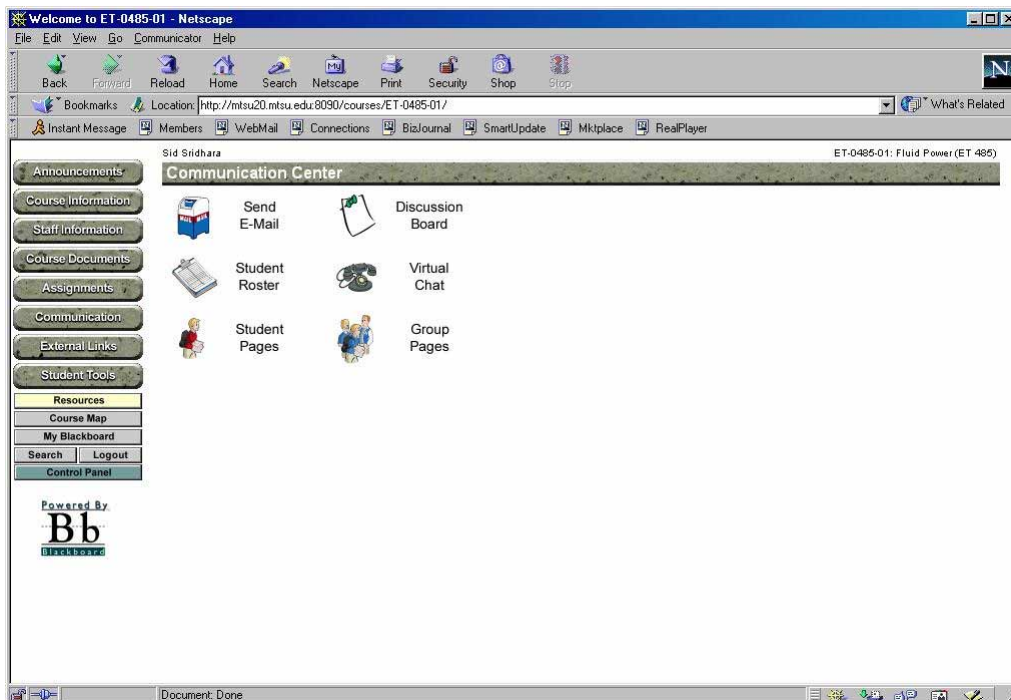


Fig. 4. Submenus under Communication Center.

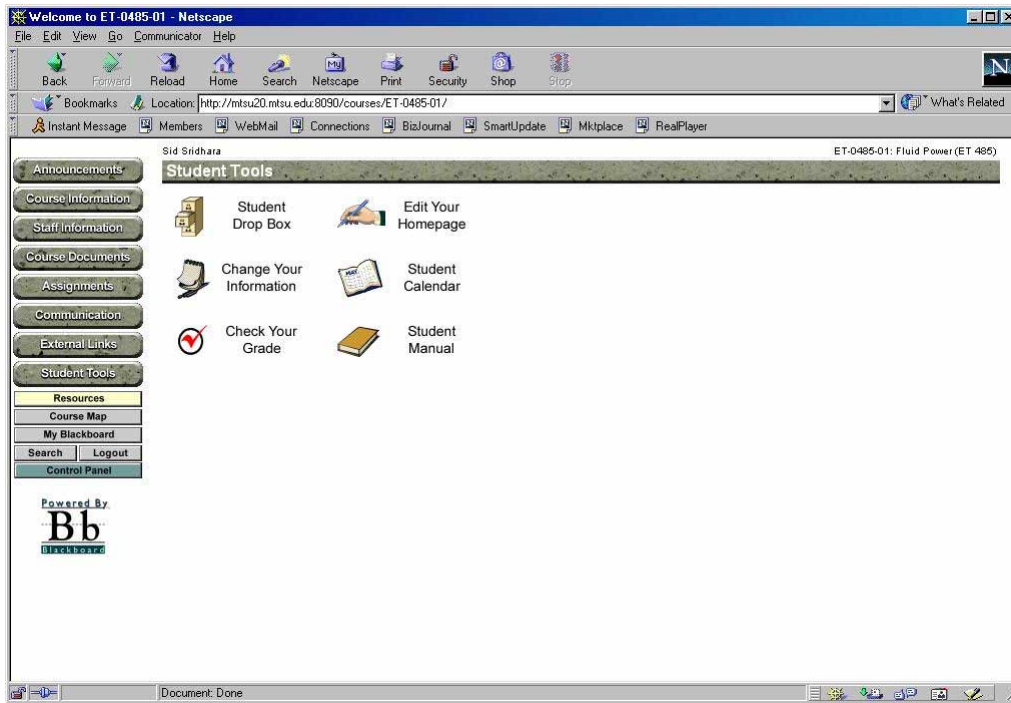


Fig. 5. Students Tools with Different Submenus.

