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"Technical Note"

Virtual Class Room Experimentation for Teaching Manufacturing and Operation Management Course

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KEYWORDS

Virtual Class room,
Web-based virtual Class room (WVC),
Information and communication technologies (ICT)

ABSTRACT

There has been a recent development and explosion of interest among academicians across a wide range of disciplines in the use of virtual Class room. Utilization of the virtual class room as a laboratory experimentation for teaching and learning has increased significantly in recent years as development tools for web based applications have become easier to use and computers have become more capable and less expensive. But, does the virtual class-room improve students learning? Herein we describe the results of two experiments conducted on sections of a Manufacturing and Operation Management course [MIME - 3240] at one of the Colleges of Technology in the Sultanate of Oman during fall semester. Two experiments were designed to determine if student learning of Manufacturing and Operation Management course was significantly affected by two treatments: 1) Virtual class room environment for the students of section S_2 and 2) Real Class-room environment for students of section S_1. The actual final scores of students of section S_1 and S_2 were compared in order to determine the effectiveness of virtual class room on student learning for the Manufacturing and Operation Management course.

In this study Web-based virtual Class room (WVC) is developed to communicate, to share and to disseminate knowledge from the teacher to student. Further, in this study web based tools are also used to create, store, and manage contents of class room instructions and course material..

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1. Introduction

The rapid growth and affordability of internet and computer technology has provided an immense opportunity for educational institutions to expand, enhance, and perhaps replace traditional class-room teaching. Use of internet and computers in teaching – learning process will enhance the self learning and independent learning. Virtual Class room is an on-line teaching and learning methodology where in teacher and student are separated by time and space. Teacher provides course content and class room instructions to students through multimedia resources, the internet and video conferencing.

Virtual Class room facilitates collaborative learning among the students, between the students and instructors and also among the instructors [1, 2]. While

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the internet offers many new potential benefits, exactly how and to what degree the internet/computers are effective in education is an important question to be addressed. This is especially true in light of recent studies that show Class room instruction cannot be effectively replaced solely by a virtual Class room environment [3,4]. However, when Internet/Computers are used as a supplement to the Class room teaching, they have been found to be more effective in teaching and learning process. Internet and computer along with class-room interaction helps to facilitate an interactive learning environment with increased students – teacher participation in the teaching and learning process.

Computer Aided Teaching (CAT) provides a significant advantage for teaching and learning. The benefits of CAT are that it reduces learning time. Another significant advantage of CAT is its cost effectiveness particularly as the cost of computer hardware continues to decrease and many software platforms are being developed which can be used in the teaching and learning process [5, 6]. Computer aided teaching has become the backbone of many teaching comparison studies. Many researchers have treated the various teaching media like computer assisting teaching and traditional method of teaching by using black board and chalk. In this paper the two different teaching environments: real class room & virtual class room environment are considered for the effectiveness of teaching and learning of the Manufacturing & Operations Management course and the objective of our study is:

1. To develop virtual Class room for the 'Manufacturing and Operation Management' course
2. To conduct an experiment to determine the learning effectiveness of students for the Manufacturing and Operation Management course through two different learning experiments
   a. Virtual class room teaching and learning experiment
   b. Real class room teaching and learning experiment

The rest of the paper has been organized as follows: next section discusses experimental frame work followed by development of virtual class room and use of statistical tools for comparing the results of the two experiments. Finally the results of this research are discussed and this is followed by conclusion and references**.**

2. Overall Design of Experiment

Herein, we describe the experimental frame work and methodology used in this experiment.

2.1. Experimental Frame-Work

This study is conducted at a College of Technology-Oman for teaching the Manufacturing and Operation Management course [MIME - 3240]. This course is for the higher diploma students for mechanical engineering specialization. The objective of course is to introduce the concept of operation management, optimization techniques, line balancing and sales forecasting techniques to students. The various modules are shown in the Table 1.

Tab. 1. Modules of the Course

S. No	Modules of Course
1	Concept of Manufacturing & Operations Management
2	Sales Forecasting
3	Capacity Planning
4	Assignment Problems
5	Inventory Management
6	Productivity & Work-study

During the fall semester, the total number of students registered for the course is divided into two sections S_1 and S_2.

Students of section S_1 were allowed to attend the regular classes. However, students of section S_2 were not allowed for attending the classes, instead they were allowed to learn through virtual class room instructional material provided to them. The students of both the section were provided an opportunity to interact with teacher outside the class to solve their academic difficulties.

