Session: FA2-2

USING MOODLE FOR ENGINEERING COURSE DELIVERY

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Abstract

This paper discusses the technical aspects of setting up and maintaining a local installation of Moodle for use as a platform to deliver a Web based engineering course. The technical aspects of recording, editing and processing key lectures for traditional engineering courses are discussed in detail. In addition, technical as well as the philosophy behind delivering extra course support material such as video recorded sessions of homework solutions is discussed. Finally the construction of adaptive course exams in a typical Fluid Dynamics course is covered. Issues such as cheating, forced student participation, attendance accounting, mandatory physical course attendance, and faculty to student communication are discussed. In addition to the technical aspects of carrying out such a venture, the political implications of such an effort are discussed. This paper/effort seeks to answer the question: How we can adapt our mentality towards education to deal with the YouTube-Face Book-Twittering generation? The final topic of the presentation discusses how the adaptive course content capabilities of Moodle and Sharable Content Object Reference Model (SCORM) based material could revolutionize education as we know it.

1. Introduction

Most universities have some form of computer based Learning Management System (LMS) [1]. These systems supply a personalized web based environment designed specifically to deliver educational material. The main commercial LMS systems as of a few years back were WebCT and Blackboard (Now merged). However, increasing pressure from Open Source alternatives has changed the LMS market place. Open Source products receive fund from supporting their product instead selling the product. As a result, a number of Open Source LMS systems have reached maturity and are highly competitive with commercial products. As a testament to this fact, several schools such as Louisiana State University and University of North Carolina are moving completely to an Open Source LMS system named Moodle. A complete Moodle implementation may be downloaded from their web site [2]. Moodle is available for Linux, Mac and Windows platforms. On Windows and Mac the instillation comes with the XAMPP application [3]. XAMPP is essentially all the server systems Moodle needs to work properly. These include the Apache web server [4], and implementation of PHP [5] and the MySQL database server [6]. Since all of these products are Open Source, they are freely downloadable and usable by anyone.

Moodle installation is relatively simple. Downloading a zip file and expanding the contents in any directory you wish is the first step. Looking into this directory one would see the following:

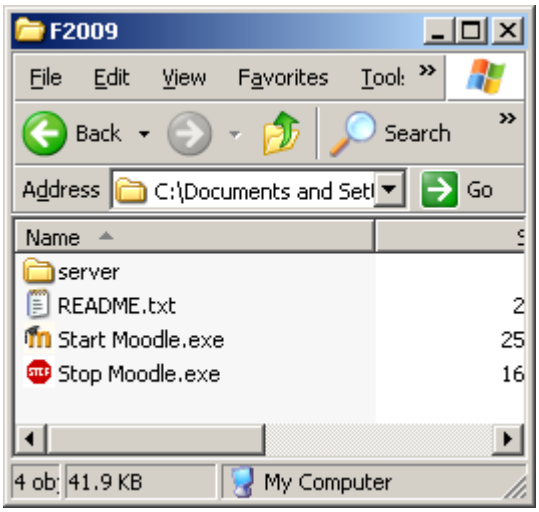

Fig 1, Directory structure.

To start Moodle simply click the *Start Moodle.exe* application. Once started, open a browser and goto http://localhost and follow the installation instructions. This process will setup a Moodle installation on your local Windows computer. During this process you will be asked the question regarding your web address. This is where you will need to contact your University level computer services department and request a Static IP as well as a location in the campus DNS server. An alternate approach is to allow the your computer to used DHCP and use a service such as DynDNS to map a web site name to your dynamic IP address [7]. Upon visiting my computer over the web, students would see Fig 2. Three of my courses are listed with course catalog description to the right. In addition a course calendar a login location is available on the main page. Students are required to self enroll in the web site. They are allowed to pick their own user names and passwords, which are authenticated on the Moodle server itself. However, numerous options exist for authenticating against other servers. Once logged in, the student will see a window shown in figure 3. To the left there exist four modules, People, Online Users, Activities, and Administration. Under the People module the student can look at other students in the course and send messages through the Moodle system to each other, as well as, the teacher(s) of the course. Online Users allow the students to see all users logged in during the past 5 minutes. The Activity module is available to students to allow them to see all activities falling into one of the five major categories. Assignments include, advanced uploading of multiple files which constitute one assignment, submitting at "Text" response to a question, Upload of a single file, or an Offline activity. Forums are essentially a student to student communication method which is based on posting questions and answers on issues. Quizzes are online, and can take a variety of forms as we shall see later in this paper. Resources are items such as locally stored files (PDFs, DOCs, etc) as well as external links of any type. Finally, SCORMs/AICCs are specially formatted web material which will be described later. Moodle is not limited to these five types of activities others include items such as "Chats", "Choice", "Database", "Glossary", "Lesson", "Survey", and "Wiki". However, by no means is this list complete, figure 4 shows the default included activities with Moodle. Notice some are turned on and some off. Since Moodle is Open Source there exists the possibility of creating an Activity and loading your own definition of that

