

Learning Simplified

Jai P. Agrawal

Electrical and Computer Engineering technology

Purdue University Calumet

agrawajp@calumet.purdue.edu

Abstract

The paper presents a project which aims at enabling the students to view the lecture beyond class time, review the lecture as many times as one needs on her/his pace, listen to the instructor again and again if she/he missed a part (or all) of the lecture. The technology developed in this project enables the students to experience the classroom environment beyond the physical classroom and when a student has either lost concentration or when she/he could not be physically present in the classroom due to situations beyond her/his control. This technology enables teaching/learning without boundaries. The students can be anywhere and the professor can be anywhere in this environment. The technology enables effective and enhanced learning. The students can concentrate on learning and not be distracted by having to take notes. The technology is simple and transparent. Just setup and forget. It is as easy as writing on transparencies. Furthermore, the legacy classroom lecturing is preserved in this technology. The technology is the result of integration of Microsoft Power Point and a third party software for capturing the audio and video parts of the lecture. The resulting lecture is uploaded on a Web server which when accessed, recreates and presents the classroom lecture in its entirety to the student. Additionally, the students can also view and download the pdf version of the lecture.

Introduction

Student population has also undergone many significant changes. The students of today are a curious mix of full-time, part-time, working, homemakers, and students in travel or at distances. Learners have replaced traditional students. The learning needs of modern distance learners are changing [1]. The teaching must come up to meet the new challenges. The technology can help greatly in this Endeavour [2].

Learning styles are as numerous as the teaching styles or perhaps more because the number of learners exceeds the number of teachers. We as educators have responsibility of enabling all learning styles to flourish; slow to fast pace, review in one pass to several passes on continuing or intermittent basis etc. The minimum that we can do is to make the classroom lecture in totality available to the learners at all times and anywhere on demand.

The Lecture On Demand project is aimed to enable the students to not take notes in the class, view the lecture beyond class time, review the lecture as many times as one needs on her/his pace, listen to the instructor again and again if she/he missed a part (or all) of the lecture. Overall, the technology developed in this project enables the students to experience the

classroom environment beyond the physical classroom and when a student has either lost concentration or when she/he could not be physically present in the classroom due to situations beyond her/his control. This technology enables teaching/learning without boundaries. The students can be anywhere and the professor can be anywhere. The technology enables effective and enhanced learning. The students can concentrate on learning and not be distracted by having to take notes. The technology is simple and transparent. Just setup and forget. It is as easy as writing on transparencies. Furthermore, the legacy classroom lecturing is preserved in this technology.

Motivation and History

In the spring of 2004, one of my student in the “Optical Networking” asked permission to audio tape my lecture and as gesture he offered to put it on the Web for other students to use. The permission was granted and the results were impressive. At that time I also used to write my lectures on transparencies in the classroom. I would make hard copies of each lecture and hand out in the following lecture meeting. In the next semester, I thought of taping the audio myself and put it on a course web-site. My son suggested to video tape the lectures and put on the web site. I took video camera to the classroom and started recording the lectures while I was lecturing on the white /black board. A student would focus on the board and record. After the class meeting I would transfer the tape to my laptop computer and put it on the course Web-site. A one and a half hour lecture took equal amount of time to transfer. This time was later saved by taking the gear to the classroom for on-the spot transfer to laptop. It was a cumbersome process plus I needed the help of a student in recording. Furthermore the quality of the recording of the text and graphics was poor. I started writing on the transparencies and the video camera was focused on the display. The video quality was improved. I scanned the transparencies as jpg files and put the whole lecture content on the web page as pdf files. The whole process at this stage was still very cumbersome and time consuming. Sometime in the middle of the semester, I was looking out for a software tool which will allow me to write and draw figures in freehand along with recording my voice, that is, I was looking for a “electronic white board” capable of recording video and audio. I stumbled upon a number of a screen-recording software tools, used by some corporate tutorial presentations. I used one of them which would allow recording and delivery in both synchronous and asynchronous methods. Finally a method was developed using Tablet PC as the main platform. This method recreates the classroom experience to a great extent although not completely as it is devoid of real-time interactivity.

The project idea went on being refined and expanded with the input from students and fellow teachers. Going into the mind of a student, we might hear the following echoes:

“I would like to have access to classroom **Lecture on Demand**

- To view the lecture beyond class time
- To review the lecture as many times as I need on my pace
- To listen to the instructor again and again if I missed a part (or all) of it
- I do not want to take notes in the class, I want a hard copy.