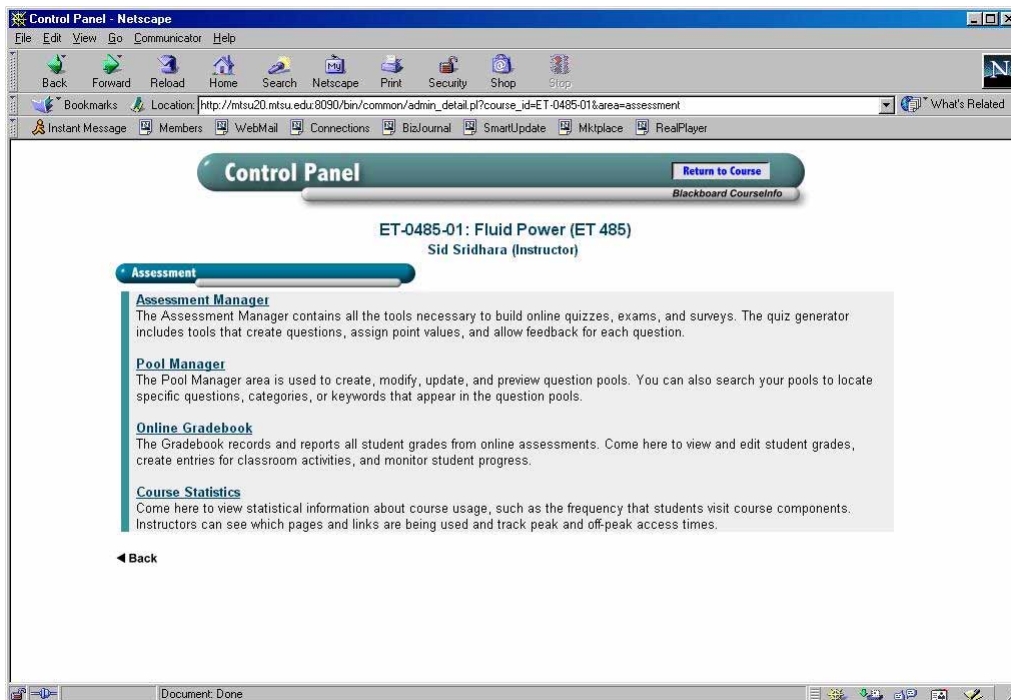


Fig. 6. Different Tools Under the Assessment Editor.

