Adoption of the SAMR Model to Asses ICT Pedagogical Adoption: A Case of Makerere University

Lubega T. Jude, Mugisha Annet Kajura, and Muyinda Paul Birevu

Abstract—For the past decade, Makerere University seen integration of ICTs as an enhancement tool in its pedagogical processes. The level of enhancement has been slow and not satisfactory considering the low number of staff that pedagogically integrate ICT for teaching and learning. Several studies had indicated in the past how e-learning has been implemented in Makerere University but there was no empirical evidence to explain the slow pedagogical ICT adoption in the University. Lack of such information contributed to the lack of concrete interventions that could be devised to transform pedagogical integration of ICT at Makerere University. Using a mixed research approach, a comparative study was undertaken to find out the actual causes of slow pedagogical integration and at the same time suggest interventions that could improve the situation from using ICT as an enhancement tool but a transformative tool as per the SAMR model. These interventions arising from this study could be utilized by any other institution which has slow adoption of ICT for pedagogical purposes.

Index Terms—SAMR model, ICT pedagogical adoption, Makerere University.

I. INTRODUCTION

Pedagogical integration of ICT may be referred to as a methodology which utilizes different Information and Communications Technologies (ICTs) for teaching and learning. ICT utilization can be done in several ways and through different tools such as: computers, CDs/DVDs, Web 2.0 technologies, Internet, T.V, mobile phones, radio, video conferencing, etc. The process if integration within institutions of learning is done differently and depends on both the available ICT tools and knowledge of integration. in the SAMR Model (Fig. 1) [1] describes an ICT led pedagogy to be the use of technology as: a direct substitute tool with no change (Substitute), direct tool substitute with functional improvements (Augmentation), a tool for significant task re-design (Modification) or a tool for creation of new tasks, previously inconceivable (Redefinition). All these levels clearly depend on the user knowledge of integration and availability of the tools.

Putting the model into practice for instance, under substitution dimension the computers are simply used to

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replace type writers to produce documents but with no significant change to their function.
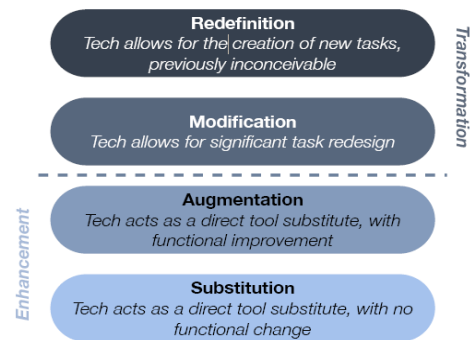

Fig. 1. The SAMR model [1].

Similarly, under the augmentation dimension, computers are for instance used to replace type writers but with significant functionality increase (e.g. cut and paste, spell checking etc.). According to the SAMR model these two dimensions (substitution and augmentation) play an enhancement role in teaching and learning process. But when ICTs are used to transform (modify and redefine) the teaching and learning processes we significantly realize a redesign of tasks. For instance, in the modification dimension technology allows for significant task redesign (processes integrated with email, spread sheets and graphing packages) while in redefinition dimension technology allows for creation of new tasks previously inconceivable (visualizations tools, simulations). This model clearly describes how technology can sequentially be integrated in education without skipping any stage of development.

In the past decade, Makerere University has been integrating ICTs as enhancement (substitution and augmentation), tools in its pedagogical processes. However, the level of enhancement is not satisfactory considering the number of staff that has adopted ICTs for teaching and learning [2]. Reasons for such a situation cannot easily be comprehended because there is no empirical evidence and if any it is scanty, none published and contains no interventions to help in changing the situation. It is apparent that ICT is a critical driver for sustainable economic and social development. The World Bank report [3] suggests that the African education status requires innovative ways to support it in achieving the millennium goals It is therefore important at any stage within the educational system to allow learners and teachers flexibly utilize ICTs for educational purposes.

Khan [4] noted that advances in IT and new developments in learning provide opportunities to create well-designed, engaging, interactive, affordable, efficient, easily accessible, flexible, meaningful, distributed, and

facilitated learning environments. With such richly enables environments, both students centered and problem based learning can easily be achieved since learning can happen in a very flexible form. Research has shown that whenever there is an abrupt increase in the demand for learning but without adequate resources, inefficiency and ineffective in service provision is the result [5]. This is true for many of the African institutions of learning which have greater demands for education but with few resources to achieve it.

