ORIGINAL ARTICLE

Perception of University Students Before and After the E-Learning Implementation in One of the Mathematics Courses: The Case of Mathematics Students in Jimma University

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Abstract

This study concentrates on the survey made to assess the mathematics year II students of JU in the year 2012/13 experience of ICT supported learning going on in the university so far and the change they observed after the e-learning infusion made as a quasi experiment for the purpose to see its influence on their performance. Data were collected through questionnaire and focus group discussion administered before the experiment of e-learning and their experience after. The finding of the study showed that students are interested to learn by the support of electronics and requested that they need further training on the knowledge and skill of handling the technology for learning purpose. It indicates that the major challenges encountered are ration of connected computers per student both during the e-learning sessions and outside the sessions. It is recommended that the required technology facilities be supplied as far as economic capacity of JU allows. It is also necessary to assign ICT experts for technical support when there is a need.

Key words: e-learning, online learning, traditional learning, active learning, conventional learning.

INTRODUCTION

The expansion and dominance of technology is increasing globally one of which is the influence of e-learning in educational systems. As Osimo (2002) state, the idea that the future fate of education without technology involvement is unthinkable.

So, going for electronic supported learning as early as possible is inevitable. E-learning in the sense of this is any electronic supported learning either with or without infusing the ICT facilities in the current conventional learning methods be it traditional or active learning. To give emphasis, it is called blended e-learning when ICT is integrated with the conventional learning system of the classroom.

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E-learning delivery system is a new technological infused learning system, mainly digital media, through internet. Students principally use internet connected facilities working independently most of the time through the uploaded modules of specific courses coached by their teachers. Education in this manner is one of the most beneficiaries of the current technological advancement where time and space are no more barriers to it (Yushau, 2006).

Following this conceptual trend, governments of developing countries like Ethiopia are taking the initiative to work for expansion of quality education so that they could have qualified human power at a higher level (MoE 2002, 2005). For this, the Ethiopian government is striving for the expansion of tertiary level education focused on technology and science through expansion of universities at a larger scale keeping in mind the necessity of quality out-puts (ESDP I, II & III). The focus on technology at university level at the rate of 70% (Yizengaw, 2007 MoE, 2008) and the venture taken on implementing plasma TV education for high schools throughout on six subjects in which one is mathematics are some of the evidences to show the Ethiopian government initiation towards the infusion of ICT supported learning (the need for e-learning supported educational system). In this case, we have to think of improving mathematics education in line with the technological influence keeping in mind that it is the basis and fundamental tool of all sciences, deeply for science and technology (Kassahun & Zelalem, 2006).

From our experience, be it high school or university level, it is a mere fact that many students have fear of mathematics learning assuming that it is one of the hardest subjects to learn; of course now a days physics is scaling up (Richard et al, 2007). This could simply be due to the fact that the teaching learning system does not suit or motivate learners to take it at ease. So one has to be worried about the teaching-learning methods of mathematics and work hard for improvement based on empirical evidences (Richard et al, 2007). Of course, implementing active learning is the essential and obvious step to be taken conventionally, but more than that supporting it with modern electronic technological facilities could be one step ahead. Currently, we see that universities are striving to go with the current conceptual change in line with technological influence towards ICT supported educational and managerial systems. A good example is the Jimma University e-learning board system which is the central agent for e-learning expansion and conducting pilot implementation in a piece meal. Mathematics course named Fundamental Concept of Algebra is one of the science courses selected for this pilot e-learning purpose at the university level demonstrated in practice.

The aim of this study is then to assess the ICT infused learning expectation and experience of mathematics students in Jimma University, based on their perception before and after e-learning implementation.

Statement of the problem

Universities in Ethiopia are working not only for the expansion of programs but also for its quality assurance (Kramer, 2000). This movement is initiated by the government to improve teaching-learning methods of teacher Education Institutes' (TEIs) by redirecting the emphasis given to active learning via the support of HDP (Higher Diploma Program), a one year on job training on active learning implementation and CPD (Continuous Professional Development) a supportive element mainly at high school and elementary school levels (MoE 2003). But this training program is deficient in that it does not consider teaching material

supporting system in its modules especially electronic facilities in support of active learning. Mathematics professionals in Jimma University are also part and parcel of this program to improve the quality of delivery methods in the university education. They are supposed to pass through the HDP with obligation of training high school teachers in need of the methods on how to handle this technological support learning. This study is therefore designed to assess the experience of mathematics students of JU on electronic support learning just before they are treated to learn by the technology expressing their expectations and after they are exposed to the treatment, the e-learning experiment. The study thus tries to assess the following objectives based on the preliminary survey which is done before the treatment and the experience after the new input, electronic support learning.

Objective: The study aims to assess the experience of students on ICT infused learning of mathematics in Jimma University based on their perception before and after e-learning implementation as a treatment in one of their major courses.

Specific objectives: The study specifically attempts to:

- Assess the situation of the existing ICT supported learning in mathematics classes
- Measure students feelings towards e-learning support learning and their readiness to use it;
- Assess the basic knowledge and skills of computer utility of the students;
- Relate their academic performance with the new agent, the technology learning;
- Relate their experience before and after the introduction of the technology in learning;
- Identify major problems in implementing e-learning from the students' perspectives;
- Suggest possible ways to alleviate these challenges.

Significance of the study: This study is assumed to contribute to the following relevant areas.

