

Impact of Information and Communication Technology on Teaching and Learning of Engineering (A Case Study of Federal University of Technology, Minna)

By

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Abstract

The study investigated the impact of ICT on the teaching and learning of engineering in School of Engineering and Engineering Technology (SEET), Federal University of Technology, Minna. The sample of 1000 engineering staff and students randomly drawn from the eight (8) departments in the School of Engineering and Engineering Technology, Federal University of Technology, Minna in Niger State, Nigeria was used for the study. A questionnaire was developed and administered in order to obtain the relevant information. The study revealed that most of the respondents in SEET are aware of ICT resources such as computer set, projectors, television set, video cassettes, audio tape player, slide projector and overhead projector. Also about 10.4% of the staff and 10% of the students strongly agree on the availability of the ICT facilities for teaching and learning. 50% of the SEET Staff were not connected to the internet and about 31.2% staff that has access to ICT facilities used it for curriculum delivery. Further finding showed that 57.5% of the SEET students could not access the network whenever the need arise. Also about 23% of the students in SEET can use most of the software for their academic activities.

Keywords: Information and Communication Technology, Teaching and Learning, Engineering

INTRODUCTION

Information and communications technology - or technologies (ICT) is an umbrella term that includes any communication device or application, such as: projector, Visualizer, radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as video conferencing and distance learning, (Israel, 2014) With this definition, it is difficult and maybe even impossible to imagine today and future learning environments that are not supported, in one way or the another, by Information and Communication Technologies.

The current widespread diffusion and use of ICT in modern societies, especially by the young ones, the so-called digital generation then it should be clear that ICT will affect the complete learning process today and in the future, (Kenway & Bullen, 2014). But to what extend is this ICT available

and accessible in Federal University of Technology, Minna remain a question to be answered from time to time, in the face of huge amount of capital investment on equipment and manpower noticeably the present laying of optic fibre cable connecting Gidan-Kwano to Bosso Campus. This is an effort by the university administration to increase the accessibility of available 10g of network. There is a widespread belief that ICTs have an important role to play in changing and modernizing educational systems and ways of learning, (Olokoba, 2014) and (Yves, Dieter, & Marcelino, 2006). The teaching of engineering requires theoretical and practical demonstration of courses that are mostly mathematical and graphical in nature. Federal university of technology, Minna is one of the specialized federal universities in Nigeria with nine (9) schools of which school of engineering and engineering technology (SEET) is one of them. The SEET has about nine (9) departments of learning including Agriculture and Bio-resources engineering, Civil, Electrical, Mechanical, Chemical, Telecommunications, Computer and Mechatronics, Materials and Metallurgical Engineering.

Information and communication technology in the past decades have not revolutionized science, engineering and technology at an unprecedented speed. This has led to short research cycle, short product design and redesign time, broader and deep understanding of teaching and learning, (Sunday, 2010). According to Opira (2010), “During the last two decades countries (including Nigeria) have invested heavily in ICT. Indeed”, the use of ICT in education and training has been a key priority in Nigeria in the last decade, although progress has been uneven. ICT has had a major impact on the education sector, on organization and on teaching and learning methods, (Chang, 2001). Yet there are considerably different ICT expenditure levels between institutions within the country. Some schools have embedded ICT into the curriculum, and demonstrate high levels of effective and appropriate ICT use to support teaching and learning across a wide range of subject areas. However, some other schools are in the early phase of adopting ICT, characterized by

important enhancements of the learning process, some developments of e-learning (ICT-enabled learning), but without any profound improvements in learning and teaching, (Yves, Dieter, & Marcelino, 2006) and (Kenway & Bullen, 2014).

There is, however, little scientific evidence of the concrete contributions/impact of ICTs to the learning domain in Nigeria higher education of learning especially engineering despite the effort of the last decades. Hence, there is a need to bring evidence together on the impact of ICT on teaching and learning of engineering, thus, the objective of this paper study.

Research Methodology

The study employed a cross-sectional research design. Cross sectional design allowed for the study of the population at one specific time and the difference between the individual groups within the population to be compared. The study was carried out among undergraduate students and staff of School of Engineering and Engineering Technology, Federal University of Technology Minna. The population of (SEET) Federal University of Technology, Minna as at 2012/2013 session is presented in table 1. Lecturers formed part of the study because of their roles in the teaching and learning process in the University.