It should be noted that learning is a process of knowledge construction that involves learner and tutors irrespective of their nature (physical or virtual). These people come to the teaching and learning process with differing goals and therefore achieve different aims at the end. Therefore, the teaching and learning activities done will be dictated by the tools available in the process. Constructivism theory states that, learners play an active role and take on responsibility to construct their own knowledge and meaning [6, 7, and 8]. They entirely do so in respect to the available environment which determines what meaning they ought to make from the learning process. Learners prefer different delivery methods for content presentation because it affects how they act on it. In current era, we are faced with a situation where by the educational systems contains both digital natives and immigrants. Many of the teachers in the higher institutions of learning are digital immigrants but teaching students who are digital natives. This results into a conflict that curtails ineffective teaching and learning. On several occasions institutions have not formerly introduced the technologies within the educational systems but integration depends on the individual teachers. However, when there is good integration of ICT in education a realization of economic development, social reform and civic participation within a society is enhanced.

II. RESEARCH METHOD

The research involved undertaking four main activities, namely: dialogue with stakeholders on ICT in education, situation analysis of pedagogical ICT use and identifying interventions and drawing strategies for their implementation. A mixed research methodology involving qualitative and quantitative approaches was employed. The study was undertaken at four Colleges of Makerere University, namely: 1) College of Education and External Studies (CEES) as a pedagogy College, 2) College of Computing and Information Sciences as an ICT based College, 3) College of Business and Management Sciences and 4) College of Humanities and Social Sciences as non pedagogy and non ICT based Colleges. The data was collected using a questionnaire, interviews, focus group discussions, observations, project blog and documentary analysis. All the data collection tools were designed following the SAMR Model. Data was analyzed using SPSS to obtain descriptive and inferential statistics.

The sample size of 600 was devised to cater for all the 4 Colleges and therefore each was offered 150 participants (50 academic staff and 100 students). These staff and students were succumbed to a variety of techniques which could help in acquiring the most appropriate data. All the colleges were allocated a research assistant to undertake the data collection and thereafter submit to a central spool for data analysis. Data analysis techniques utilized include average computations, Chi Square tests, Ratios and percentage computations. The results were written in a particular format as presented in section of the results.

III. RESULTS

A. Response Rate

Whereas equal number of questionnaires (150) were issued to the respondents in the four sampled Colleges, a response rate of 35% ($n=208$, $N=600$) was registered. There was a response of 32.7% from College of Education and External Studies (CEES), 44.2% from College of Computing and Information Sciences (CoCIS), 10.6% from College of Business and Management Sciences (CoBAMS) and 12.5% from College of Humanities and Social Sciences (CHUSS).

It should be noted that despite having distributed the sample size amongst the 4 colleges not all participants responded. The colleges that were accustomed to using ICTs in teaching and learning ended up participating more because they were more knowledgeable of what was being asked from them.

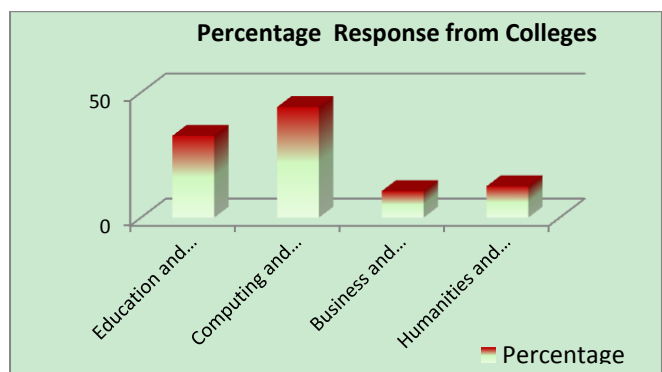### B. General Characteristics of Respondents

Fig. 2. Graph showing responses from colleges.