- It could be initial point for similar impact studies in other subjects;
- It can give some evidences to convince the University to decide its further expansion in e-learning validity;
- It can help revamp the teaching methods of mathematics to motivate students learning and reduce their fear of learning mathematics;
- I could have theoretical contributions to methodological aspects in the direction of new conceptual change could be one area of significance.

METHODOLOGY

Research design and study site: This study is a cross sectional survey which is part of a quasi-experimental design conducted through pre-treatment assessment and post-treatment assessment using questionnaires and focus group discussion (FGD). The study site was Jimma University Mathematics Department, while the subjects were year II mathematics students of 2012/13 academic year who were involved in the class of the basic algebra course named, Fundamental Concepts of Algebra. Questionnaires and FGD were employed to measure students' background knowledge, level of computer skills and attitudes towards e- learning and identify major challenges during implementation. The study was conducted in 2005 E. C. (2012/13) academic year, semester, one, while the analysis was done in semester two and during summer.

Data collection instruments and administration: In this study, two types of questionnaire were employed whereby one was for the pre and the second for the post assessments. FGD was conducted during the post-assessment only. The data collection was done only by the researcher. Validity and reliability of the instruments were ascertained by critic reviews of relevant and senior researches and making modifications accordingly.

Sampling: In this study all mathematics year II students of 2012/13 were taken as sources of data, accepting as they are grouped into two sections proportionally. Therefore, the population size of the study was 144 regular students. For the post-assessment, only the treatment group (75 of them) was assessed since the assessment depends on e-learning experience.

Data Analysis: Data were analyzed through basic statistical methods, both descriptive and inferential, using SPSS package. Relevant analytical tests like chi-square, ANOVA and t-test were dealt calculated, according to the need.

Ethical considerations: Official permission from the department, the teachers and students consent were taken into consideration, approached and secured.

RESULTS

I: Preliminary survey results

Background

A total of 144 second year mathematics undergraduate students responded for this preliminary survey in which 75 (52.1%) of them were in group-1 and 69 of them were in group-2. As observed from the data 98.6% of them were males with only 1.4% of them females; all of them were in the age range between 19 and 25 years old the a majority of them (88.1%) were age 20 to 22. Of these undergraduate students, many of them (93.7%) joined the university by their first choice while 73.6% of them joined the Mathematics Department by the same first rank of choice, but 92.1% had chosen the department by the first three ranks (1^{st}, 2^{nd} & 3^{rd}). Comparing the two groups, there was no any significance difference between the two regarding their choices when they first come to the university and joined their department, at P=0.05 significance level.

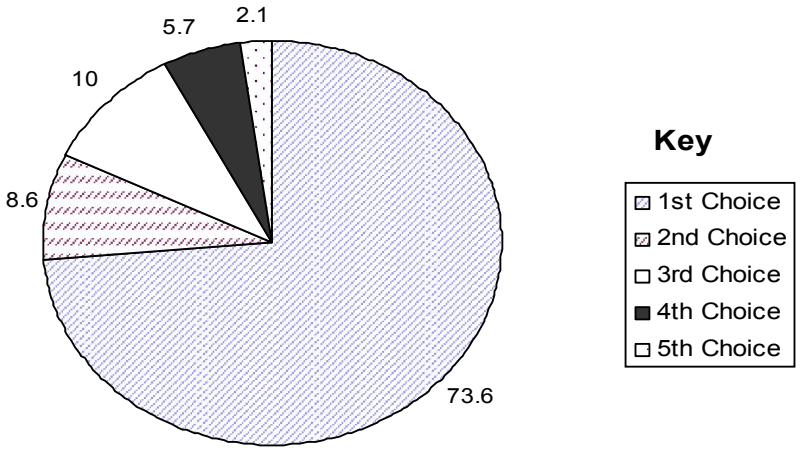

Figure 1: Student choice of the Mathematics Dept. when they 1st joined JU

Situational analysis on electronic facilities

According to their responses, 80.9% of students said that they had computer labs for appropriate courses like Mathematics and computer science course. They said that 71.4% of the labs were organized and used mainly for computer courses while 15.2% were used for both computer and mathematics courses. Students were found congested during the lab sessions in such a way that only 3.6% of them had the opportunity of using the computer desk at individual level and 33.6% used the computer desk for 3 students per piece. On an average, 5.64 (st. dev.=3.86), students at around a computer. As to the information from these students, 99% of the lab computers were connected to internet though many of them were not functional (were on and off).

Possible areas to access the internet facilities were also investigated by this study. Accordingly, 78.8% of the students confirmed that they were able to access internet in different areas like computer labs (67.4%), libraries (50.7%), student lounge (11.1%), and very few used their own personal computers (8.3%) and SMART classes (6.3%).

Students were asked to indicate for what purpose they used the internet facilities available. Accordingly, the majority (69.4%) of them used the access for doing exercises, homework's and assignment; while 46.5% used it for reading learning materials of courses; 21.5% for browsing and downloading references, 30.6% for communication purpose, while on the other hand only 3.5% used it for chatting and entertainment.