Overall, I do not want to miss the classroom experience when I have either lost my concentration or when I could not be physically present in the class due to situations beyond my control."

Synchronous vs. Asynchronous Learning

Before I present the method of lecture on demand, Let us see the two types of pairing of teachers and learners. Traditional classroom teaching is a synchronous method in which teaching and learning are synchronized. The teacher presents the material to the students in person. The teacher gets visual feedback and has the time and ability to use this feed back instantaneously for adjusting the instructional delivery. Students can interact and enhance the learning experience by asking questions. This method is very effective when either the students have gone through the material before coming to the class or the number of students in the classroom is smaller. However, now the student population has changed. The students are now a curious mix of full-time, part-time, working students, students in travel or at distances. The number of students in a classroom has increased, specifically in the freshmen and sophomore classes. The students may not have time to preview the lecture material in advance and for good reason. The synchronicity is lost almost completely. Some methods use live broadcast, telecast using television, cable or satellite, or using video conferencing. One of the important aims of these technologies is to provide some measure of synchronicity. More is needed, however, than the synchronicity for enhancing the effectiveness and efficiency of learning.

In the asynchronous method of education delivery, the teaching and learning are not synchronous. The teacher records the lecture in a studio with camera focusing sometimes on the teacher and other times on the lecture notes. The lecture notes are either written on paper in handwriting or are prepared in the PowerPoint. The teacher basically combines the video presentation of the lecture with the audio. The recorded lecture is webcasted to a tuned audience using streaming video/audio. The student- teacher interactivity is via chat-line or telephone. The spontaneous student feedback and teaching resilience is missing completely.

There is a need for a method of connecting the teacher and the learner that will have a new paradigm in outreaching to distance and non-traditional learners, high flexibility and aid effective learning. Several experiments and methods are being tried and the related issues are being discussed [3] – [7]. Tegrity Inc. [8] has a solution that is very good, is expensive and does not let the teacher take full command of the process. The technology of Lecture on Demand as presented in this paper is a low-cost and provides the instructor full command of the teaching-learning process. This technology is also very effective in other parts of the world where students in some institutions have to learn the courses themselves in the absence of instructors.

Project Lecture on Demand

In the method of lecture on demand, the production and delivery are all done by the instructor himself without any complicated gear and without any assistance. Teacher has the flexibility of recording the lecture in a studio or in the real classroom with students in the synchronous manner or in studio or at home or elsewhere. The instructor uploads the lecture in totality (video+audio) on a website and the learners have access to it at all times and from anywhere. The students have

access to the teaching material off the classroom for repeated viewing, and for learning on their pace. It is a great help to those who missed out in the classroom, came late or did not show at all.

Students may use Video Podcasting using iTunes for access in mobility. Podcasting is an accessing method for the course content which is stored on the ECET server. It can enable video-streaming, provided the /audio/video file is recorded in that format. The file size may increase in the video-streaming format.

Project Definition

- 1) To record both audio and video in the classroom lecture.
- 2) The lecture recording must be as easy as possible with minimal gear and minimal training.
- 3) To publish lecture on the Web along with other instructional materials

Demonstration

The following web page demonstrates the lecture recording using a simple electrical circuit problem: <http://ecet0.calumet.purdue.edu/JPA/lectureondemand.htm>. This demonstration assumes that the initial settings are completed as given in the appendix. It will show how to record the lecture in audio-video using .wmv file and create a soft copy of the lecture as a .pdf file. The lecture may be hand-written (using a stylus) on a PowerPoint (2003 or higher) blank on a Tablet PC. The instructor speaks as he/she writes or draws. The instructor can use a pre-scanned picture from a book or other sources, stored as an icon on the side of the screen or PowerPoint window. The whole file is recorded as a .wmv file. The Huelix [3] software allows selection of the quality of the video/audio recording on a big range from Finest to the lowest resolution. The file size for optimum recoding quality is approximately 500 Kbits per minute of recording. A lecture of 75 minutes is recorded typically in a 30-35 Mbits file. Learners will require a high-speed broadband connection for complete download, else it may be streamed. Learners with limited Internet speed can be provided lectures on pre-recorded CDs or DVDs.