The choice of enrollment between the two sections S_1 & S_2 was made by the students with out prior knowledge of the differences between the teaching-learning systems.

However, the students were allowed to switch between sections for the first three weeks (although no students elected to make a change from one section to another).The students of both the sections were provided with hard & soft copies of the course material, power point presentation of course material. Web-based virtual class room instructional materials were made available for students of both the section S1& S2. Figure 1 shows the relationship between two experiments conducted for finding the learning effectiveness of two different teaching environments 1) Virtual class room environment and 2) Real class room environment.

In this study teacher, Class room and course material are considered as an experimental constants and teaching environment as an experimental variables. Section S_1 is treated for real Class room environment and section S_2 is for virtual Class room environment. Students of both the sections were given identical home works, quizzes and assignments. Final examinations were conducted for both the sections on the same date and time and also at the same location during the semester. Table 2 summarizes the experimental constants and experimental variables.

2.2. Grading Methodology

Learning performance of the student is measured by the grades obtained by them. The grading methodology is same for both the section S_1 and S_2. Students were

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accessed continuously through out the semester. The continuous assessment was done by giving assignments and quizzes which were given 25% weightage each. Final assessment was done by conducting the final examination which was given 50 % weightage. Finally, the weighted average method was used for calculating the marks and grading the students. The weighted final score is calculated as below.

Weighted final score = 0.25(Assignment) + 0.25(Class Test) + 0.50(Final Exam).

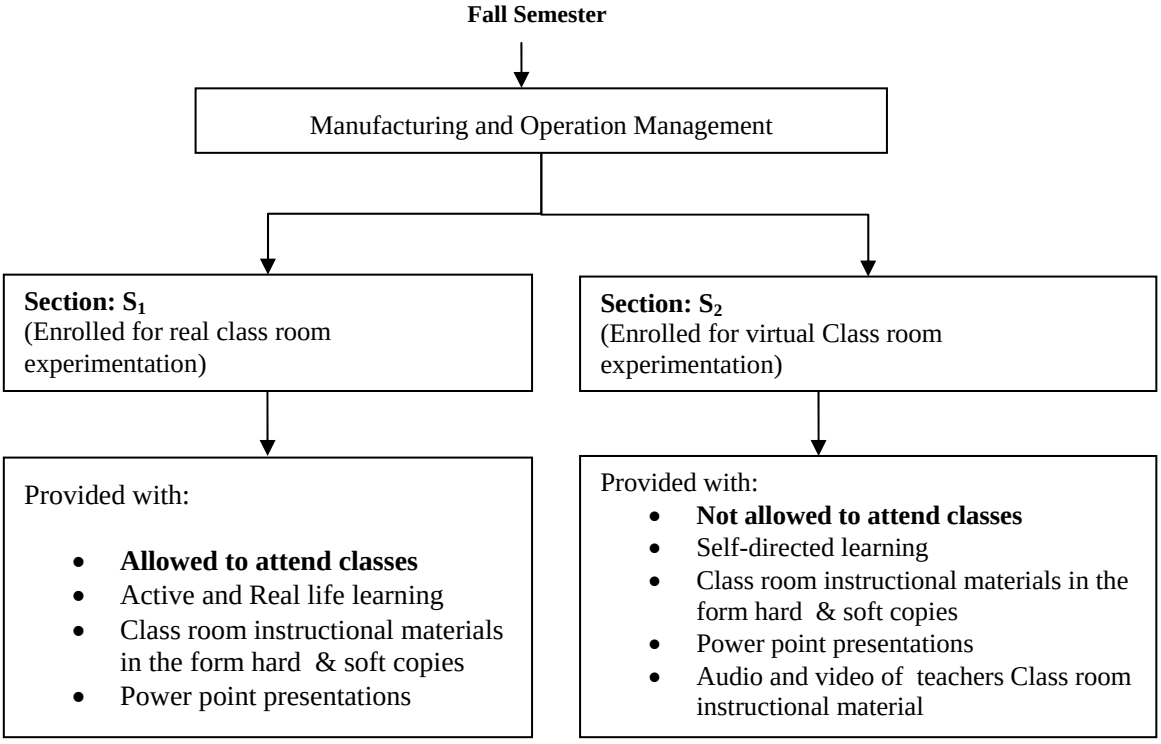

Fig.1. Relationship between two experiments

Tab. 2. Experimental Constants and Variables

Experimental Constants	Experimental variables
Teacher	Teaching Methodology
Class room	Virtual Class room environment for Section2
Course material	Real Class room environment for Section1
Power Point presentation materials	
Quizzes/Assignments/Final examination	

