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CAN VIRTUAL CLASS ROOM REPLACE REAL CLASS ROOM? A CASE STUDY

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ABSTRACT

Virtual class room is a form of learning using electronic means, primarily e-mail and the internet, as computers have become more capable and less expensive. In virtual class room there is less direct teacher-to-student interaction than normally found in the real class room. In virtual class room teacher's role is mainly that of facilitator, who motivate the students to accept more individual responsibility to manage time and complete tasks within the given time frame. Still, some students learn less in actual fact using this method via internet. Move ahead, they need explanation from the teacher as they may not be able to comprehend the given information. Therefore, this case study emphasize that virtual class room may not be able to replace real class room in the teaching and learning process.

This case study investigates the validity of equivalency theory among 39 students by comparing two teaching and learning methods. Commonalities included same term, same lecturer, and identical assignments/tests in the same order, thus allowing a direct comparison of course outcomes.

Keywords: Information and communication technologies (ICT), Internet, Real Class room, Virtual Class room, internet.

1 Introduction

The rapid growth and affordability of internet and computer technology has provided a huge 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,

International Journal of Enterprise Computing and Business Systems

ISSN (Online) : 2230-8849

<http://www.ijecbs.com>

Vol. 2 Issue 1 January 2012

the internet and video conferencing (Bordogna, 1996; Coppola and Deborah, 1997). Due to Globalization and new technologies like the internet make the world appear smaller and without boundaries (Manisha and Niti 2011).

Virtual class room requires patience, motivation, self-confidence, dedication, and a general knowledge of using a computer and internet. Furthermore, the effectiveness of virtual class room varies based on individual's learning style and behavior type (Jones, Moeeni, and Ruby, 2005; Meyer 2003). Internet and computer along with class-room interaction provide an interactive learning environment with increased students – teacher participation in the teaching and learning process (Montgomery and Fogler, 1996; Pan and Sullivan 2005).

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 (Ibanez and Carlos, 2006). While the internet offers many new potential benefits, exactly how and to what extent the internet/computers are effective in education is an important question to be addressed. For today's computer literate generation of students are act as driving force for educational institute to improve online learning environment. Due to the fast growing population in universities, the option of distance education serves students in areas where adequate funding to provide larger facilities is a scarcity (Moller, Foshay, and Huett 2008).

Many researchers have treated and compared the various teaching media like: computer assisted teaching and teaching by using white board and marker. 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

For this study, two sections of an undergraduate course were offered during the same semester by one lecturer using identical syllabi and assessment instruments. The two courses differed only in the presentation format: one was a traditional classroom with limited online exercises and other was entirely online. The course used in this study was "Manufacturing and Operation Management," an introductory class designed to familiarize students with various aspects of the course. To address a greater emphasis on teamwork and development of student competencies, practice-centered techniques are used in the practical sessions of the subject. Practice-centered approaches emphasize knowledge acquisition through the individuals' social

International Journal of Enterprise Computing and Business Systems

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<http://www.ijecbs.com>

Vol. 2 Issue 1 January 2012

or cultural surrounding, which are central to how concepts are understood and how learning occurs (Sargent et al., 2009).

The 22 students enrolled in the classroom section of the course were mostly traditional, residential undergraduate college students. The 17 students in the online course were geographically distant so never met the professor face-to-face, contact was limited to e-mail, online discussions, and occasional phone calls from students to the professor. These students were mostly non-traditional, with many of them working full-time and taking the course due to its time flexibility.

Huang (2002) describes the big constraint for the success of virtual class room is that some students are not focused and willing to thrust themselves to complete the work, they need a teacher in front of them for explaining the course subject matter and materials, answering spontaneous questions, and monitoring their work. In order to learn, these types of students need a traditional class room. In this research, the effectiveness of virtual class room were analyzed, it suggests that virtual class room cannot be used to completely reduce real class room based learning.

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

In this, 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 target population for this study was defined as students enrolled for the fall 2010 semester. The basis for selection of this course was that there were two sections of the course taught during the same semester, one of which was taught in a real class room and the other taught in a virtual class room. In addition, same teacher taught both sections of the course.

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.

Table 1 Modules of the Course

S.	Modules of Course	Time allotted in Hours
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International Journal of Enterprise Computing and Business Systems

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<http://www.ijecbs.com>

Vol. 2 Issue 1 January 2012

No		
1	Concept of Manufacturing & Operations Management	6
2	Sales Forecasting	8
3	Capacity Planning	6
4	Assignment Problems	6
5	Inventory Management	10
6	Productivity & Work-study	10

In this study teacher, Class room and course material are considered as an experimental constants and teaching environment as an experimental variables. 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.