Lecture on Demand

Demonstration

Maximum Power Transfer Theorem

$$V_o = \frac{R_L}{R_L + R_s} \cdot V_s$$

Power delivered to the load

$$P_L = \frac{V_o^2}{R_L}$$

Lecture on Demand

1

Figure 1 A web page in the demonstration of Lecture on Demand

An Engineering Course Using Lecture on Demand

The author has taught a number of courses using this technology in last three semesters. The following web page demonstrates a complete class based on the technology of the Lecture on Demand: http://ecet0.calumet.purdue.edu/JPA/ecet154_s06.htm. This course was developed and taught in the Spring Semester 2006 in the Department of Electrical and Computer Engineering Technology at Purdue University Calumet. Students are excited about having the hardcopy of the lecture after the synchronous teaching in the classroom but generally do not have time to review the audio/video lecture again after class hours. The students-on-work are extremely happy to be able to not completely miss the classroom experience by watching the audio/video lecture. It has affected the attendance in the classroom to some extent, but that is essentially a choice adult learner have to make.

For the lecturer, delivering the lecture is little different from writing on transparencies. It requires minimal change of style of lecturing and minimum training. It may be easily incorporated on any distance teaching/learning platform such as the WeBCT platform. Recording can be paused and resumed easily. The synchronicity between audio and video is ensured by the Huelix recording software.

PURDUE
UNIVERSITY
CALUMET

Electrical And Computer Engineering Technology

ECET 154- Analog Electronics

ECET-154: Analog Electronics

Lecture: Monday and Wednesday 5:00-6:20 p.m. POTT 213
 Laboratory: Monday 6:30-9:20 p.m., lab- POTT 316
 Instructor: Dr. Jai P. Agrawal, POTT 315B, ph. 219-989-2479, agrawajp@calumet.purdue.edu

Instructor

	Jai P. Agrawal
Office	POTT 315B
Office Hours	TBD
Phone	219-989-2479
Email	agrawajp@calumet.purdue.edu

Course Description:

A study of the character and applications of transistors, integrated circuits, and other solid-state devices. Includes rectifier circuits, waveform interpretation, AC and DC load lines, biasing techniques, equivalent circuits, single and multistage class A small-signal amplifiers, and h parameters.

Prerequisite: ECET 102 and ECET 152 or consent of the Instructor

Laboratory:

- A laboratory group consists of a maximum two students who will be doing lab together for the whole semester.
- Each group must complete all exercises, write reports and keep them in a folder. The folder will be examined at the end of the semester.
- Each student member of group must alternately write report.
- The cover page of the lab reports must contain the following info:
 - Title of the exercise
 - Date of

Figure 2 the main page in the Class website based on the technology of Lecture on Demand

Impact

The lecture on demand technology has brought a new paradigm in my teaching. The impact of the technology can be highlighted in the following:

- Effective and enhanced learning
- Students can concentrate on learning and not be distracted by having to take notes.
- The technology is simple and transparent. Setup and Forget.
- It is as easy as writing on transparencies.
- The legacy classroom lecturing is preserved.
- Teaching/Learning without boundaries; Students can be anywhere and the Professor can be anywhere.

This technology can usher in some new thoughts and out-of-box impacts:

- Students will be able to register for those classes which have overlapping schedule.
- The scheduling of classes will become easier.
- The graduation period could be reduced.
- Enable web based education with wholesome experience.

- Working professionals can take continuing courses without leaving the premises and can mix and match learning with work.

If this technology is used in complete on-line teaching, we must resolve the issues relating to testing and on-site proctoring and conducting laboratory experiments in engineering courses. Until the technology of the remote controlled experimentation is matures, the lecture-on-demand technology is restricted to no-lab courses.

Conclusion

The Lecture on Demand technology of instruction is a low-cost, highly flexible technology. It enables the learners view the lecture beyond class time, review the lecture as many times as one needs on her/his pace, listen to the instructor again and again if she/he missed a part (or all) of the lecture. This technology makes it unnecessary to takes notes in classroom lecture, which often distracts the learners and may result in blanking out some parts of the lecture. Overall, the technology developed in this project enables the students to experience the classroom environment beyond the physical classroom and when a student has either lost concentration or when she/he could not be physically present in the classroom due to situations beyond her/his control. This technology enables teaching/learning without boundaries. The students can be anywhere and the professor can be anywhere. The technology enables effective and enhanced learning. The students can concentrate on learning and not be distracted by having to take notes. The technology is simple and transparent. It is as easy as writing on transparencies, therefore does not require big adjustment on the part of the lecturer. Furthermore, the legacy classroom lecturing is preserved in this technology.

Appendix

The following hardware and software information is provided for the ones used in the project of this paper.