Fig 2, Main Moodle web page.

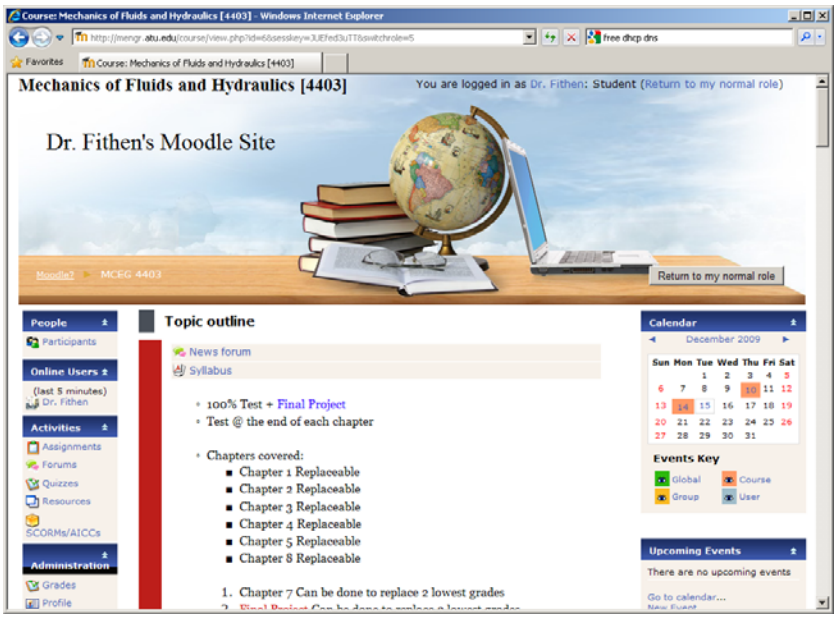

Fig 3, Fluids course web page.

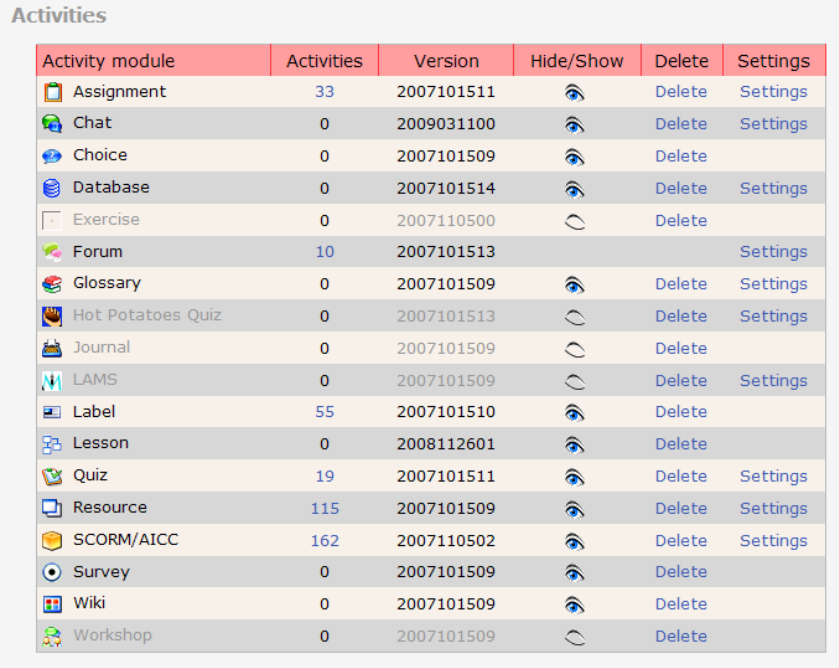

Fig 4, List of activity modules.

activity in Moodle. In the remaining of this paper I will focus on creating two types of activities, Assignments and SCORMs. I will also spend some time describing Online Quizzes and the construction of these for a Moodle system.