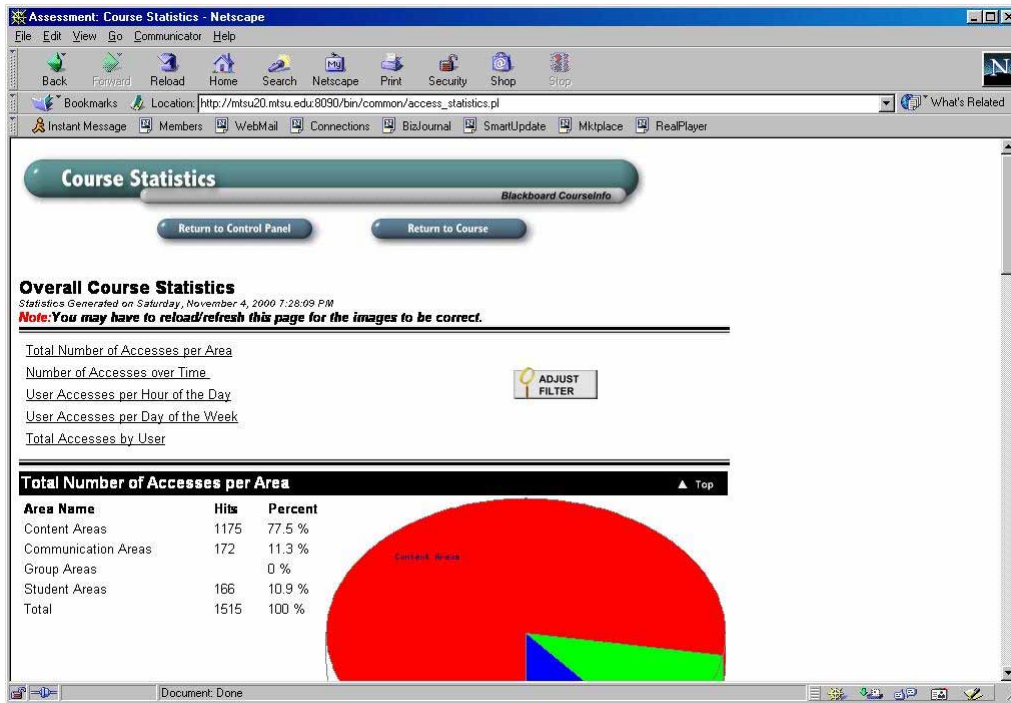


Fig. 7. Overall Course Statistics for Fluid Power (ET 485).

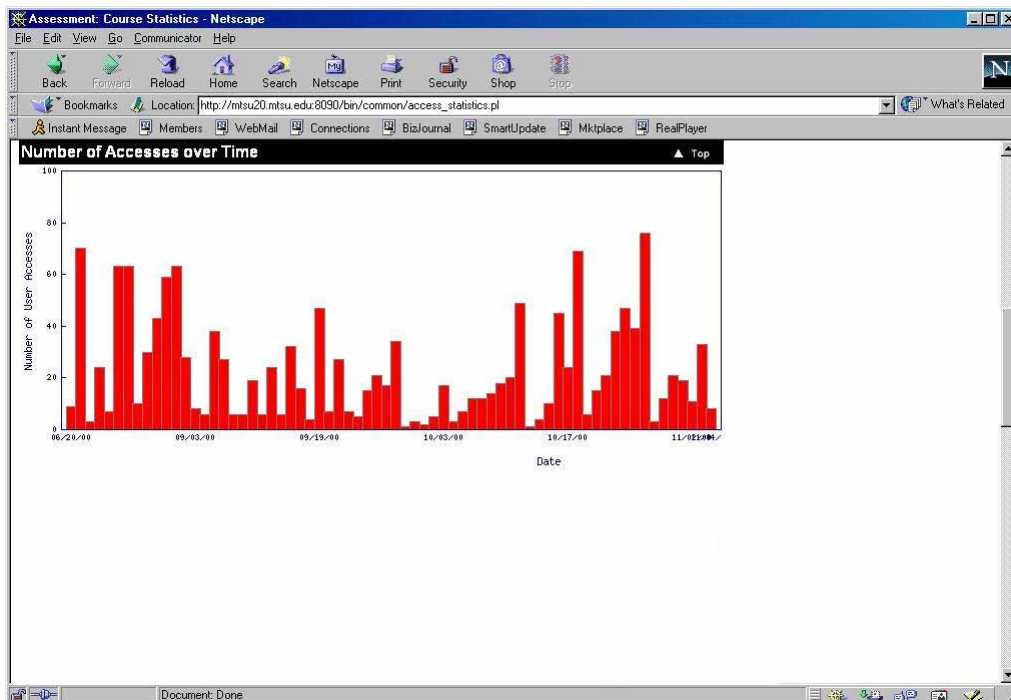


Fig. 8. Number of Accesses over Time – from June to November 2000.