C. Gender

The study drew findings indicate that 67.3% men and 32.7% women. The percentages indicate that men are more involved in ICTs than women. The reason why women were less interested in ICTs was that it needed more time and yet women are more engaged in other issues such as domestic activities than their counterparts (the men).
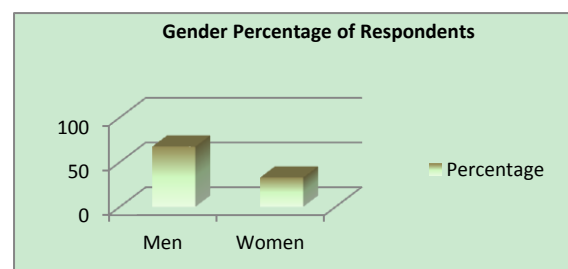

Fig. 3. Graph showing gender disparity.

It was noted that there were more male participants in the research hence inducing the fact that it is the same gender

that probably utilized more of the ICTs in teaching and learning. This result was not a very surprising result because many of the female teachers within the University had a techno phobia especially those from the non ICT based Colleges.

D. Age

The majority of respondents (29.1%) were aged between 26 to 30 years. Those aged between 31 and 35 constituted 28.2% while those aged between 36 and 40 constituted 15.5%. All together, the respondents aged over 41 constituted 23.3% of the sample. Young generations have a higher affinity for ICT adoption than their counterparts, the relatively old (Prensky, 2001). Makerere University could tape from this age characteristic to adopt an ICT-led pedagogy
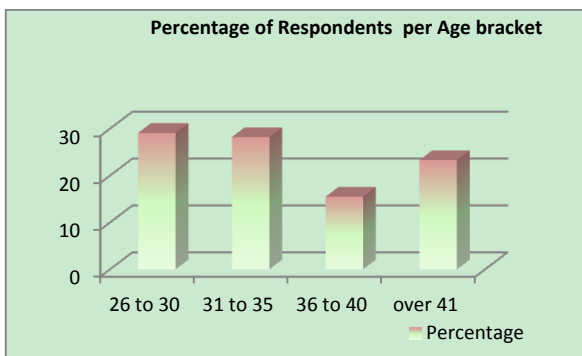

Fig. 4. Graph showing respondents as per the age.

From the analysis it was noted that majority of the respondents were aged from 26-35 which is the adult stage and probably those people who have grown up in the digital era. However there was a surprising age bracket of over 41 years which is more attributed to the professors who have acquired the skills of using ICT by the fact of their training either from abroad or undertaking research.

E. Education

The majority (60.6%) of the respondents were PhD holders. Only 19.2% were masters' holders. Bachelors' degree holders were 20.2%.
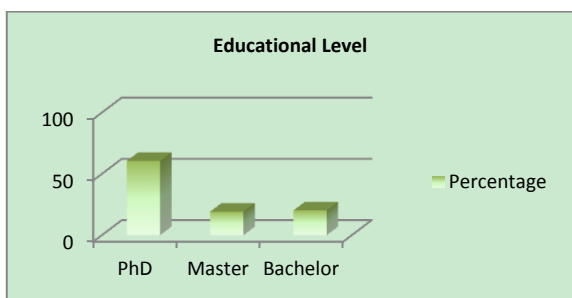

Fig. 5. Graph showing respondents as per the age.

The respondents who had PhD were the majority who responded and partly it is due the fact that staff members of that educational level were more exposed and used ICTs in their teaching and learning than the teaching assistants who had the master and bachelor's degrees.

F. ICT Literacy

The majority of respondents (92.2%) were ICT literate

with only 6.7% having basic ICT literacy and 1.0% being completely ICT illiterate. Thus, Makerere University has a fertile ground on which pedagogical ICT usage can sprout. So is this high level of ICT literacy being translated into frequent use of different ICTs for teaching? This is the question that needed to be answered as an assessment of ICT integration based on SAMR model is being done effectively.

G. ICT Use in Pedagogical Processes

In order to establish whether staff were using ICTs to conduct different teaching and learning activities, staff were asked to indicate the frequency (never, sometimes, always) of use of various ICTs in different pedagogical processes. The findings are presented in Table I below.