Table 1:
Categories of Respondents

Level	Mechanical	Civil	Electrical	Agric.	Mechatronics	Telecom	Chemical
500	106	150	150	85	0	29	130
400	93	120	170	46	0	32	99
300	138	120	160	45	0	55	126
200	183	160	250	12	30	52	154
100	144	160	160	120	76		150
Total	664	710	890	308	106	168	659
30%	199	213	267	92	32	50	198

Random sampling technique was used to draw 1050 students and 60 staff (respondents) from Nine (9) departments of School of Engineering and Engineering, Federal University of Technology, Minna. The sample population and size of the respondents that took part in the study are herein

presented in table 2. Stratified random sampling was used to come up with a small size which was representative of the study population i.e. 30% of each class per level per department was randomly selected for this survey.

The researchers administered the copies of the Questionnaires to the respondents. Items which needed clarification were explained to the respondents. To ensure that the respondents do not have ready answers and to avoid bias responses, the respondents were not pre-informed of the visit by the researchers. Out of the 1000 copies of the Questionnaire administered, 94.6% were returned. To establish the relevance of the validity questionnaire (Utibe-abasi sceptre stephen, 2013) in the instruments prepared for this study, the instruments were subjected to three independent accessory' on scrutiny. The established CVI was 0.86 which indicates that the instrument was valid.

Table 2:

Sample selection and categories of respondents

Categories	Number	Sample	Percentage
Students	8,000	100	80 %
Lecturers	215	60	20 %
Total	8215	250	100.0 %

Table 3:

Frequency count and percentage of respondents (students) that participated in this survey and distribution of respondents according to year of study

Attributes	Level	Freq. Count	Percentage
Year of study	100L	230	23%
	200L	240	24%
	300L	180	18%
	400L	160	16%
	500L	190	19%
Total		1000	100%
Department	Agric. Eng.	90	9%
	Chemical Eng.	190	19%
	Civil Eng.	200	20%
	Electrical Eng.	250	25%
	Mechanical	190	19%

	Mechatronics	30	3%
	Tel Com.	50	5%
Total		1000	100%

Results and Discussion of Results

Table 4:

Result of respondents on their opinion on the availability, accessibility and skills of the students in using ICT facilities

Distribution of respondents by opinions on the availability of ICT resources

ICT Resources	Status	Freq. Count	Percentage
Computers/ pc in classroom	Not sure	750	75 %
	Fairly available	150	15 %
	Available	100	10 %
Total		1000	100%
Internet & E-mail	Not sure	575	57.5 %
	Fairly available	325	32.5 %
	Available	100	10 %
Total		1000	100 %
Television set	Not sure	425	42.5 %
	Fairly available	375	37.5 %
	Available	200	20 %
Total		1000	100 %
Projector	Not sure	250	25 %
	Fairly available	450	45 %
	Available	300	30 %
Total		1000	100 %
Software	Not sure	320	32 %
	Fairly available	470	47 %
	Available	210	21 %
Total		1000	100 %
Computer laboratory	Not sure	100	10 %
	Fairly available	505	50.5 %
	Available	395	39.5 %
Total		1000	100 %
Video conferencing	Not sure	825	82.5 %
	Fairly available	175	17.5 %
	Available	0	0 %
Total		1000	100 %

From table 4, the following findings were revealed about the availability and adequacy of ICT facilities: 10% of the students have PC or laptops, access to internet services and uses them for academic matters. 30% of the students said that projectors are available during the lecture hours. 21% of the students have and can use relevant software for academic purposes. About 39.5% of the student says computer laboratories are available and assessable. All the respondents agreed that 0% of the staff and students use video conferencing in curriculum implementation.

Table 5:
Result of respondents on their opinions on adequacy of ICT resources

ICT resource	Status	Freq. Count	Percentage
Computers/ PC in classroom	Inadequate	750	75 %
	Fairly adequate	150	15 %
	Adequate	100	10 %
Total		1000	100 %
Internet &E-mail	Inadequate	575	57.5 %
	Fairly adequate	325	32.5 %
	Adequate	100	10 %
Total		1000	100 %
Television set	Inadequate	425	42.5 %
	Fairly adequate	375	37.5 %
	Adequate	200	20 %
Total		1000	100 %
Projectors	Inadequate	250	25 %
	Fairly adequate	450	45 %
	Adequate	300	30 %
Total		1000	100 %
Software	Inadequate	320	32 %
	Fairly adequate	470	47 %
	Adequate	210	21 %
Total		1000	100%
Computer laboratory	Inadequate	100	10 %
	Fairly adequate	505	50.5 %
	Adequate	395	39.5 %
Total		1000	100 %
Video conferencing equipment	Inadequate	750	75 %
	Fairly adequate	175	17.5 %
	Adequate	75	7.5 %
Total		1000	100 %