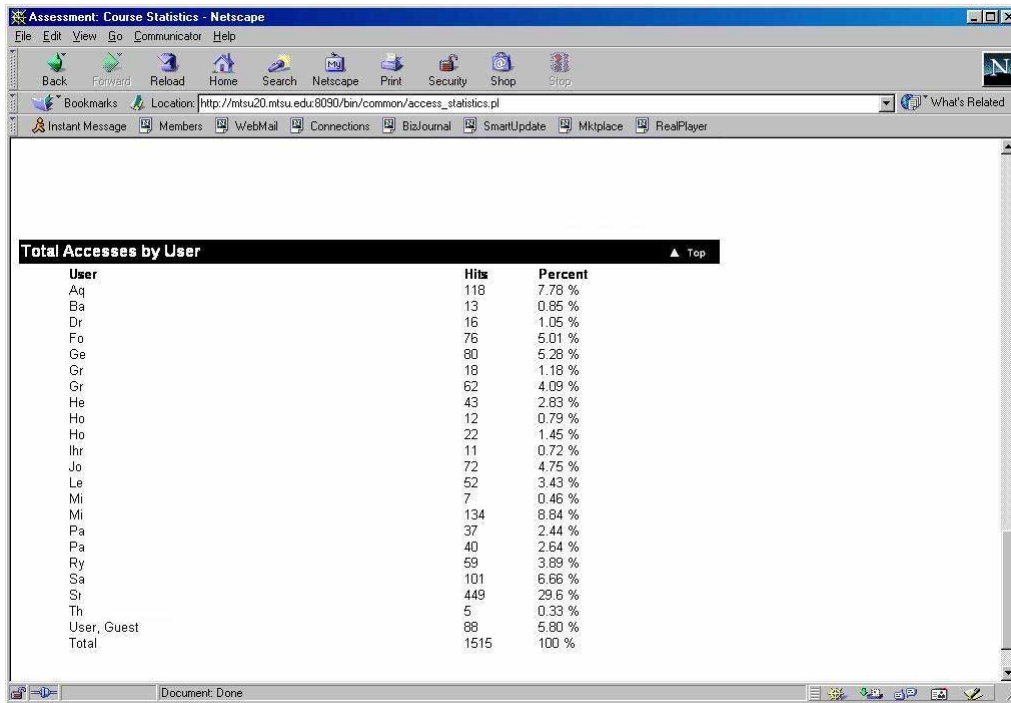


Fig. 9. Number of Accesses by User – Fall, 2000.

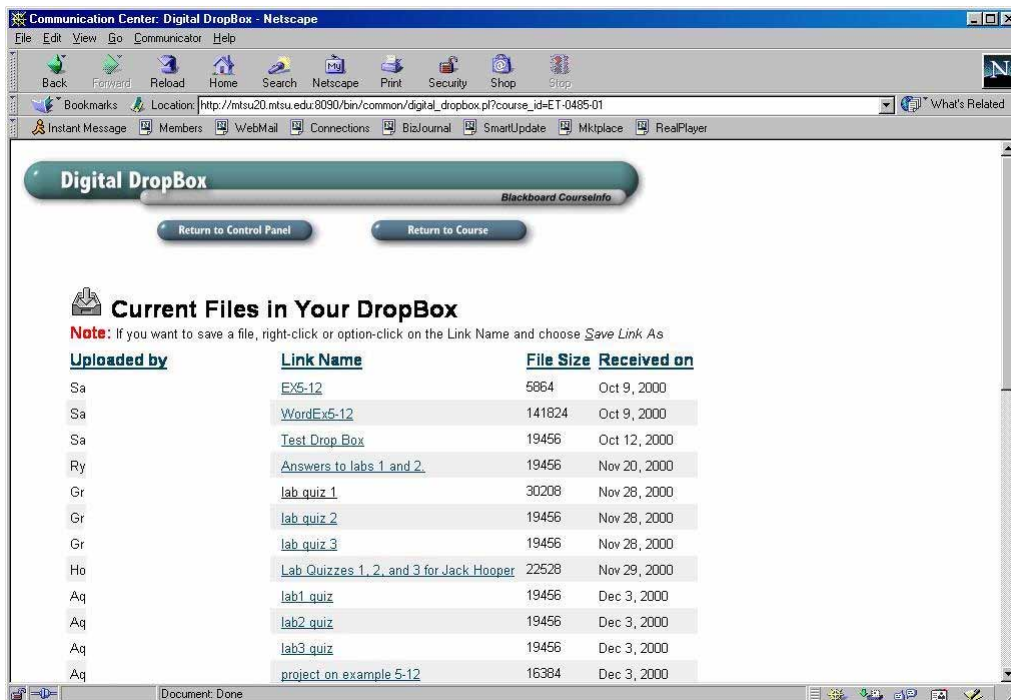


Fig. 10. Student Files in the Digital Drop Box.