Whereas the majority of academic staff are ICT literate (over 90.0%), Table I above shows that there is insufficient use of ICTs in pedagogical processes at Makerere University. The personal computer is by far the highly (84.6%) used ICT. This is followed by the Internet (58.3), Power Point Projector (52.4%), e-mail (51.5%), mobile devices (34.3%) and MUELE (33.0%). Social media applications and emerging educational technologies such as Face book, Twitter, Second Life, e-Portfolios, Scoop it and many others are yet to see their use at Makerere University. Despite being in place for over 10 years, the Makerere University Electronic Learning Environment (MUELE) was only in the sixth position in terms of ICTs that were always used by staff for pedagogic activities. The main reasons advanced for not used most of the educational technologies relate lack of knowhow on how to use the equipment or application and lack/limited access to the equipment/application. "I do not know how to use Second Life and I have never even heard about it. How do you expect me to use it," said one of the respondents. Another respondent said, "we do not have access to most of the educational technologies. The few computer labs that are available are always congested with students". Besides the pedagogical affordances of most of the educational technologies is not known. "What will i be using if I used Drop Box in my class?," asked one of the respondents.
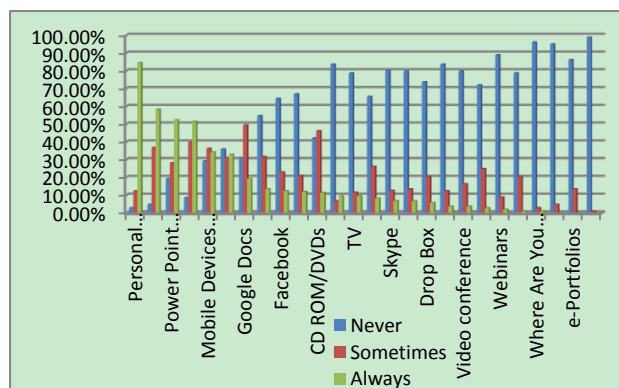

Fig. 6. Graph showing ICT usage for pedagogy.

This implies that the pedagogical affordances of the different ICTs in Table I above need to be explored so that they can be integrated in an ICT led pedagogy at Makerere University. Is the environment conducive for an ICT-led pedagogy at Makerere University?

TABLE I: FREQUENCY OF ICT USE FOR CONDUCTING TEACHING ACTIVITIES

ICTs	Never	Sometimes	Always
Personal Computer/Laptop	2.9%	12.5%	84.6%
The Internet	4.9%	36.9%	58.3%
Power Point Projector	19.4%	28.2%	52.4%
E-Mail	8.7%	39.8%	51.5%
Mobile Devices (e.g. mobile	29.3%	36.4%	34.3%
MUELE	35.9%	31.1%	33.0%
Google Docs	31.1%	49.5%	19.4%
YouTube Videos	54.8%	31.7%	13.5%
Facebook	64.4%	23.1%	12.5%
Smart Board/Interactive Board	67.0%	21.0%	12.0%
CD ROM/DVDs	42.3%	46.2%	11.5%
Radio	83.7%	6.7%	9.6%
TV	78.8%	11.5%	9.6%
Blogs	65.5%	26.2%	8.7%
Skype	80.4%	12.7%	6.9%
Twitter	79.8%	13.5%	6.7%
Drop Box	73.8%	20.4%	5.8%
Note Share	83.7%	12.5%	3.8%
Video conference	79.8%	16.3%	3.8%
Digital Camera	72.1%	25.0%	2.9%
Webinars	89.1%	8.9%	2.0%
Video Camera	78.8%	20.2%	1.0%
Where Are You Now (WAYN)	96.2%	2.9%	1.0%
Second Life	95.1%	4.9%	0%
e-Portfolios	86.4%	13.6%	0%
Scoop it	99.0%	1.0%	0%

H. The ICT Environment

In order to establish whether the environment was conducive for ICT integration in pedagogic processes at Makerere University, respondents were asked about the conduciveness of the environment for pedagogical ICT integration. Findings are presented in Table II below.

Results in Table II above indicate a mixed opinion about the conduciveness of the environment for ICT integration in teaching and learning at Makerere University. On average 26.2% and 20.2% of the respondents agreed and strongly agreed respectively that the necessary conditions for ICT integration exist.