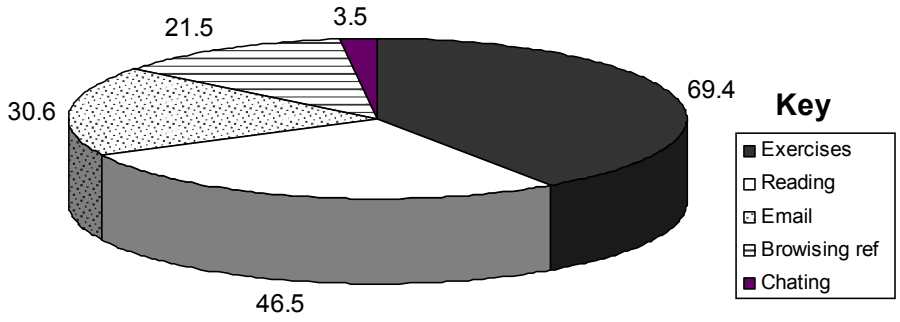

Figure 2: Types of internet utility by students

Students were also asked to reflect on their experience of the management system of the internet facilities. From their experience, students revealed who are responsible for proper management of the technological facilities like the ICT labs and the internet, and how the responsibility was handled. Thus, some of them indicated that the management used to be handled by ICT personnel (38.9%), technical assistants (26.4%), decentralized ICT units for major maintenance (26.4%).

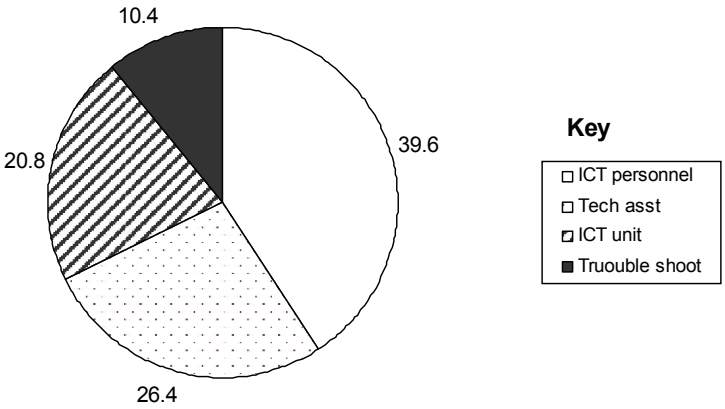

Figure 3: ICT Management system

According to their experience, students indicated the major problems they encountered while using the internet facilities. According to the responses, the top three problems indicated by most of the students in the order of their rating priority were lack of space (82.6%), networking problem/lack of connectivity (75.7%) and internet traffic problem/the load on the connection lines (31.3%).

Students' attitude towards e-learning and their academic performance

From these mathematics students, 63.2% of them confirmed that ICT support learning can improve their academic performance, while 16.7% of them said no and the rest were undecided According to their first year academic performance, their year 1 Cumulative Grade Point Average (CGPA) revealed that the majority (66.67%) scored 3.00 and above; 30.2% passed with distinction and 6.3% with great distinction levels **[Table-1].** The average CGPA of these students were found to be 3.10 (st. dev.=0.84). Comparing the two mathematics group of year-I respondents, there was no significant difference in their academic performance and their feelings that e-learning involvement will improve their performances, at the significant level of P=0.05.

Table-1: Students' Cumulative Grade Point Average during Their First Year in JU

CGPA-I	Status	No. of students (N)	No. of students (%)
< 2.00	Unsatisfactory	2	1.6
2.00-2.99	Average & pass	42	33.33
3.00-3.24	Above average	36	28.60
3.25-3.74	Distinction	38	30.20
3.75-4.00	Great distinction	8	6.3
Total		126	100
Min	**1.95**	**Mean**	**3.0974**
Max	**3.91**	**St. dev.**	**0.43858**

These students were asked to indicate the maximum and minimum letter grades they scored in major courses of mathematics which run from F to A. So, 66.7% have A's as their maximum grade while 51.4% have C as their minimum grades whereas by 22.9% scored B as their minimum grades.

In the same manner, students revealed their letter grades scored in specific mathematics courses they had taken during their first year. Consequently, 56.9% of them scored A's on the first basic course entitled Fundamental Concept of College Mathematics, which is the highest in which 79.8% of them scored A's and B's on this course. On the other hand, only 9.7% and 19.4% scored A's respectively on Calculus and Introduction to Combinatorics where the majority of them, 72.9% and 75.7%, lied in B's and C's respectively on these two courses.

Table-2: Letter Grades Scored in Mathematics and Related Courses During Year-I

Courses	Letter grades scored by the students in percent (N=144)			
	A	B	C	F
Fund. C. College maths *	56.9	22.9	13.9	-
Calculus I *	9.7	4.1	31.9	4.2
Int. to Combinatorics *	19.4	39.6	36.1	0.7
Introduction to Statistics	6.9	39.6	45.8	0.7
Int. to Computer	32.6	53.5	10.4	-
Fund. Programing	29.2	47.9	16.7	-

- *Mathematics courses*

These students had taken two computer courses by the time of this study whereby 32.6% scored A's on introduction to Computer Science and 29.2% scored A on Fundamental Programming. Majority of the students scored B's, 53.5% on the first and 47.9% on the second computer courses mentioned above.