2. Online Assignments

Online Assignments are locations on the Moodle system to upload one or more digital document(s) into your own account. Hence, every student may submit a digital copy of their homework, test, etc. I use these for two distinct purposes. To accept assignments of a digital nature such as Word documents, Excel documents or Matlab scripts. However, I also use this location to store in class exams in PDF format. Once an exam is taken and scored, it can be scanned to and opened in Adobe Acrobat and each individual students Exam is saved to a file name. Entering the Moodle system the teacher may *Login As* a particular student and upload his/her exam into their(the student's) location. This allows the student the ability to review their work without ever receiving a hard copy of their exams. This process is the same for any out of class work including homework. From a professor's view, this allows for all work to be stored in one location throughout the semester, and lends itself well to assessment activities that have become a part of all of our lives. For assignments such a projects, which may have multiple files, Moodle's advanced uploading activity works well. In fact, I often use the advanced uploading of files due to its flexibility with regard to uploading multiple files. It even allows for the possibility of changing the number of files for each upload. The only downside is the required faculty intervention if the students click the "submit for grading" button before they needed to. This will actually lock the student out of possible uploading more or different files prior to the submission deadline. This approach has served well for the last 4 semesters. Moodle allows for complete

backup of each course including all course material and student submissions. If the need arose for a review of each semester, that particular course could be restored, in its entirety on another Moodle system. As a result, during an ABET review year any semesters work may be restored and sorted by good/bad/average on a student by student basis or, on an assignment by assignment basis.

3. Online Quizzes

Online quizzes can be placed in Moodle in a variety of ways. This flexibility is one of Moodles strengths. Quizzes can include any mathematical symbol or equations, as well as, any figure either static or animated GIFs. This allows for good communication of the quiz problem to the student. However, as the complexity of the quiz grows, so too does the time required to create the quiz. An example of a quiz problem from fluid statics is shown in figure 5.