Table 6: Distribution of respondents by opinions on accessibility of ICT resources

ICT Resource Location Category	Response	Freq. Count	Percent
Library	Never at all	240	24 %
	Not sure	50	5 %
	Sometimes	610	61 %
	Always	100	10 %
Total		1000	100 %
Computer lab	Never at all	50	5 %
	Not sure	50	5 %
	Sometimes	600	60 %
	Always	300	30 %
Total		1000	100 %
Lecture rooms	Never at all	440	44 %
	Not sure	50	5 %
	Sometimes	300	30 %
	Always	210	21 %
Total		1000	100 %
Resources centre	Never at all	410	41 %
	Not sure	220	22 %
	Sometimes	330	33 %
	Always	40	4 %
Total		1000	100 %
Halls of residence	Never at all	610	61 %
	Not sure	80	8 %
	Sometimes	210	21 %
	Always	100	10 %
Total		1000	100 %
Internet café	Never at all	300	30 %
	Not sure	200	10 %
	Sometimes	400	40 %
	Always	200	20 %
Total		1000	100 %

Table 6 shows results of question about accessibility of ICT resources. About 10% confirms that they were able to use ICT resources in the university library and 30% says they have access to computer laboratory of either the school or the university. 21% of the students uses computer in their lecture halls and 4% of the students respondents were able to access ICT resources at the university ICT resource centers. 10% of students can have access to internet at their hall of residents, while about 20% of the students uses internet access.

Table 7:
Result of respondents on their skills in the use of various ICT tools

ICT Tools	Level of Skill	Freq. Count	Percentage
Word processing	Very poor	70	7 %
	Poor	80	8 %
	Fair	230	23 %
	Good	400	40 %
	Very good	220	22 %
Total		1000	100 %
Spreadsheet	Very poor	70	7 %
	Poor	80	8 %
	Fair	340	34 %
	Good	345	34.5 %
	Very good	165	16.5 %
Total		1000	100 %
Presentation	Very poor	110	11 %
	Poor	140	14 %
	Fair	360	36 %
	Good	230	23 %
	Very good	160	16 %
Total		1000	100 %
Graphics	Very poor	240	24 %
	Poor	230	23 %
	Fair	250	25 %
	Good	230	23 %
	Very good	50	5 %
Total		1000	100 %
Video conferencing	Very poor	310	31 %
	Poor	350	35 %
	Fair	220	22 %
	Good	70	7 %
	Very good	50	5 %
Total		1000	100 %
Publication software	Very poor	230	23 %
	Poor	280	28 %
	Fair	270	27 %
	Good	140	14 %
	Very good	80	8 %
Total		1000	100 %
Projector	Very poor	170	17 %
	Poor	200	20 %
	Fair	270	27 %
	Good	250	25 %
	Very good	110	11 %
Total		1000	100 %
Engineering Software such as AutoCad, Matlab, C++ e.t.c.	Very poor	50	5 %
	Poor	90	9 %

	Fair	200	20 %
	Good	300	30%
	Very good	369	36%
Total		1000	100 %

Table 7 revealed that about 36% are skillful with relevant engineering software such as CAD software, CAE software, programming software. 22% can use word processing software, 16.5% says they are very good with spreadsheets. 16% of the students can prepare a power point presentation. Only 5% of the student can use graphic software such as CorelDraw and video conferencing. 8% of the engineering students uses publishing software, 11% of the responding students can use projectors on their own.

Table 8:
Result of respondent on their opinions on factors affecting students' use of various ICT resources

Opinion	Freq. Count	Percent
Inadequate power supply	90	9 %
Limited time to access the lab	220	22 %
Inadequate infrastructure	70	7 %
Bureaucracy	20	2 %
Limited ICT facilities	370	37 %
Inadequate internet services	70	7 %
Lack of hand on experience	150	15 %
Mismanagement of lab equipment	10	1 %
Total	1000	100 %

Table 9:
Result of respondents on their opinions on performance of learning tasks