According to the inquiry regarding the interest of the students towards ICT supported learning, most of the students (93.8%) were interested and excited to see this e-learning lesson out of which 26.2% of them were very excited, 18.5% excited and 49.2% interested. Only 3.1% were found indifferent while 2.3% did not like it at all. Though these students had taken two computer courses, one in basic application and the other in programming, during their first year stay, many of them complained that they had no basic skills in using the practical application (69.3%). Some of the students (19.9%) felt that they had never taken computer courses while 77.9% of them agreed they had taken it. Furthermore, 88.5% of the students think that the modern technology could make a difference in their learning if infused. Regarding this issue, 88.9% of them agreed that ICT support will help advance quality of education in general. Specifically, 61.8% of them agreed that ICT will help for the best academic achievement, 70.8% for quality of learning, 61.1% for facilitating teaching and learning, and 50% for enhancing active learning. On the contrary, few of the students were against the support of ICT learning, in the rates of 10.1%, saying it is a waste of time; 11.1% saying it would add unwanted extra time to work with it, 6.9% even said it would take them to low achievement.

Nevertheless, concerning this same issue, many (84.1%) of the respondents seemed ready to learn through the help of ICT and internet shown as, "I like it" (34.1%) and "I like it very much" (50%). But there were few students who held the opposite view, 7.2 % of them saying "I want learning as usual"; 3.6% saying "I do not like it at all". For the reason why they do not like it, 67.3% said because they had no basic skills

(51.9%) or no idea about it (15.4%); of course, some think they will be technology dependent (15.4%).

On the other side, those who liked the technology gave their reasons for why they liked it. Accordingly, the majority of them reasoned that it makes things go fast (52.8%)', it is interesting and attractive (47.2%) and it creates wide access (38.9%). The details are shown in the Table-3 below.

Table-3: Reasons Why Students Like to Learn by ICT Support

Reasons for liking e-learning	Respondents	
	Number	%
It makes things go fast	76	52.8
Interesting and attractive	68	47.2
It is new area of media	31	21.5
It initiates me	33	22.9
It supports the teaching	28	19.4
It is the future	31	21.5
It creates wide access	56	38.9
Supports the conventional learning	39	27.1
Gives me choice for independent learning	39	27.1

Students were also asked to express their readiness to learn through ICT assistant, and their support of the system to their level best. As can be seen from the table-4, 56.3% said that they were very much interested to support and go with it, 50% promised that they would use their extra time to use it efficiently and 49.3% said they would work hard to be acquainted with the computer utility.

Table-4: Students' Readiness for E-learning

Feelings	Respondents	
	Number	%
I am very much interested to support and go with it	81	56.3
I will take the advantage of it	63	43.8
I will use my extra time	72	50
I will work hard in computer courses	71	49.3
I will work hard to cope up with the new technology	44	30.6
I have no interest to do anything	4	2.8
I have no plan towards ICT learning	6	4.2
It will waste my time, needs extra time	5	3.5
I am indifferent	2	1.4

Major anticipated challenges and possible solutions suggested

Major problems expected to challenge the e-learning implementation and suggestions for possible solutions were also investigated in this study. In this regard, students anticipated major problems that would occur during ICT learning implementation. In this line, 58.3% said lack of internet connectivity, and 45.1% mentioned lack of sufficient skills to make the technology friendly.

Apparently, students forwarded possible suggestion to alleviate the challenges mentioned above. As can be seen from which table-5 many of them (52.8%) suggested consecutive trainings at basic knowledge and skill of ICT utility; and economic support to avail the technology (49.3%), awareness creation (38.9%) and initiate and encourage to level up the commitment of the staff and students (34.7%).

Table-5: Anticipated Challenges Against E-learning and Possible Solutions Suggested by Students

Expected challenges	Response Rate		Possible solutions suggested	Response Rate	
	No	%		No	%
Lack of computer facilities	84	58.3	Install generator for power interruption	20	13.9
Lack of internet connectivity	71	49.3			
Lack of basic knowledge and skills in ICT	65	45.1	Trainings for basic skills for both parties	76	52.8
No sufficient time and space	44	30.6			
Lack of sufficient and relaxed ICT labs	60	41.7	Implement the e-learning in gradual phases	31	21.5
Economical problem to buy the technological tools	62	43.1	Search for economic support	71	49.3
Managing problem of the tech.	32	22.2	Prepare modality6 of ICT learning	45	31.3
Awareness problem of staff and students	40	27.8	Organize awareness creation programs	56	38.9
Lack of skilled human power in ICT	45	31.3	Work on human power development system in ICT	51	35.4
Lack of commitment of staff and students	18	12.5	Initiate and encourage to increase the commitment of staff and students	50	34.7

II: Post e-learning treatment survey analysis

For post assessment of this experimental study the treatment group of students who passed through e-learning experience were asked to reflect on their e-learning experience based on the two types of evaluation tools designed. One is a short questionnaire to convey their reflections on the e-learning at individual level in which 68 students responded since these were the only available students during the data collection. The second tool was a focus group discussion in which students were grouped into 13 groups consisting 5 or 6

students per group and conducted the discussion independently within the group based on discussion format consisting of structured ideas given for discussion and finally give their similar consensus or differences in report form. Thus, the analysis of the two sets of data is conveyed below as per the respective category.

Results of post survey on e-learning experience

In this section, students were given questionnaire to be completed only by those who passed through e-learning lessons, the treatment group. Accordingly, 68 students evaluated the e-learning design using the questionnaire. Students revealed that the working desk around one internet connected computer was so congested that the chance of working individually per desk was almost impossible whereby only 2.9% of the students had this chance to work at individual basis; the rest of them working 2 to 6 students around one desk. The average congestion per computer desk was 2.93 (st. dev. = 1.285). From these students, 46.5% responded to the question about how they use their extra time for the e-learning and 88.1% of them said they use their extra time for e-learning with all odds and cones. The majority of them (77.7%) used their extra time two to three days per week for the e-learning where 21.2% used for one day only while 3% used for four days. Many of them (78.5%) used their extra time of one to two hours per day for the e-learning.