Table 2 Experimental Constants and Variables

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

Students of section S_1 were allowed to attend the regular classes. However, students of section S_2 were not attended lecture sessions; instead they were allowed to learn through virtual class room instructional material provided to them. 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. 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 S_1 & S_2 . 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.

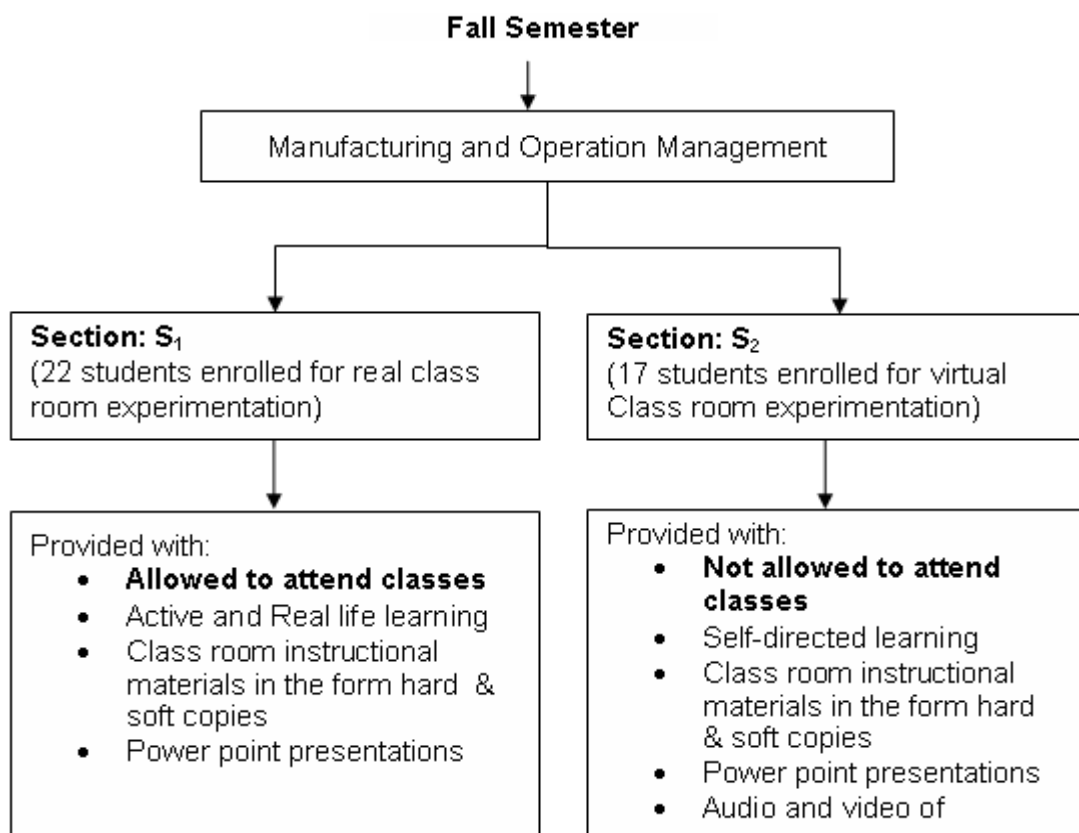
International Journal of Enterprise Computing and Business Systems

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<http://www.ijecbs.com>

Vol. 2 Issue 1 January 2012

Figure 1 Relationship between two experiments



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 accessed continuously throughout 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 = $0.25(\text{Assignment}) + 0.25(\text{Class Test}) + 0.50(\text{Final Exam})$

International Journal of Enterprise Computing and Business Systems

ISSN (Online) : 2230-8849

<http://www.ijecbs.com>

Vol. 2 Issue 1 January 2012

3 Virtual Class room Environment

A virtual Class room is a “virtual facility” provided for interaction among members of class. [Hiltz, 1986]. 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 [Claeys, L., and Van der Perre, 1997].

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 [Moore, 200; Regan and Sheppard, 1996].

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. 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 [Smith, Higgins, and Miller, 2005].