3. Virtual Class Room Environment

A virtual Class room is a "virtual facility" provided for interaction among members of class. [7]. A Virtual Class room will work over the internet and it is a collection of word files, audio and video files and still pictures. Virtual class room is developed and is provided to the students of both the sections S_1 & S_2 of Manufacturing and Operation Management course. Virtual class room contains course materials, power point presentations of the course, audio and video of teacher's class room instructions, assignments and quizzes. Virtual class room is created and posted over the internet for learning by those students who were absent for the class and also for those who needs repetition of class.

3.1. Role of Information Technology in Educational Institutes

Technology plays an important factor in education. Information and communication technologies in education encompasses the technologies such as desktop, notebook, digital cameras, local area networking, the Internet, CD-ROMs and DVDs, and application such as word processors, spreadsheets, tutorials, simulations, email, digital libraries, computer-mediated conferencing, videoconferencing, and virtual reality.

These IT tools are being used for online registration of courses, for communicating to students and staff, for sending the results of the examinations, for displaying results and important instructions to students etc.

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Internet is being used for online learning which gives students the opportunity to learn without any time and location barriers. The interactive whiteboard is capturing the attention of academicians to use it as teaching media in the class room.

3.2. Role of Interactive Whiteboard in Virtual Class Room

In this research, an interactive white board (IWB) was used to develop virtual class room. Interactive white board is a large interactive display that connects to a computer through a wired medium or wireless connection (Bluetooth) and projector. The device driver software is loaded in the attached computer where it enables the IWB to act as a Human Input Device (HID).

A projector projects the computer's desktop on the board's surface, where user controls the computer using a pen, finger or laser pointer. The board is typically mounted to a wall or on a floor stand. Interactive Whiteboard can interact with online shared annotation and drawing environments in the form of interactive vector based graphical websites. It allows the lecturer to keep notes and annotations as an electronic file for later distribution either on paper or through a number of electronic formats. It also allows the lecturers to record their instruction as a digital video file and post the material on the college server.

3.3. Design of Virtual Class Room

A virtual Class room environment was created for the students of section S_2 to replace the real class room environment. Developed virtual class room, provides a means for out-of-class room discussions, and foster 24 – hours learning. The initial course material is being prepared by lecturer with the modules referred to as topics.

Each topic contains illustrations in various media such as text, still pictures, slides, video, and interactive software. Virtual Class room which is prepared in this study is a combination of picture slides and audio and video files.

The students can retrieve and down load the contents of virtual class room through a link which is provided on the virtual class room website. Students can view the slides and hear the lecturer's voice. The architecture of virtual class room is shown in the figure 2.