Students also revealed the areas in which they used their extra time for the e-learning. Many of them (72.7%) used mathematics ICT lab while 46.2% used the Information Science Department ICT lab which was borrowed just for this program. These two ICT labs were also the areas in which the regular e-learning classes were going on twice a week, two hours a day. Based on the ranking they made, they usually go to mathematics lab and Information Science lab at the rates of 72.7% and 46.2% respectively. These two labs were also made open one extra day on Saturday at about the end of the sessions to get ready for the exam.

Table-6: ICT labs used in extra time, ranked

ICT Centers	Ranks in percent				
	1st	2nd	3rd	4th	5th
Maths lab	72.7	24.2	1.5	1.5	-
Inf. Sc. Lab	46.2	48.1	3.8	1.9	-
Library desk	22.9	12.5	56.3	6.3	2.1
ICT center of student affair	20	16	20	12	32

Students were given list of possible challenges encountered during their e-learning activities and asked to identify their experience. Accordingly, the biggest rate (39.6%) was internet connection problem followed by space problem in

sharing working desks (29.2%), and 17.4% of them said they have basic skill problem in handling the computers.

Students were also required to evaluate the post experiment test given at the end of the e-learning lessons. All respondents agreed that the examination content was related to the e-learning lessons in which 56.7% of them said they are very much related. They also reflected on their experience of the post test which was conducted at the end of the experiment on how appropriate the questions were. Accordingly, the majority of them (64.7%) said that the questions were appropriate and 29.4% said they were hard and tough but they could try them, while only 1.5% each in the two extremes rated (simple or cannot try).

Group discussion results of post survey on e-learning experience

In this section, students were given discussion format bounded by identified ideas on the experience they encountered during their e-learning exercises. The objective is just to improve the e-learning delivery system to use its highest quality under the general instruction saying the leading point was "please discuss the issues thoroughly and give the common responses and issues of disputes if any".

These groups of students were asked to list the problems they encountered during their e-learning lessons and suggest possible solutions they think for improvement under each of the issues listed like; handling the computer system, reading and exercise materials, sharing with friends, internet connection, ICT lab set up, e-learning sessions in and outside the classes, the face to face summary session, etc. As explained above, the response is based on the group discussion whereby all students were divided into 13 groups of 5 or 6 members each and required to briefly write their responses on one piece agreed up on or the otherwise. Accordingly, the following points were reflected by each group item by item according to the structure given. The following explanations convey the group discussion results.

Problems and suggested solutions for improvement

Handling the computer system: Students said that they did not have enough practical skills to handle the computer, and as a result suffered from lack of basic skill in operating the computer and its different programs. They complained that so far, they had been handling computer courses focusing more on theoretical usuer and they experienced no adequate practical exercises at all in the ICT labs. Beyond this, they had lack of skill to access the internet program itself. In this issue, only one group out of 13 said that they had no problem in handling the computer system.

Regarding this, students suggested that they must to do more practical exercise to improve their skills using more time. In addition, computer sciences teachers need to be capable of doing both theoretical, and practical sessions in ICT labs. The university is expected to facilitate availability of ICT labs and expand it proportional to student population. So that students could use computer wherever and whatever the case may be. They emphasized that students should have adequate basic skills before e-learning commences and lab attendants need to be assigned regularly to assist the student right at the spot.

Using the e-learning system properly: In using e-learning system, students reported shortage of ICT lab classrooms and their facilities like chairs, accessories including cables, power interruption and lack of internet connection all in all and lack of adequate number of internet-connected computers even if connectivity is working.

Password utility problem and overlap of names in creating users name, problems of opening some topics in some computers and lack of sufficient time to work in the lab are some more problems raised. In this issue, two groups reported that they had encountered no significant problem.

To alleviate the above problems, students suggested expanding ICT labs and assigning respective skilled human power and professionals if possible in the areas to solve students' immediate problems and repair the computers regularly. Furthermore, they suggested giving sufficient time, extending the lab service, making the internet connected computers 1-1, orient students adequately on how to handle the e-learning program first, and making the reading and exercise materials downloadable.

Reading Materials: Regarding the e-learning reading materials, students complained that they are congested in one sit and cannot freely read and do the exercise. They further complained that they could not easily understand the notes since some concepts were difficult to catch up which also took much time to take/write notes since the notes are very long. Besides, they found some writing mistakes, wrong answers, questions which have no answers and some theorems without proofs. They said that they cannot display some topics to work on the screen; there are some unrelated portions written under one title. In this issue, the two groups also said that there was no any significant problem.

Here, students suggested to making sure the topics have purpose, adding more references as much as possible in the e-learning lessons and supplying hard copy handouts, making the lessons easily understandable and simple and keeping notes short and precise.

The Exercises: In the type of exercises and process of doing them, students complained that hiding some question and answer is not comfortable, matching question and answer takes time, the instructions are not clear, answers are not found easily, some exercises are not correctly written (or punctuated), some exercises have wrong answers and some are not clearly seen, if answer is not given the lesson cannot be replayed, there are activities without answers, there are redundant questions and difficult exercises.