Real Class room Environment

The course is having 4 contact hours per week. The lecture was scheduled on every Monday at 8:00AM to 10:00AM and on every Saturday at 10:00AM to 12:00PM in ME102 Class room. The Class room is provided with various latest technologies like, computer, local area network,

International Journal of Enterprise Computing and Business Systems

ISSN (Online) : 2230-8849

<http://www.ijecbs.com>

Vol. 2 Issue 1 January 2012

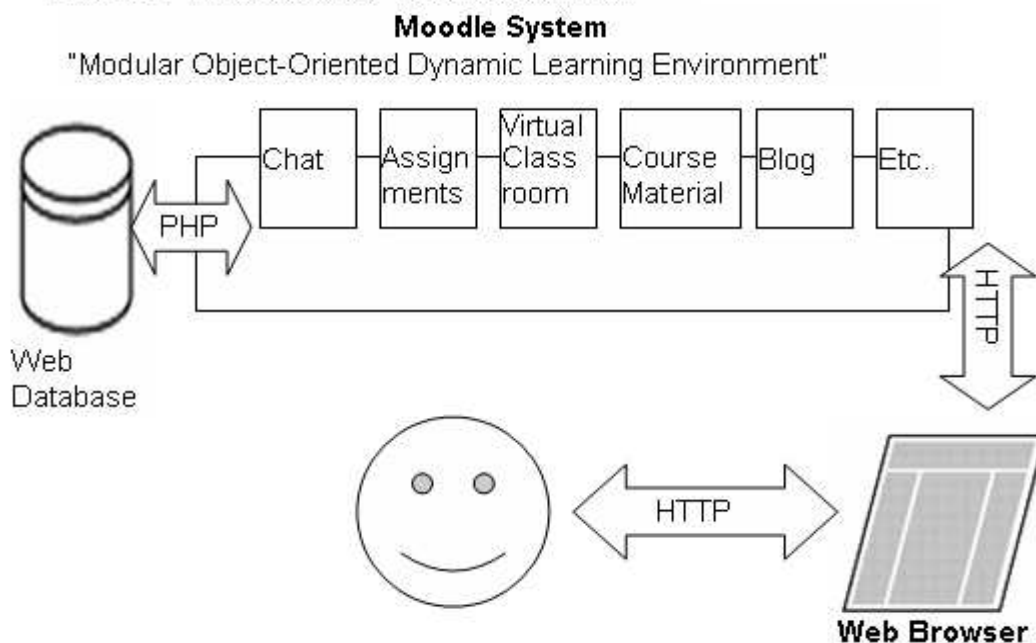
internet, white board and interactive digital white board. These tools were used for teaching and learning process with new technology. Students of section S_1 were allowed to attend the regular classes. However, students of section S_2 were not allowed for attending the classes.

3.4 Design of Virtual Class room

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. 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 electronically-stored notes and solutions. The students of section S_2 were allowed for accessing this virtual class room.

The architecture of virtual Class room is developed in this research is shown in figure 2. 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.

Figure 2 Architecture of Virtual Class room



4 Results of Experiment

4.1 Statistical tabulation of students' final score

After the final examination, 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).

Table 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

International Journal of Enterprise Computing and Business Systems

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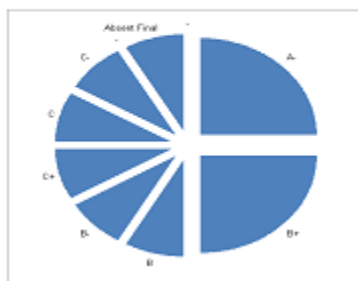
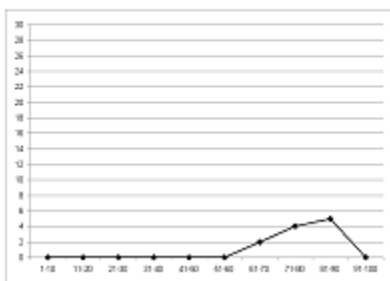
Vol. 2 Issue 1 January 2012

S ₂	Virtual class room teaching & learning Environment	86	67	74.76	5.81
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Table 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

Graph 1: 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]



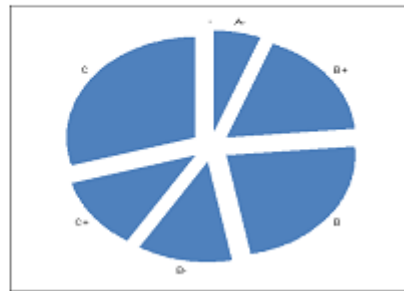
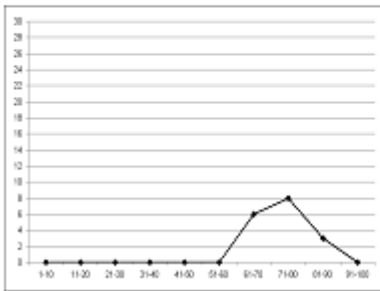
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ISSN (Online) : 2230-8849

<http://www.ijecbs.com>

Vol. 2 Issue 1 January 2012

Graph 2: 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]



4.2 Research Hypothesis and its issues

We now investigate the two experiments impact on students learning the course MIME 3240. This research involves two populations: a population of students using the real class room and another population of students using the virtual class room for teaching and learning process. Population mean marks: μ_1 is Population mean marks of students of real class room and μ_2 is Population mean marks of students of virtual class room. The objective of the hypothesis test is to show that population mean marks of students in real class room μ_1 is more than that of virtual class room μ_2 . In this case, the difference between two population means $\mu_1 - \mu_2 > 0$. The research hypothesis $\mu_1 - \mu_2 > 0$ is stated as alternative hypotheses.