Learning	Opinion	Freq. Count	Percentage
Use the computer to complete course works, project report etc.	Strongly disagree	70	7 %
	Disagree	100	10 %
	Don't Know	50	5 %
	Agree	550	55 %
	Strongly Agree	230	23 %
Total		1000	100%
Own learning using computers and internet	Strongly disagree	80	8 %
	Disagree	260	26 %
	Don't Know	40	4 %
	Agree	380	38 %
	Strongly Agree	240	24 %
Total		1000	100 %
Use the computer to type course work and assignments	Strongly disagree	50	5 %
	Disagree	60	6 %
	Don't Know	20	2 %
	Agree	520	52 %
	Strongly Agree	350	35 %
Total		1000	100 %
Apply what has been learnt to the real world situation	Strongly disagree	40	4 %
	Disagree	90	9 %
	Don't Know	110	11 %
	Agree	540	54 %
	Strongly Agree	220	22 %
Total		1000	100 %
ICT improves organization skills	Strongly disagree	50	5 %
	Disagree	70	7 %
	Don't Know	120	12 %
	Agree	530	53 %
	Strongly Agree	230	23 %
Total		1000	100 %
Helps in developing interest in the learning content	Strongly disagree	40	4 %
	Disagree	120	12 %
	Don't Know	50	5 %
	Agree	580	58 %
	Strongly Agree	210	21 %
Total		1000	100 %
Use the internet/computer to look for information	Strongly disagree	20	2 %
	Disagree	50	5 %
	Don't Know	60	6 %
	Agree	550	55 %
	Strongly Agree	310	31 %
Total		1000	100 %
Acquire some of the pre-requisite skills for workplace preparedness	Strongly disagree	40	4 %
	Disagree	120	12 %
	Don't Know	120	12 %
	Agree	530	53 %
	Strongly Agree	190	19 %
Total		1000	100 %
Linking academic subjects to workplace demand	Strongly disagree	40	4 %
	Disagree	80	8 %
	Don't Know	40	4 %
	Agree	540	54 %
	Strongly Agree	300	30 %
Total		1000	100 %
Use the internet to collaborate with others/team	Strongly disagree	60	6 %
	Disagree	120	12 %
	Don't Know	50	5 %
	Agree	550	55 %
	Strongly Agree	220	22 %
Total		1000	100 %

Table 9 shows that 35% of the students strongly use computer to complete course work, project report etc. The result also show that 24% of the respondents carry out own learning using computer and internet. More than 53% agrees that ICT improves their organization and learning skills.

Table 10:

Result of respondents on their opinion on the availability of ICT resources

ICT Resources	Status	Freq. Count	Percentage
Computers/ pc in classroom	Not sure	45	75 %
	Fairly available	8.76	14.6 %
	Available	6.27	10.4 %
Total		60	100%
Internet & E-mail	Not sure	33.78	56.3 %
	Fairly available	19.98	33.3 %
	Available	6.24	10.4 %
Total		60	100 %
Television set	Not sure	26.22	43.7 %
	Fairly available	22.50	37.5 %
	Available	11.28	18.8 %
Total		60	100 %
Projector	Not sure	15	25 %
	Fairly available	27.48	45.8 %
	Available	17.52	29.2 %
Total		60	100 %
Software	Not sure	18.72	31.2 %
	Fairly available	28.74	47.9 %
	Available	12.54	20.9 %
Total		60	100 %
Computer laboratory	Not sure	6.24	10.4 %
	Fairly available	30	50 %
	Available	28	39.6 %
Total		60	100 %
Video conferencing	Not sure	45	75 %
	Fairly available	11.28	18.8 %
	Available	3.72	6.2 %
Total		60	100 %

Table 10 show over 75% of the staff do not use computer in the classroom. 56.3% of the staff respondents do not have access to the internet. Only 20.9% of the staff uses projector in the class during lectures. 20.9% of the staff uses relevant software for curriculum implementation. And 6.2% of the staff has used video conferencing.

Findings

The findings of this study revealed that;

1. 75% of lecturers who teach engineering student of FUT Minna do not use computer in the classrooms
2. 56% of staff of engineering does not have access to internet facilities within their office
3. Only 29.52% of the SEET staff uses projector during teaching
4. 20.9% of the staff of SEET have and can use relevant software for implementing this curriculum
5. 10% of the students of SEET have access to university internet facility and 4% do that from the ITS center. While about 20% access the internet facility outside university source
6. 10% of the students of FUT Minna have PC and uses it for learning engineering
7. 36% of the engineering students sampled have access and can use relevant engineering software for their academic purposes

Recommendations

Based on the findings of the study, the following recommendations were made;

- Lecturers should be encourage to use computer in their teaching
- Internet facilities should be provided to staff offices
- Lecturers of SEET should be encourage to use projector during teaching
- The University administration should provide internet access to students and also provide them with PCs in order to improve and facilitate their learning

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