For this, they suggested putting the exercise and answer on the same page, check the correspondence of answers and if they are not wrongly set up, edit twice and showing clear procedures for different questions before sending to the e-learning system.

Sharing the access with friends: Sharing access with friends is believed to be time taking in general since one is fast while the other is slow which is difficult to go in the same pace and the activities are not going parallel with in the time.

In this scenario, individual conflict within the group was observed. Nevertheless, students did not deny that working together had positive values in helping one another and doing together demonstrating cooperative learning which is good for students for sharing ideas. On the other hand, they suggested making the working desk available for independent use.

E-learning in extra time: Students also complained that they had no more time for the opportunity to access the internet in their spare time, denied by coordinators of the labs. They said that lack of punctuality of ICT lab workers, mismatch between accessible computers and student population and mismatch of schedule to use their extra time properly beyond their short of knowledge and skills on how to use e-learning were major problems encountered in this situations. For such problems they

suggested that agreement should be reached with lab coordinators to give sufficient time to e-learners till they finish the lessons. The coordinators should be made responsible to help and respond to fast repairing and creating expanded opportunity by adjusting the schedule and looking into students class and their extra time. They further suggested increasing and expanding the quality and number of attendants by training them adequately from time to time.

The overall e-learning lesson design: In assessing the overall e-learning design students revealed that there was shortage of working time, lack of knowledge about the e-learning system, redundancy of topics, lack of understanding each topic, overlapping topics, hard questions to handle (specially the proving part) no summary of each topic and no miscellaneous exercise; access of the e-learning desk is not 1-1 to students number, there is frequent connection problem, and the design did not consider the availability of adequate ICT labs in the area. For such general comments on the e-learning system design, students suggested in general giving more time for the e-learning system activities, ensuring e-learning utility skills before starting the lessons and revising the topics in specific and their modules in general.

The ICT lab set up: Regarding the ICT lab set up, students found that it was difficult to use ICT labs under computer department which created conflicts with other group of students due to clash/overlapping of schedules. Some computers were found locked with pass words, there were cable connection problems regularly, the ICT lab was not open on time, and closed before time and there was no sufficient access for the activities. Specially, the lab assistants were not voluntary to help students right on the spot since they are not professionals and hence lack of knowledge and skill.
In this case, students suggested the need to ensure cable connectivity, prepare independent ICT desk, make students work individually, arrange schedules with agreement, give additional classes in the labs, train the lab assistants and assign skillful technical persons, and ensure the computers are not closed by pass words.

The face to face session for summary: Students also commented on the weekly face to face summary session given by the instructor conventionally. In this regard, they suggested to arrange extra period and giving more time for it. They wanted to have more explanation thinking that the summary is short, and confirmed that it best for them but short of brief note saying covering the whole thing of the week in one period is not good. They agreed that there was lack of preparation from the students' side before the lesson. Furthermore, they commented that face to face summary is quite useful for them and requested for one more day noting that the contact time is not suitable for them. They put suggestions like arranging the period and giving more explanation and more time. In general, they were worried about the limitation of ICT labs for Mathematics Department in which there should have been several labs by this time since students are taking several computer courses and ICT related mathematics courses like numerical analysis and graph theory. In the end they supported the program by saying "keep it up. It is the best of the best system to learn, and no this much significant" problem.

Strong/good part of e-learning as perceived by mathematics students
The students, were also asked to reflect on the strong part of this e-learning program based on their experiences to view their ideas based on specified issues bounded to

them. Accordingly, they reflected the following points in favor of the program:

i. **Collaborative works with their friends:** Students revealed that they could benefit from the following advantages from e-learning in the sense of doing collaborative works with friends outside as well as inside the ICT labs. So many ideas were forwarded which we can categorize into four condensed ideas as follows.

- It helps to understand and use the technology by supporting one another on how to use the computer and the internet, and develop the skill of using e-learning program and understand modern learning style.
- It facilitates exchange of experience in communication skills both in person and with the different programs designed for application, e.g. software.
- It increases friendship and develops team spirit to work together by exchanging ideas and skills.
- It increases the students' strength academically as well as technically through doing activities in groups, solving problems together, sharing knowledge to achieve a clear understanding of a given topic.

ii. **Reading materials supply:** Similarly, the respondents reflected the following for the advantage of reading materials and the exercises within the system.

- Sufficient notes and solved/processed exercises are available.
- It is a good supply of reading materials.
- We get more knowledge about the course .
- It provides enough written information about the lesson.

iii. **Doing variety of exercises:** Variety of exercises were uploaded in this e-learning design on the Noodle system at hand. The discussion of the student groups emphasized the following benefits:

- The variety of exercises helps as to acquire knowledge.
- It enables us to practice different exercise and read the section now and then.
- It measures our skills on how we understand the lesson.
- It makes the course clear and good or it provide exercises with answers.
- It gives extra knowledge.
- It increases talent and potential of students.
- It increases students' confidence and prepares them well for exams.

iv. **Work during extra time:** Working in extra time is assumed one opportunity of e-learning students. Regarding this benefit, students revealed the following points:.

- It good to use extra time in helping us know e-leaning system properly things are repeated as per our pace.
- It motivates us to read the lessons and do exercises.
- It helps to understand the concepts through time.
- It uses ICT lab service at night whenever possible.
- Sharing data when we discuss in group is facilitated due to the system.
- It initiates students to use computer access acquainted more to the technology.
- It is easy to revise the topics as much as we want depending on the time we have.