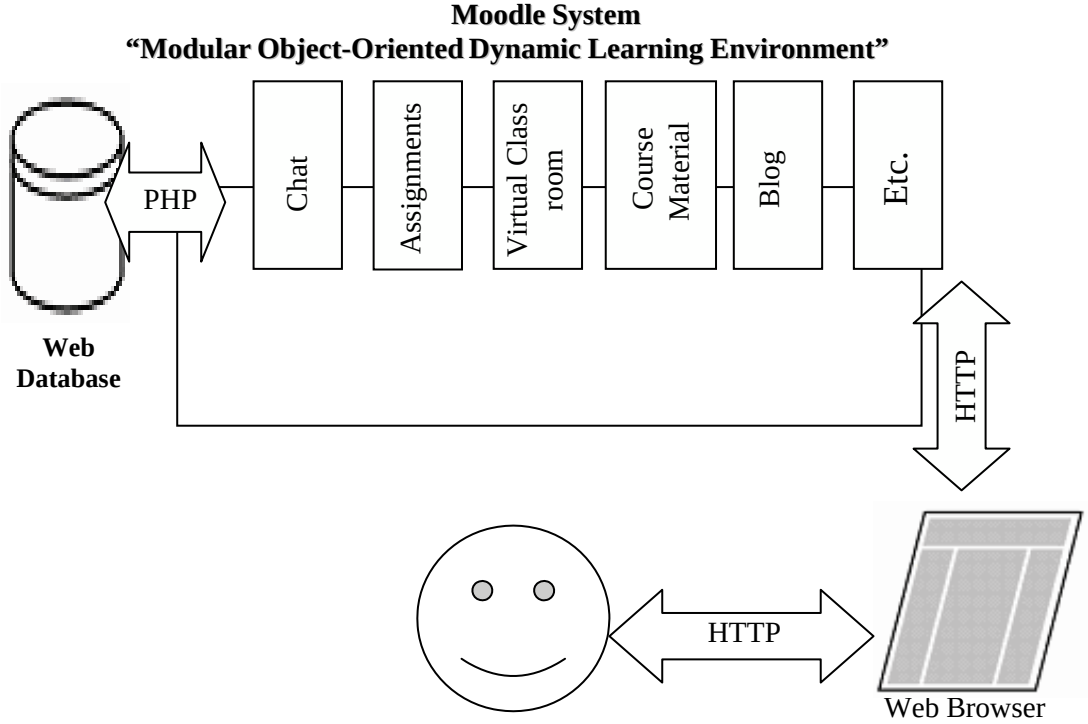

Fig. 2. Architecture of Virtual Class room

Further, virtual class room also contains electronic library. The virtual class room is uploaded in the college website through e-learning perspective link-http:/ict.edu.om. Students were strongly encouraged to access this website for in-class handouts and class room instructions. The details regarding the website which is developed for the virtual class room experimentation can be found in Appendix A. Each student who has registered for the course is provided with user name and password to access this virtual class. Virtual class room relies heavily on Moodle software, internet, local area network and

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electronically-stored notes and solutions. The students of both the sections S_1 & S_2 were allowed for accessing this virtual class room.

3-4. Real Class Room Environment

The course is having 4 contact hours per week. The lecture was scheduled on every Monday at 8:00AM to10:00AM and on every Saturday at 10:00AM to12:00PM in ME102 Class room. The Class room is provided with various latest technologies like, computer, local area network, internet, white board and interactive digital white board. These tools were used for teaching the students of Manufacturing and Operation Management course. Students of section S_1 were allowed to attend the regular classes. However, students of section S_2 were not allowed for attending the classes.

4. Results of Experiment

The weighted final scores of all the students of both the sections were calculated. Various statistical values like mean, standard deviation, maximum and minimum marks for both the sections are calculated and shown in the table 3. Further, the number of students got different grades in each section are compared and shown in the table 4 and in the graph 1 & 2.

It is observed from the statistical analysis that mean, minimum and maximum marks for the students of real class room environment (section S_1) are higher than the students of Virtual class room environment of section (S_2).

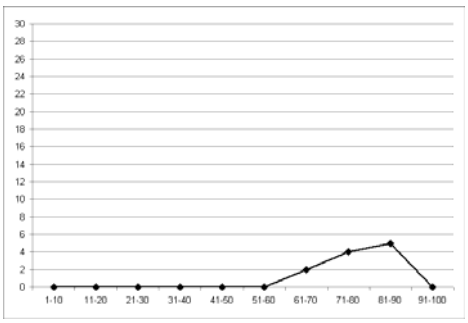
It can also be concluded from the comparison table 4 that students of S_1 have obtained higher grades compared to students of section S_2.

Tab. 3. Descriptive statistics of weighted final scores

Section	Teaching Methodology adopted	Maximum marks	Minimum marks	Average	Standard deviation
S_1	Real Class room teaching & Learning Environment	92	70	82.82	5.69
S_2	Virtual class room teaching & learning Environment	86	67	74.76	5.81

Tab. 4. Descriptive statistics of weighted final grades

Grades	Number of students in S1 section	Number of students in S2 section
A(90-100)	2	Nil
A-(85-89)	5	1
B+(80-84)	10	3
B(76-79)	3	4
B-(73-75)	1	2
C+(70-72)	1	2
C(67-69)	Nil	5
C-(60-66)	Nil	Nil
D(53-59)	Nil	Nil



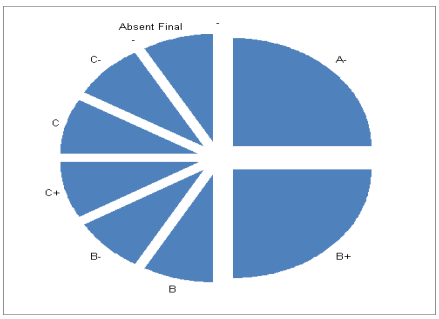


Fig. 3. Graphical representation of Number of students and grades for students of Virtual class room experimentation [X-axis- Range of Marks & Y-Axis-Number of students]