From the survey, the academic staff are positive to ICT integration in teaching and learning, because as it was revealed in the focus group discussions, ICTs, "make teaching and learning easier" (63.5%), "are the modern chalk and board" (9.6%) and "have ability to point to vast sources of knowledge for reference" (5.8%). Further, the environment is rife for pedagogical ICT integration because, according to respondents, there exists at Makerere University, ICT literacy courses for staff and students (68.0%), an ICT policy that encourages pedagogical ICT use (64%), qualified ICT in education staff who could mentor others (60.4%), engendered ICT access (59.8%), staff who have attended pedagogical ICT training (53.0%), infrastructure to support pedagogical ICTs integration (43.6%), ICT embedded curricula (42.6%) and regular training for pedagogical ICTs (40.6%).

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TABLE II: THE ICT ENVIRONMENT

Opinion	SD	D	N	A	SA
ICTs integration in teaching and learning is vital	2.0%	0%	2.0%	17.6%	78.4%
ICT literacy is taught as a separate course Colleges	12.6%	8.7%	10.7%	40.8%	27.2%
There is an ICT policy that encourages pedagogical ICT use	2.0%	6.1%	27.3%	32.3%	32.3%
There are qualified/skilled personnel to mentor others	5.9%	10.9%	22.8%	40.6%	19.8%
Engendered access to pedagogical ICTs exists	7.2%	15.5%	17.5%	24.7%	35.1%
I have attended pedagogical ICTs training	18.6%	22.5%	5.9%	32.4%	20.6%
Adequate infrastructure to support pedagogical ICTs integration exists	20.8%	24.8%	10.9%	28.7%	14.9%
Curricula has ICTs incorporated in each and every course	10.9%	14.9%	31.7%	28.7%	13.9%
There is regular training for pedagogical ICTs	12.9%	15.8%	30.7%	32.7%	7.9%
There are incentives for encouraging pedagogical ICT use	20.4%	21.4%	32.0%	15.5%	10.7%
ICT policy is clear on issues of teaching and learning	3.1%	11.5%	59.4%	18.8%	7.3%
Clear strategies for monitoring and evaluating pedagogical ICTs exist	12.9%	29.7%	31.7%	17.8%	7.9%
The staff capacity in the E-Learning Unit is sufficient	9.0%	26.0%	43.0%	19.0%	3.0%
Budget votes for pedagogical ICTs exist	12.4%	25.8%	41.2%	16.5%	4.1%
Average	10.8%	16.7%	26.2%	26.2%	20.2%

Further, from Table II above, on average, only about 27.5 % believe that the environment is not conducive enough for ICT integration in teaching and learning at Makerere University. According to them, there are no, adequate

infrastructure to support pedagogical ICTs integration (45.6%), no clear strategies for monitoring and evaluating pedagogical ICTs (42.6%) and no incentives for encouraging pedagogical ICT use (41.8%). There are also no staff that have attended pedagogical ICTs training programmes (41.1%), no budget votes for pedagogical ICTs (38.2%), no human resource capacity in the E-Learning Unit (35.0%), no regular training programmes for pedagogical ICTs (15.8%), no engendered access to pedagogical ICTs (22.7%), no separate ICT literacy courses taught at College level for staff (21.3%) and no qualified/skilled personnel to mentor others (16.8%). Also the existing ICT policy is unclear on issues of pedagogical ICT integration (14.6%).

On average, a good proportion of staff (26.2%) did not know whether the environment was conducive or not because they had not been keen on issues of ICT pedagogic integration. "I do not know what happens in the area of ICTs," said one of the neutral respondents. Another said, "I care less about ICTs for as long as my students are satisfied". It is therefore very important for the institution administration to have a buy in the integration of ICTs in education if it is ever growing to effectively implemented. Having policies without a good implementation and monitoring makes no sense.

I. Level of ICT Integration at Makerere University

The results presented in Sections above show that there exists some pedagogical integration of ICTs at Makerere University and an environment which can be harnessed to encourage pedagogical ICT integration. In order to determine the level of integration, the researchers used Puetendura's [1] model of ICT use in educational institutions. According to Puetendura (2010), ICT use in educational institutions can be found in four different levels, namely, Substitution, Augmentation, Modification and Re-definition, that is the SAMR Model. This was found to be the most suitable model because; it describes the stages of ICT pedagogical integration, and was developed basing on the teaching and learning process which is the core of this study. In this model, basic integration is usually found at the Substitution level while the most advanced integration is found at the Re-definition level. The following sections present the level of ICT integration at Makerere University based on the SAMR Model lens.