- It helps us to use the time properly and peacefully through self regulated work.

v. The design of the e-learning lessons: The following views were expressed regarding this:

- The e-learning design is good because we acquire more knowledge than others (the control group).
- It is very good if connection is corrected for the future.
- It develops our understanding.
- It makes students computer-literate (be able to use computer).
- It makes students develop computer application skill.
- We see short and precise lesson
- It is so much interesting, and we extend our best regard and respect to the teachers conducting this program. The optimistic man who thinks for coming generation should have to put in to consideration by concerned body to safeguard and to keep up his moral.

vi. Independent or self work

- It is good that a person who works independently and creates self confidence will have confidence and adequate awareness about e-learning.
- Nice to improve self-sufficient but it depends up on individual ideas and efforts.
- It helps to understand each and every detail.
- Independent work is impossible since there are no sufficient computer-connected.
- It makes do exercise on our space and time.
- It gives time for fostering computer application.
- Students study with experienced knowledge.

vii. Effective and efficient utility of the technology

- The technology application is good to us because it uses controlled word to help us.
- It is nice and must continue in improved manner in the future including the summary of week's lesson with sufficient time.
- It the most important experience for our understanding.
- We can get extra information from the computer through internet.
- It initiate students to create new technology.
- It enables to become efficient users of time and effective persons.
- It enables everybody to go with the technology running the world to compete and catch up to the developed countries.
- It gives great motivation for everybody even for creating and discovering new ideas and things.

viii. Others (Appreciations)

- We have great thanks to you! We learned what we didn't learn so far.
- This e-learning motivates us to continue our lesson (follow our lesson) in good manner.
- We got the software copy of knowledge from you.

Thank you!!

- We cannot enumerate our thanks for our lecturer who gives such interesting time and opportunities!!
- We hope others do the same.

DISCUSSION

I: Preliminary Assessment

One of the important factors for the success of mathematics learning is the attitude of students towards subject. Learning this subject cannot be fully effective unless the learners are interested in the content they are assigned to learn. In this issue the study result confirmed that the majority of the year 2012/13 second year mathematics students had joined the department by their 1st choice (73.6%). The department could not have complained in line with the interest of its students towards the subject even when one can see that 92.1% joined it by one of their first three choices. So, according to the target of the study, the other important factors for the success of learning mathematics are the methods and facilities used in the process of learning, ICT supported learning to be specific. In ICT supported learning, we could see both the methods and facilities integrated in a new set up in which the modern world is imposing on our-day- to-day interaction, let alone education (Yushau, 2006 & Bass, 2006).Thus, investigating the current situations on how ICT supported learning involved in mathematics classes is the major concern. Though the majority of the students 80.9% confirmed that there are ICT labs mainly for computer courses and ICT related mathematics courses like Numerical Analysis, the complaint about the congested ratio of students to the available computers in the labs is a very serious problems to be taken in to account for improvement. Currently, it is obvious that students browse internet connected facilities to support their learning either by their own personal initiation or reinforced by instructors assignment or project works. This should be encouraged. Nevertheless, the finding of the study shows that many of the connections are not functional though 99% of the ICT lab computers are connected. This indicates that we have to work a lot to promote e-learning style of learning according to the direction of the learning system of this study. According to this study, accessible areas for browsing internet facilities are labs, libraries, corridors and few personal laptops using the wireless. This indicate the university's effort to expand the ICT supported learning despite the connectivity problem mentioned above.

As soon as one is convinced to implement ICT supported learning, it is not only the facilities and connectivity that could be the center of the plan to get ready but also the human power capacity we need to deploy to support the learning technically in giving services to at least for immediate troubleshooting needs planning. According to this study the facilities are managed by ICT experts, technical assistants, maintenance units. Therefore, there is a need for expanding their services in all required areas and upgrading by continuous training. Apparently, from this result, we can see that these personnel are very essential beyond the major problems indicated by students like space, connectivity and internet traffic problems.

As can be seen from the result most of the respondents (93.8%) are very interested and excited in this e-learning model. This positive attitude of students towards ICT supported learning is supported in that about 88% of the students think that the modern technology could make a difference in their learning and could advance the quality of education if infused in the learning systems (Kramer, 2000). But, on the other hand, many students did not deny that they lack basic skills in applications of the technology, complaining that they lack practical exercise in computer related courses. The complaint went further in that the ICT related courses mostly treated more of theoretical concepts which were supposed to be integrated with the lab work to help in

developing the required skills. This implies that we need to plan for intervention and work on advancing awareness and training programs on technical skills regularly, since from the result we know that almost everybody is ready to have basic knowledge and skill on using the modern technology facility. From the result, we can recognize the problems that students respondent anticipated many challenges beyond the connectivity and basic computer skill problems which gives us leading direction to compare it with the post evaluation results and plan carefully to overcome them, we have to take the supported possible solutions into consideration forwarded by the students. Some of the problems from the part of the plan are the technology facility, economical problem, lack of relaxed ICT labs, management problem equipped with appropriate professionals, lack of committed staff and the like (Canavan, 2004).