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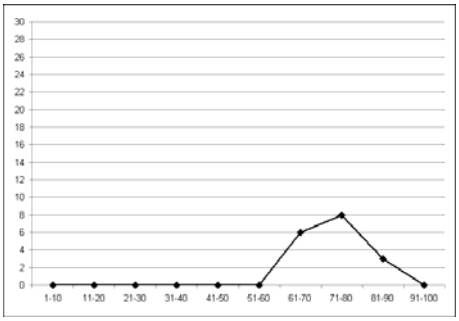

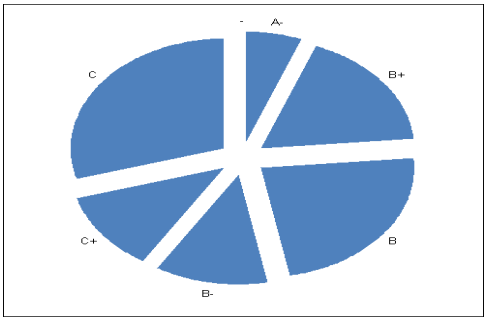

Fig. 4. Graphical representation of number of students and grades for students of real class room experimentation [X-axis- Range of Marks & Y-Axis-Number of students]

5. Conclusion

From the results of the experimentation, (Table 3 & 4, Graph 1& 2) it appears that students have scored more when they were provided an opportunity to attend the classes. Following are the conclusions of this study.

I. The students of virtual class room experimentation (section S_2) have not performed very well. One of the possible reasons for this phenomenon is that students of section S_2 were not allowed to attend the classes. Virtual class room environment has not produced any additional effect on the learning of the students.

II. The students of Section S_1 have more mean, maximum marks, higher grades and less standard deviation compared to students of section S_2. One of the possible reasons for this phenomenon is that students of section S_1 were allowed to attend the classes in addition to the use of virtual class room material which were uploaded in the college website.

III. The various IT tools like Internet, computer and electronic board were more effective in the teaching and learning process when they were used along with teacher in the class room. However, these electronic tools were not much effective in the teaching and learning, when they were used as a replacement for the teacher.

IV. Virtual class room is not the replacement for the real class room for the effective teaching and learning process.

Inventions of the new technologies are not the replacement of the existing systems. However, the new technologies and old systems should be used together for improving the teaching –learning process.

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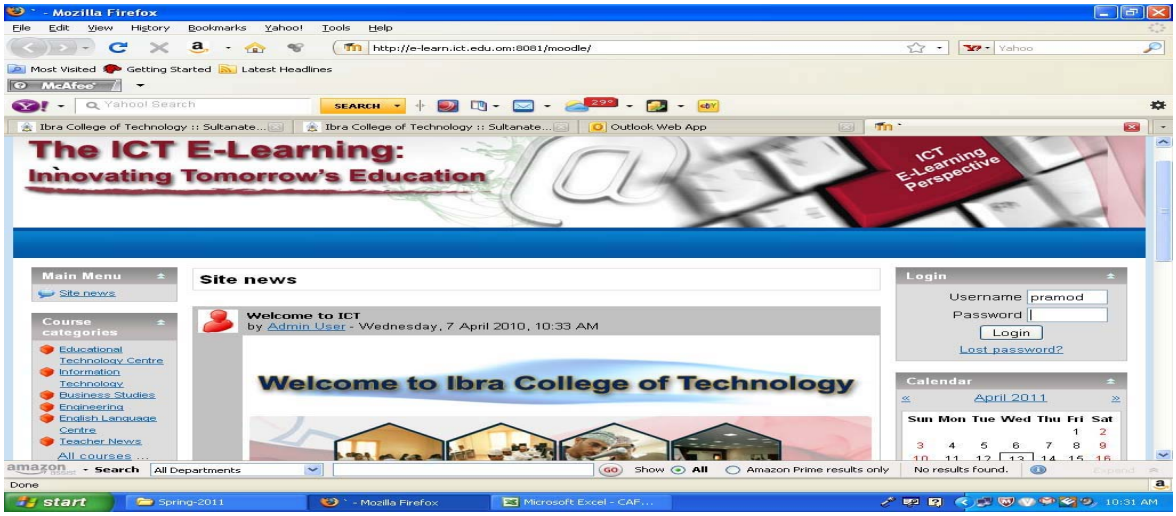