J. Substitution ICTs Used at Makerere University

Substitution ICTs attempt to replace manual practices with ICT-based practices with no functional improvements in the practices, for example using a word processor to replace a typewriter. Table III below investigates the use of ICTs as a substitute to manual pedagogic processes at Makerere University.

Table III above indicates that the most common substitution pedagogical ICTs are those used for preparing lecture notes, assignments and examinations, which are always used by 74.4% of the lecturers. This finding collaborates with that established earlier in which the personal computers/laptops were the most highly (84.6%) used ICT for teaching and learning. Lecturers use the word processor to prepare notes, assignments, tests and examination which were hitherto handwritten.

TABLE III: SUBSTITUTION ICTS USED AT MAKERERE UNIVERSITY

Substitution ICTs	Never	Sometimes	Always
I use ICTs to prepare my lecture notes, assignments and examinations	9.1%	16.2%	74.7%
I use PowerPoint presentation method to deliver my lectures	22.3%	29.1%	48.5%
I upload my teaching and learning materials on MUELE or other electronic sites/devices for students to access	38.2%	21.6%	40.2%
When supporting my students, I communicate to them using e-mail.	15.8%	49.5%	34.7%
I refer my students to electronic databases for reference materials instead of hard copy textbooks	9.2%	61.2%	29.6%
When supporting my students, I communicate to them using my cell phone	15.0%	58.0%	27.0%
During my lectures, I use the smart boards/interactive boards installed in the lecture rooms for writing instead of the chalkboard	62.7%	23.5%	13.7%
I prefer students to submit their course work assignment through e-mail	39.2%	47.4%	13.4%
In my College, all notices are placed in the electronic notice boards installed in/out of the College buildings	68.4%	18.9%	12.6%
When supporting my students, I communicate to them through social media such as Facebook, Twitter, chat rooms, discussion boards, etc	62.0%	32.0%	8.0%
I administer multiple choice questions for tests/examinations through MUELE in order to avoid heaps of paper to mark	77.8%	17.2%	5.1%
I record my lectures on CDs/other media and give them to my students	86.4%	11.7%	1.9%
I take video/audio recordings of myself while lecturing and use them in subsequent years to teach the same course to another cohort of students	82.5%	16.5%	1.0%

To substitute the traditional chalkboard, 48.5% of the lecturers are using LCD projectors to present their lectures. The institutional learning management system (MUELE) is being used to store content by 40.2% of the lecturers.

The least substitution ICTs are video/audio recordings of lectures. In a nutshell a number of teaching activities are yet to be computerized even at the basic substitution level. The reason for this is related to the non institutionalization of the e-learning policy that was developed. The little substitution that is undertaken is entirely dependent on the individual efforts.
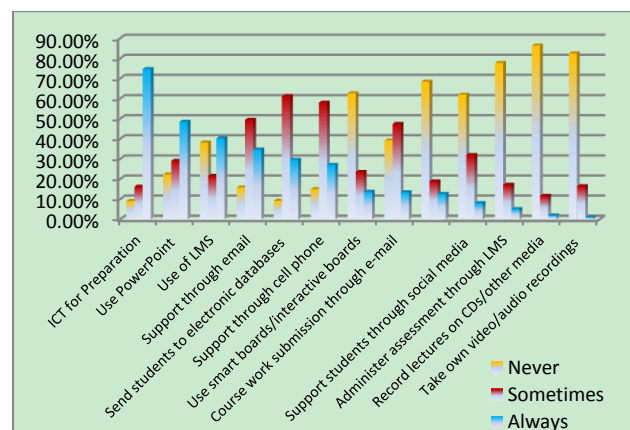

Fig. 7. Graph showing substitution ICTs used at Mak.

K. Augmentation ICTs Used at Makerere University

The Augmentation level pre-supposes that pedagogical ICTs are used to substitute traditional ways of teaching and learning but with a little bit of functional improvement. For instance a lecturer using a word processor to substitute a typewriter can employ a spell checker to remove typos from his/her lecture notes. Table IV below investigates the level of use of ICTs for augmenting pedagogical processes at Makerere University.