A hypotheses test is developed for which the decision to reject a null hypotheses H_0 will lead to conclusion that the population mean of students marks in real class room is greater than population mean of marks in virtual class room. The table 5 gives sample means and sample standard deviations of real and virtual class room students.

4.2.1 Null and alternate hypotheses

No significance difference existed between actual performance of students in real classroom experiment and students of virtual classroom experiment.

H_0 : The mean actual scores of the real classroom were not significantly different from the mean actual marks of the virtual classroom.

Null hypotheses H_0 : $\mu_1 = \mu_2$

Null hypotheses H_1 : $\mu_1 > \mu_2$

4.2.2 Hypothesis Testing

International Journal of Enterprise Computing and Business Systems

ISSN (Online) : 2230-8849

<http://www.ijecbs.com>

Vol. 2 Issue 1 January 2012

The critical value approach is used to make the rejection decision. The t distribution with 37 degrees of freedom and $\alpha = 0.05$ level of significance, $t_{c[37]} = 1.689$ is the critical value for the test. The rejection rule for rejecting null hypothesis is reject H_0 if $t_0 > 1.689$.

Table 5 Descriptive statistics of two populations

	Real Classroom	Virtual Classroom
Sample size [N]	22	17
Mean [x]	82.82	74.76
Standard deviation [S]	5.69	5.81

$$n_1 = 22, \bar{x}_1 = 82.82, S_1 = 5.69$$

$$n_2 = 17, \bar{x}_2 = 74.76, S_2 = 5.81$$

t_0 : Observed or calculated value statistics

t_c : Critical value of statistics from table at 0.05 alpha.

n_1 and n_2 are the sample sizes, x_1 and x_2 are the mean of samples; S_1 and S_2 are standard deviation of samples.

$$t_0 = \frac{\bar{x}_1 - \bar{x}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \approx t_{c[n_1+n_2-2]}$$

S = common standard deviation of samples taken together

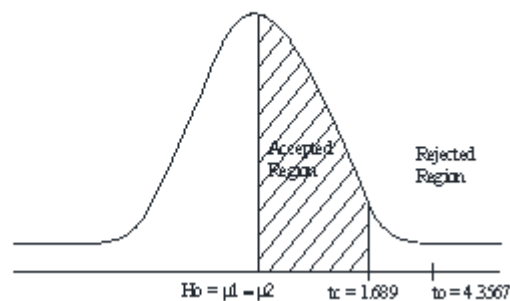
$$S = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 + n_2 - 2)}} = \sqrt{\frac{(22 - 1) \times 5.69^2 + (17 - 1) \times 5.81^2}{(22 + 17 - 2)}} = \sqrt{\frac{679.898 + 540.097}{37}}$$

$$= 5.742$$

$$t_0 = \frac{82.82 - 74.76}{5.742 \sqrt{\frac{1}{22} + \frac{1}{17}}} = \frac{8.06}{5.742 \sqrt{0.045 + 0.0588}} = \frac{8.06}{5.742 \times 0.3222} = 4.3567$$

We mark the calculated t_0 [4.3567] and critical value t_c ob t- distribution as shown in figure 3.

Figure 3 Illustrates the t-distribution curve



4.2.4 Results of experiment

On comparing t_o and t_c : $t_o > t_c$, hence we conclude that there is no sufficient evidence to accept the null hypotheses. Hence, there a significance difference exists between marks of students in real class room and students of virtual class room. The sample results enable the researcher to conclude that $\mu_1 - \mu_2 > 0$ or $\mu_1 > \mu_2$. The research concludes that students of real class room did perform better than the students of virtual class room teaching. We infer that class room teaching is more effective than virtual class room in the teaching and learning process.

5 Conclusion

From the results of the experimentation, it appears that students of section S_2 did not seem to gain the same amount of knowledge using virtual class room as that of section S_1 by using real class room. The majority of students of section S_2 were uncomfortable either due to their understanding or their changed study habits. Finally, this research concludes that students have scored more when they were provided an opportunity to attend the classes. The various IT tools like Internet, computer and electronic board were not much effective in the teaching and learning, when they were used as a replacement for the teacher. 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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