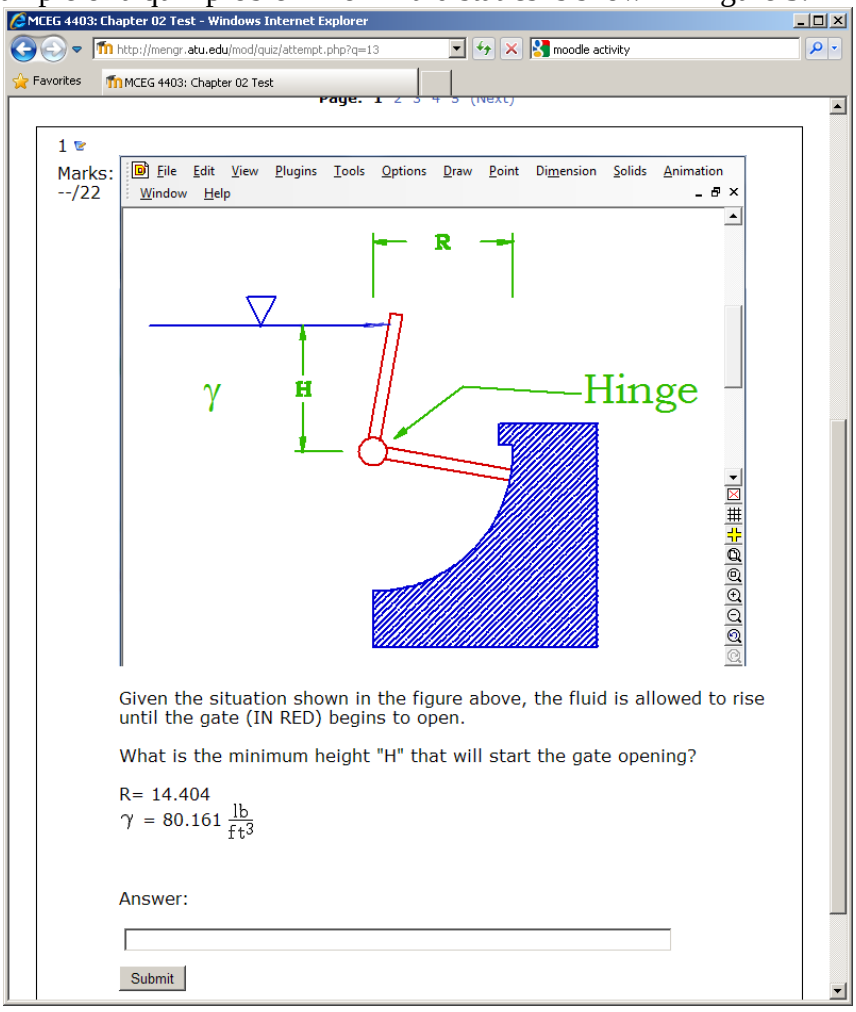

Fig 5, Typical online quiz for fluids course.

In this figure, the red gate is actually moving in a sequence about the hinge. This animated GIF was created within a standard CAD package. Notice also the existence of mathematical symbols such as the gamma. Math symbols are created using LaTeX [8] in conjunction with the

ImageMagick [9] software package. These allow for complete typesetting in the Moodle system as shown in figure 6.