TABLE IV: AUGMENTATION ICTS USED AT MAK

Augmentation ICTs	Never	Sometimes	Always
I use search engines (e.g. Google) to look for vital research content in my discipline	3.0%	20.0%	77.0%
I use the editorial tools in my word processor to correct grammatical errors in any documents I process	23.0%	18.0%	59.0%
I use the editorial tools in my word processor to receive alternative words to use in my essays	29.3%	19.2%	51.5%
I use the online dictionaries like Wikipedia to make meaning of the words/phrases that I do not understand	15.8%	36.5%	48.5%
I use digital libraries as a source of useful content for my lectures	13.9%	40.6%	45.5%
I use track changes tool in my word processor to review communal documents or students' dissertations	34.7%	26.7%	38.6%
I use Internet group lists to contact my students in matters related to their academics	38.8%	30.6%	30.6%
I use citation tools like Endnote to improve on the citation and referencing quality of my scholarly work	42.0%	34.0%	24.0%
I encourage my students to use Google docs to accomplish group assignments/course work	40.4%	45.5%	14.1%
I use bulk messaging to contact my students in matters related to their academics	57.6%	30.3%	12.1%
I subject my scholarly work to a plagiarism test using plagiarism detection software	62.0%	28.0%	10.0%
I provide feedback to students' reports, papers and assignments through their emails	48.5%	42.3%	9.3%
I use Google docs to share documents with my students	46.0%	47.0%	7.0%
I use different videos to illustrate different case studies during my lectures	64.9%	30.9%	4.3%
I use my blog to discuss topics with my classes before we meet in the lecture room for the lecture	88.0%	12.0%	0%
I use Skype to teach my students when I am not at campus	95.0%	5.0%	0%

Table IV above indicates that most academic staff are more likely adopt augmentation ICTs that assist their own scholarly research work than those that are for pedagogical activities in and outside the classroom. One of the reasons that can be advanced for this scenario is the high level of training needed to use augmentation ICTs than that which is needed to use substitution ICTs. For scholarly work, search engines (e.g. Google) are the most frequently (77.0%) used augmentation ICTs. This is followed by editorial tools in word processors (59.0%), online dictionaries (48.5%) and online libraries (45.5%). It should also be noted that the

social interactive tools like Skype are less used in Makerere University for pedagogical purposes despite having a great potential for ubiquitous reach to students and lecturers. The reason for not adopting such technologies could be related to lack of knowledge by the students and lecturers on how to use them, and the technologies needed to implement such social media. Thus, more pedagogical activities in and outside the classroom are mainly ported onto substitution ICTs than augmentation ICTs as is shown in Table III and Table IV above.

Which College is the most prominent in conducting Internet research? Table V below shows a cross-tabulation of the College variable with the Use of Search Engine variable.

TABLE V: COLLEGES AND USE OF INTERNET SEARCH ENGINES SOURCE: PRIMARY DATA PERCENTAGES ARE COMPUTED ROW WISE

Options	Never	Sometimes	Always
I assign students topics to research about from the Internet	17.6%	53.9%	28.4%
Use open education resource	45.0%	42.0%	13.0%
Use group discussion facility	62.7%	28.4%	8.8%
Teach modules in course using MUELE	63.4%	28.7%	7.9%
Use my cell phone to send academic support	67.7%	25.3%	7.1%
Use Internet to cell phone messaging	71.3%	23.8%	5.0%
Use content authoring software	77.0%	19.0%	4.0%
Facebook with my students	72.5%	24.5%	2.9%
Use online assessment tools	71.6%	26.5%	2.0%
Use video conferencing	95.7%	4.3%	0.0%

From Table V above, it is evident that no staff in the Colleges of Computing and Information Sciences and that of Business and Management Sciences had never used an Internet search engine for information access. The College of Humanities and Social Sciences had the highest number of staff (7.7%) that had never used a search engine for information access followed by the College of Education and External Studies (6.1%). By its mandate, the College of Education and External Studies is supposed to lead in the area of ICT pedagogical integration. This however is not the case! Results from the focus group discussion held with staff of the College of Education and External Studies indicate that the less use of ICTs for research emanates from the fact that the College lacks ICT infrastructure and leadership to propel an ICT led pedagogy. Computing and Business Colleges are so engaged in use of search engines because according to one of the respondents, "ICT is the modern pen and chalkboard" in these disciplines. Therefore, ICT integration is highly associated with discipline and availability of ICTs in a given College whereby science related Colleges are more likely to adopt pedagogical ICTs than humanity related ones. This is exemplified in Table VI below.