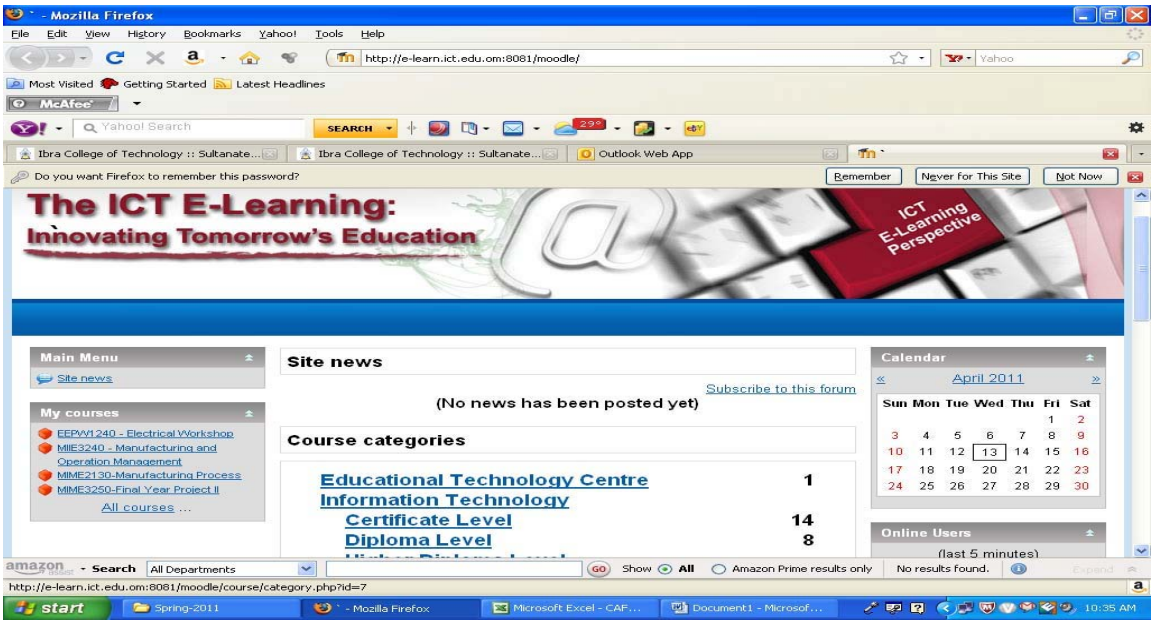

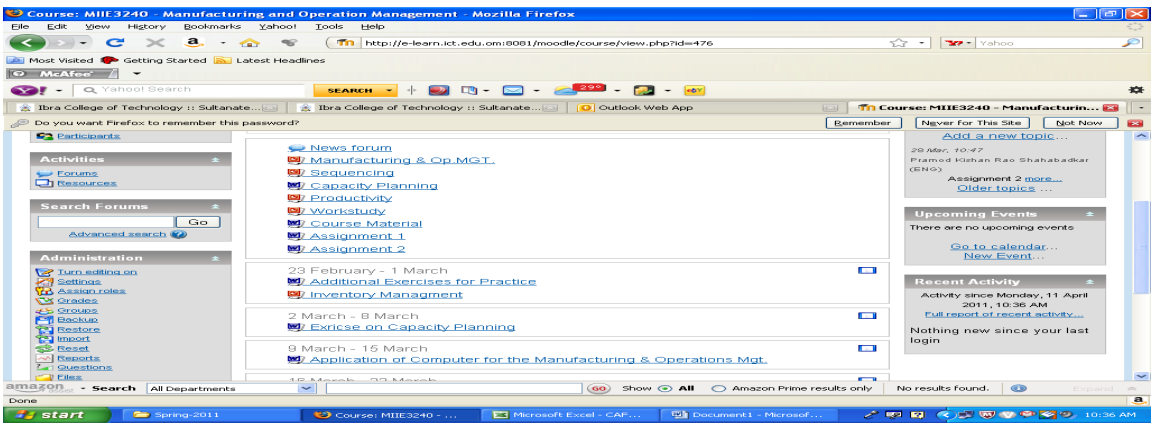

Annexure A- Website for Virtual Class room experimentation

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