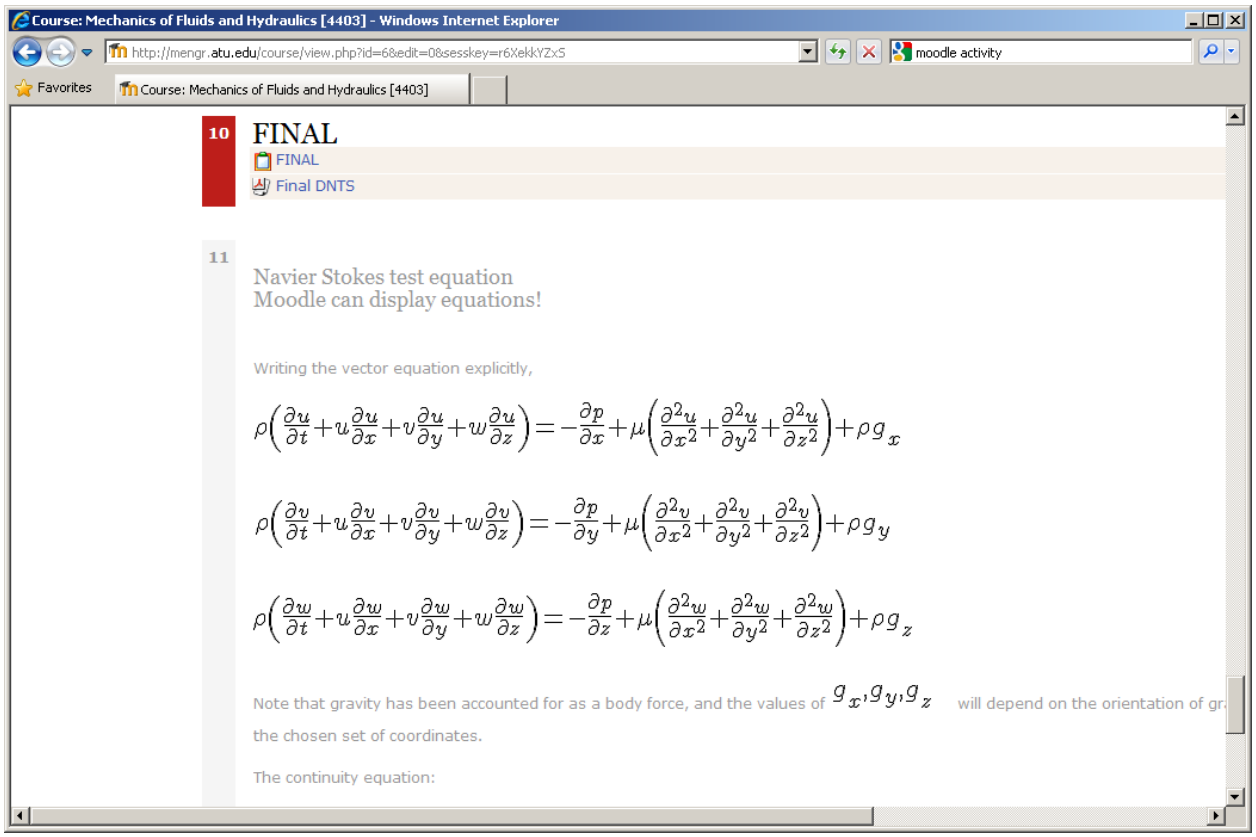

Fig 6, Equation processing in Moodle.

To insure adequate confusion and reduced cheating, Moodle allows the possibility of each student's numerical data to be different. During the creation of the quiz an equation (solution) relating all the unknown variables is placed in Moodle and a database of possible variable combinations is generated. The database may contain only one combination of variable thereby ensuring every student's quiz problem is the same. However, I usually generate 100 possible exams during the creation of the exam to boost the probability that each student receives a different quiz. Quizzes can be timed and restricted to a slice of time in which the quiz may be taken. In fact, if the quiz is password protected, students can be required to show up in a specific room on campus and take the exam during an allotted time. In this scenario, students would show up in a specific room at a specific time, receive a password required to take the test. Not having this password would mean the student could not take the test in another location. However, if an in class student were to send the password via a text message to an out-of-room student, the test may be made available to only a specific set of IP addresses therefore restricting them to either an on-campus or even an in-room location. In addition, these quizzes may be adaptively graded. Adaptively graded quizzes are quizzes that require the correct answer to be submitted to receive any credit. If the student answers the question incorrectly he/she will incur a points penalty. If they answer the problem correctly on the second try their partial credit come in the form of this

points penalty. For example, if a problem is worth 20 points and you, as the teacher, decided that each attempt is worth 5 points; if the student answered the problem correctly on the second (third) try they would receive 15 points (10 points). This enforces good engineering practice in-that pushing a pencil around on a page is not sufficient to receive partial credit, the correct answer is needed at some time before the student exhausts his/her points to receive partial credit.

4. SCORMs

SCORM stands for Sharable Content Object Reference Model and is a collection of standards devised by the department of defense through its Advanced Distributed Learning Lab [11]. SCORM's capabilities are much larger than the small subset of capabilities I use for my courses. In addition, I do not generate the required file structures directly, I use a commercially available package name Camtasia [12] to generate SCORM content. Camtasia is a computer screen recording program. In addition to capturing the computer screen, it simultaneously captures video through a webcam and audio as well. Once recorded, the videos may be edited to cut, add or alter the timeline. One powerful feature, from an educational perspective, is Camtasia's ability to place questions throughout the video stream. Students must answer these questions before the video continues. Processing these files into SCORM format and placing the SCORM package into Moodle allows one to test the students during a video to ascertain their comprehension of the material in the video. This also allows the professor to determine, based on all student responses, whether the material or questions need to be altered in the future to facilitate better comprehension. My first attempts at generating key lectures involved using a webcam recording a white board lecture session. After several attempts, I determined the video size was too large and processing a one hour lecture took more than five hours of computer time. In addition, once created the students often complained about the jumpiness in the video. My next approach involved the use of Microsoft's OneNote in conjunction with Camtasia and a computer projector. This approach removed the jumpiness, increased the number of possible colors used in the lecture and allowed for the creation of a pdf version of each lecture through use of Adobe Acrobat Professional package. A typical OneNote lecture file is shown in figure 7. The lecture was performed using a tablet PC connected to a projector. Since my tablet PC uses Windows 7, I used the snip tool to copy images to paste into OneNote to help in the lecture. As a result, students have the video of the lecture, as well as the pdf of the lecture. In addition to these lectures placed online, I have worked numerous homework problems over the last four semesters and placed them online in SCORM/video format. An example from fluids class may be seen in figure 8.