II. Post treatment experience

Enhancing active learning with technology support is one essential element of the learning facilities that one has to consider very seriously. This will be materialized through promoting ICT supported learning to be transformed to e-learning, its highest level of the technology involved in education, mathematics in particular (Kassahun & Zelalem, 2006). For this, possible short comings and challenges should be identified along with the benefits to be gained due to its implementation. This identification of shortcomings shall be followed by a well designed strategic plans to implement the learning successfully. From this study therefore, we have benefited in identifying the challenges anticipated before and the challenges experienced after e-learning implementation sessions. Most of the problems like lack of basic knowledge and skill on how to handle the technology, lack of expanded facilities like connected computers in appropriate labs which require a lot of money at the beginning, shortage of ICT professional to support the e-learning and manage the lab systems, lack of connectivity and power interruption, and awareness problems to accept the technology friendly were anticipated before the experiment of e-learning. They were also experienced /observed during the implementation sessions identified through both instruments designed; the questionnaire and the FGD format. In both response forms, these challenges were followed by possible solutions suggested by respondents; almost all of them were reasonable suggestion we have to accept (Cwely et. al, 2002).

According to the suggestions, trainings should be offered regularly for developing basic computer and internet utility skills, we have to expend a reasonable amount of money to purchase the technology equipment with its all essential accessories including internet lines proportional to our maximum student population. In addition, relevant ICT professionals to support the training and the learning process should be the primary targets to start e-learning conductively. Creating options like planting generators to be used during power interruption is also essential even for the conventional system we are using now (Mayer, 2003 & Descamps, 2006).

Beyond the above major challenges, there were a lot of areas that we have to take care of during designing the e-learning syllabi or lessons. This is by starting from the course module for e-learning model to utilizing different facilities of the e-learning software adjusting the reading materials, exercises, assignments, projects, discussion forums up to tests and exams through continuous assessment.

Both students and teachers have to know how to handle the e-learning software in

which students encountered several problems during the implementation. Here the teacher should upgrade himself/herself in both using connected computers and manipulating the e-learning software successfully uploading the e-learning materials and assigning working accounts for the students. The reading materials as well as the exercises and assessment tools should be updated from time to time reducing the possible errors to zero though time. On the other hand, problems raised regarding using the ICT facilities in the extra time shall be flexible to give special privilege in timing for such special e-learning students. The library digital rooms are good examples for this allowing only one hour per day regularly.

Though e-learning is mainly for self regulated learning it also facilitates sharing ideas and experience with friends wherever necessary and it should be encouraged. One important issue raised by this study is the need to give attention to-face-to-face summary session, the conventional model, the usual system so far. This complaint of students to extend the one day a week face to face to at least two days per week implicates the need for blended e-learning until it gradually reaches at its highest level of purely electronic dependent learning in which the learning goes independently by the guidance and coaching of the instructor. So, the change **assimilates** at the beginning and **accommodate**s at the end (Yager, 1991 & Cobern, 1996).

In addition, taking notes from the e-learning lesson right during the regular e-learning classes should be abandoned since it is taking the time assigned for practical work. Rather, possibilities should be facilitated to students so that they can down load the reading material easily on their flash disc or CD to re-read or print later on. Does this mean students should be provided with CD. .

Though identifying challenges to improve the program and solving them is the primary goal of the study it is worth sum to mention the strength of the ICT supported learning acknowledged by the students to encourage and keep it up (Shuell, 1986 & Biggs, 1999). In this regard, most of the benefits of the e-learning experienced by the students were like working with friends which facilities collaborative learning, easily accessing well designed course materials at individual level, making possible to repeat the variety of exercises in ones spare time at personal pace, getting acquainted with independent learning gradually maximizing self regulated learning. Besides, it helps in getting friendly with the technology to make learning easy and even customize it to other purposes using the knowledge and skills gained by these exercises are some of the very strong points to be noted from this study.

Conclusion and recommendations

Awareness and attitude of learners towards e-learning: From this study we can conclude that every one (93.8%) of the students are interested and excited to learn through e-learning and confirmed that ICT could make a difference in learning. This shows that the essential element for learning, in the attitude, awareness and readiness to use the technology in learning are basically grounded as a pillar. Furthermore, students think that e-learning could promote self-work, independent learning and supports constructivist learning theory from the theoretical points of view. Thus, it must be encouraged and supported by availing the technological facilities.

ICT knowledge and skill of learners: Though in reality, mathematics students should take some computer courses let alone basic computer knowledge which was confirmed by their response in this

study. The majority of them lack basic skills in implementing their ICT knowledge while using it for e-learning activities implying theoretical activities are dominating the practical ones. This is mainly indicated that they do not write their thesis reports by their own at the final year. This entails that a serious change must be done in revising the methodology of the delivery system the computer and related course in the university.

Benefits of e-learning: As we can see from the finding, e-learning exercise benefited the learners to practice independent work, collaborative learning, makes students technologically friendly, making them use their extra time, etc. So constructive learning was enhanced through this blended learning. This has to be encouraged, and we have to refrain from generalizing the new system that it did not surpass the conventional one just using one experiment experience and hence we know that it will serve as additional variety of teaching resource.

Major challenges and suggestions for solutions: As from the results, problems like lack of adequate ICT facilities to satisfy the learning need including independent e-learning implementation labs, reducing the density of student population per computer desk and increase the time given to access internet, availing adequate ICT experts to help students and teachers for trouble shooting during e-learning exercises, reducing connectivity problems and smoothening the ICT management system

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