Hardware	Make	Specifications	Cost	Comments
Tablet PC	Toshiba Satellite	Standard	\$1500	Essential
Video Camera	Logitech	Lap-top camera		Required only if the instructor wants to put her/his live image on the screen
Clip-on microphone	Built-in Toshiba Satellite	With power amplifier		May be required on some Tablet PCs.
Projector	Any that can interface a laptop computer			
Software	Make	Specifications	Cost	Alternatives
Windows XP/ Office 2003	Microsoft			
Huelix Screen Recorder	www.huelix.com	Version 2.0	\$35	1) Wink 2.0 (free) http://www.debugmode.com 2) Camtasia Studio with Techsmith video Codec (\$149)
Windows Media/Real Player	Microsoft		Free	

Initial Settings:

- Open the PowerPoint 2003 window where you would like to write the lecture.
- Add sufficient number of blank pages for the lecture duration.
- Add drawings/clips as small icons on in a small area, such as in a small vertical space on the right of the window.
- Open the Huelix Screenplay Wizard window by clicking the icon on the bottom right corner or on the desktop.
- Select the *Screen area* as the area of recording.
- Select to save the output to a file.
- Select to capture audio from the default device.
- Select medium quality of recording. This setting ensures a typical 0.5 Mbits per minute of recording.
- Set the microphone as the audio input device; make sure the microphone is active.
- Minimize the Huelix Wizard window, so that it comes on the right bottom corner of your PC screen.

- Connect the projector via a monitor cable to the tablet PC, set for dual display on your screen and the projector screen simultaneously. Set the projector.

Recording:

- Open the PowerPoint file which you have just created.
- Set the writing area to approximately 85% of the total screen.
- Select the ballpoint pen on the Insert Ink Annotations menu. Set the pen color. Open the pen stylus of the Tablet PC.
- Start recording screen activity and audio after selecting the “start” button on the Huelix Wizard button the right bottom corner of the PC screen.
- Start writing with the pen and speaking into Tablet at convenient height with or without the clip-on microphone, or wireless microphone, depending on the Tablet PC system.
- Turn the pages on the PowerPoint file in usual manner.
- After the recording is completed, press the “stop” button the Huelix Wizard window. The output file is saved in the .wmv format at the desired location.

The tablet pen has an eraser to erase any ink annotation. The .wmv file can be uploaded and linked on the course web page using the Microsoft FrontPage or DreamWeaver tool. The PowerPoint file must be saved along with the annotations. You may generate a .pdf version of the PowerPoint file and upload to the course Web page. Students find the .pdf file very useful. This enables them to concentrate in listening to the lecture without taking notes.

I have included a freeware for screen recorder software, Wink. However, the initial tests that I have done Wink, does not reduce the file size. I have also noticed the lack of synchronicity between the audio and the video content of the recording. It has to be investigated further. There are many recording software tools which can be looked into.

References

- [1] Distance Learning -- http://horizon.unc.edu/projects/issues/papers/Distance_Learning.asp
- [2] Software Tools for Web Learning –
<http://www.knowledgeability.biz/weblearning/softwaretools.htm>
- [3] “Technology: will it replace us? Digital Diploma Mills?” National Education Association, <http://www2.nea.org/he/webppt/cgu2/sld018>.
- [4] The Chronicle of Higher Education, Friday, October 13, 2000. New Data on Technology Spending Offers Benchmarks for College Administrators.
- [5] U.S. Department of Education, Distance Education, Distance Education at Postsecondary Education Institutions: 1997-98, National Center for Education Statistics (available on-line at nces.ed.gov)
- [6] Green, Kenneth. Campus Computing 2000: The 2000 National Survey of Computing and Information Technology in US Higher Education. Encino, CA: Campus Computing 2000.
- [7] CAETE Distance Learning Program, Colorado University at Boulder,
<http://caete.colorado.edu/>
- [8] www.tegrity.com

Biographies

Jai P. Agrawal is Professor of Electrical and Computer Engineering Technology. He received his Ph.D. in Electrical Engineering from University of Illinois, Chicago, in 1991, M.S. and B.S. also in Electrical Engineering from I.I.T. Kanpur, India in 1970 and 1968 respectively. Professor Agrawal has worked recently for two years in optical networking industry in the Silicon Valley in California. Professor Agrawal is the Founder Advisor to Agni Networks Inc., San Jose, California. His expertise includes optical networking at Physical and Data link layers, optical and WDM interface, SONET and Gigabit Ethernet and analog electronic systems. He is the author of a Textbook in Power Electronics, published by Prentice-Hall. His professional career is equally divided in academia and industry. He has authored several research papers in IEEE journals and conferences.