5. Student's Response

Student's response to this type of course structure has been very favorable. In addition, for the first time in 15 years of teaching I was able to actually get some tangible insight into studying habits of my students. I routinely look at the log files after each test to see their access times to key lectures and homework problems. Interestingly, 80% of students would access the material less than 24 hours prior to each quiz. Those 80% would score on average 12 points lower than those that accessed the material earlier.

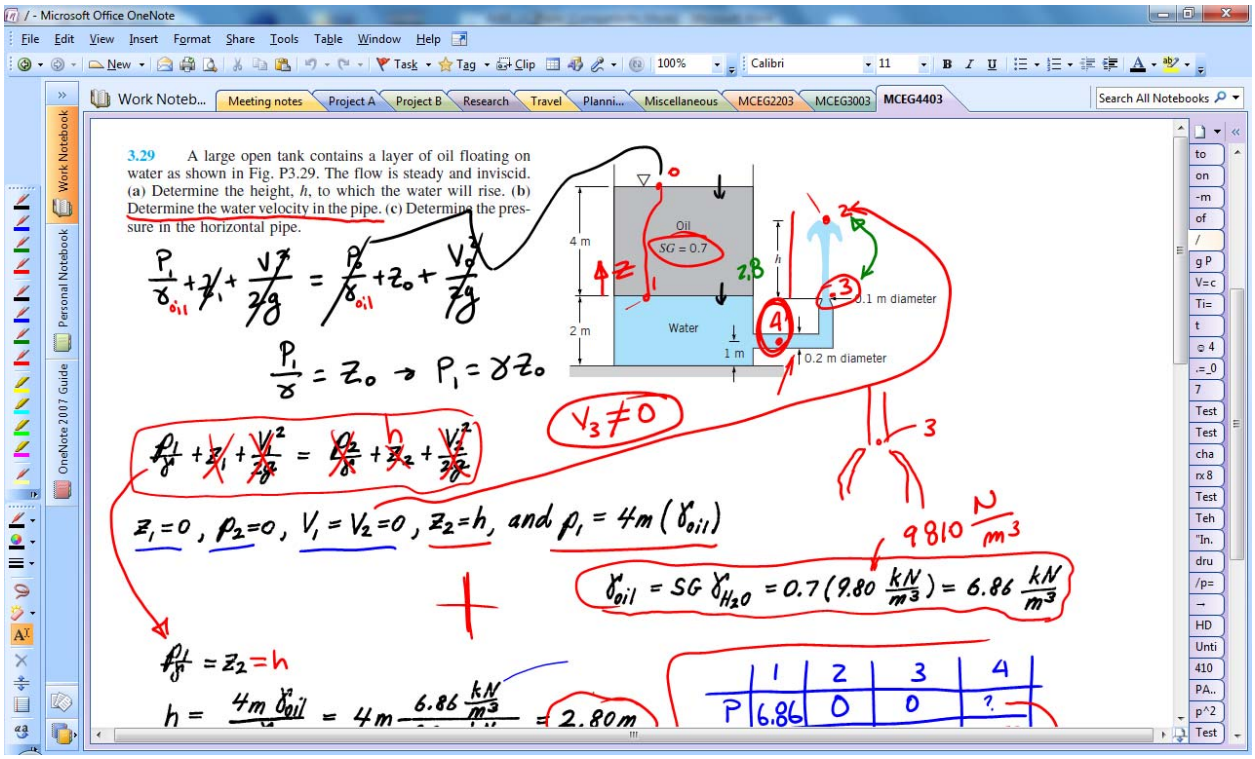

Fig 7, Microsoft OneNote snapshot of fluids lecture.

6. Conclusions

With some work, it is possible to create your own Moodle site for engineering courses. In addition, it is possible to create a functioning Moodle server on your office PC. Once a Moodle site is created, with the proper technical and computer software key lectures and homework problems may be placed online. Although this is possible, undertaking such a project is often misunderstood by many. Far too often those not involved in this type of undertaking see it as a threat and believe you can simply turn on a future course to run on its own without a professor. This comes from a total misunderstanding of the intense effort involved in creating such a body of work as well as a misunderstanding of the true social nature of learning. However, if such a site were create as an integral part of an in-class experience the benefits to both teacher and student can be positive.

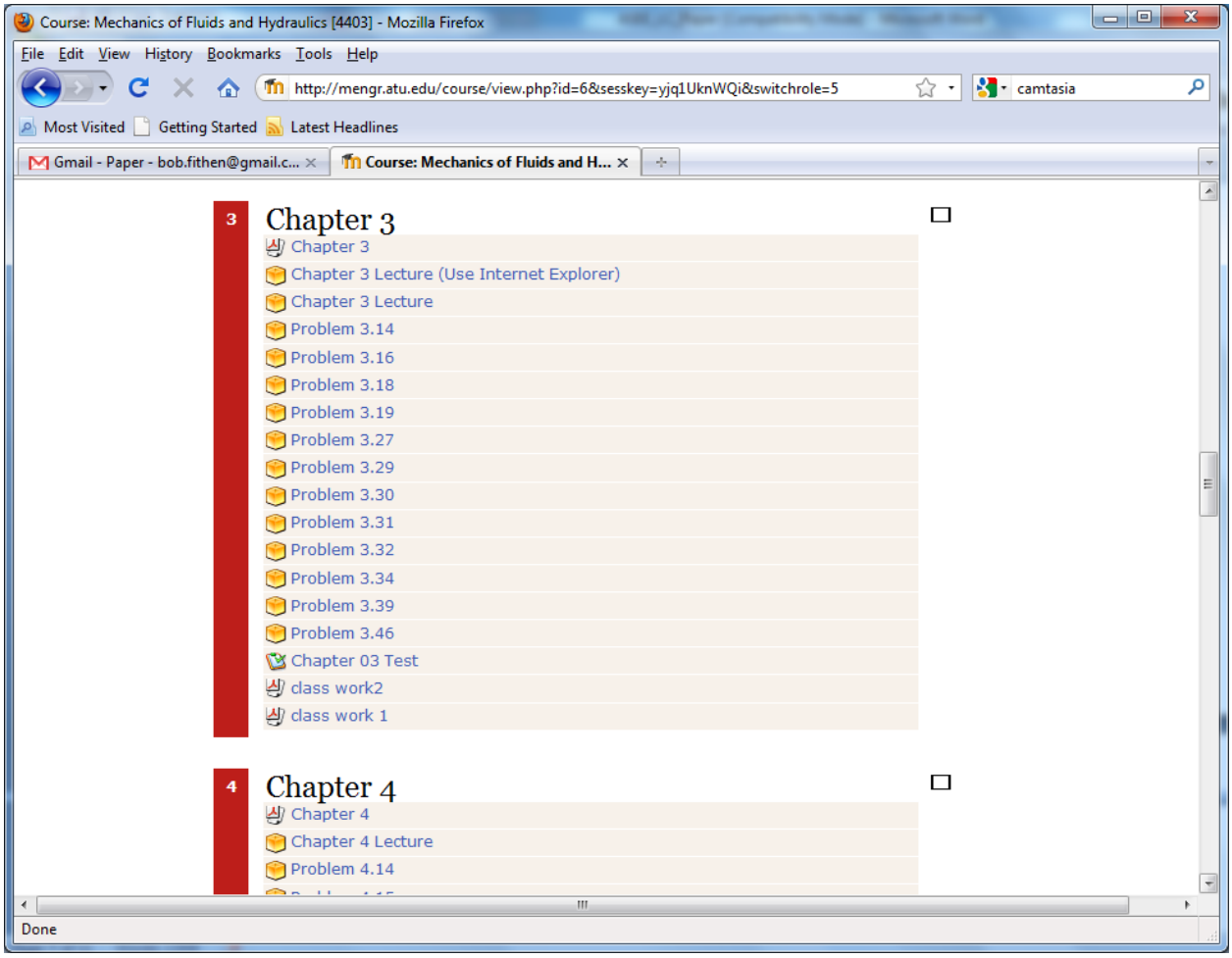

Fig 8, List of online problem videos.

References

[1] http://en.wikipedia.org/wiki/Learning_management_system
[2] http://moodle.org/
[3] http://www.apachefriends.org/en/xampp.html
[4] http://www.apache.org/
[5] http://php.net/index.php
[6] http://www.mysql.com/
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[11] http://www.adlnet.gov/Pages/Default.aspx
[12] http://www.techsmith.com/