At 6 degrees of freedom and 95% level of confidence, a p-value of 0.001 was generated in the cross-tabulation of the College and Use of Search Engine variables as is seen in Table V and Table VI above. This implies that there exist a significant association between the College's main discipline and integration of ICTs in pedagogical processes.

It was not surprising to find no staff that had not used search engines in the two colleges which are looked at as the main ICT compliant within the University.

TABLE VI: ASSOCIATION BETWEEN COLLEGES AND USE OF SEARCH ENGINES

College	Use of Search Engines			
	Never	Sometimes	Always	Total
Education and External Studies	6.1% (*n*=4)	12.1% (*n*=8)	81.8% (*n*=54)	(*n*=66)
Computing and Information Sciences	0% (*n*=0)	16.3% (*n*=14)	83.7% (*n*=72)	(*n*=86)
Business and Management Science	0% (*n*=0)	18.2% (*n*=4)	81.8% (*n*=18)	(*n*=22)
Humanities and Social Sciences	7.7% (*n*=2)	53.8% (*n*=14)	38.5% (*n*=10)	(*n*=26)
Total	3.0% (*n*=6)	20.0% (*n*=40)	77.0% (*n*=154)	(*N*=200)

L. Modification ICTs Used at Makerere University

Under Modification, technology allows for significant task re-design. Table VII below shows how respondents were re-designing their teaching and learning tasks using ICTs.

TABLE VII: ICTS AS MODIFICATION TOOLS IN TEACHING AND LEARNING

Statistic	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.566ª	6	.001
Likelihood Ratio	29.492	6	.000
Linear-by-Linear Association	9.882	1	.002
N of Valid Cases	200		

From Table VII above the most common modification ICT is the Internet. About 28.4% of the lecturers always assign students topics to research about from the Internet while 53.9% sometimes do so. About 17.6% never assign Internet-based research topics. They advance reasons such as: there being no access to computers (15.4%), this not being applicable in their disciplines (11.5%).

Also from Table VII, 42.0% of the respondents sometimes used open education resources (OER) while 13.0% regularly use them in their research, teaching and learning processes. About 42.0% had never used OERs in their teaching and learning functions because they had never heard of them. However, the use of OER was acclaimed as a good practice because OER provide free study materials

Another modification ICTs investigated were the group discussion ICTs. About 28.4% of the respondents surveyed sometimes used group discussion facilities while only 8.8% always used group discussion facilities in learning and teaching. About 62.7% never used group discussion ICTs because, there is no access to such facilities in their departments (16.7%), large number of students (12.5%), lack of skills to use such facilities (12.5%), reluctance of students to use the facilities (8.3%), no time to use the facility (4.2%), slow Internet connection (4.2%) and fear that students would not participate actively in the class (4.2%). Others (4.2%) never simply thought of it.

Still in Table VII above, about 28.7% sometimes teach modules in their courses using MUELE while less than a tenth (7.9%) always use MUELE. A whopping 63.4% of the respondents never used MUELE because: more time is needed to use MUELE (14.3%), lack of access to computers (14.3%), big student numbers (4.8%), they never thought of it (4.8%), they do not know how to use it (4.8%), among others.

On the use of the cell phone to send academic support messages, Table VII above shows that both the students and the lecturers sometimes (25.3%) used the method while 7.1% always used it. The majority (67.7%) of respondents did not use cell phones for academic purposes because: it was costly (20.0%), they lacked participants' telephone numbers (15%), they lacked of airtime (10.0%), this would infringe on their privacy (10.0%), the method lacked face to face contact (5.0%), e-mail was better (5.0%) and it was only suitable for those who had cell phone access (5.0%).

In Table VII, 23.8% of respondents reported that they had sometimes used the Internet to cell phone SMS messaging system to support their students while 5.0% had always done so. A big number of respondents (71.3%) had never used Internet to cell phone SMS messaging. This was because of: lack of access to ICTs (10.5%), lack of knowledge for using the system (10.5%), slow Internet connectivity (5.3%), it is time consuming (5.3%), limitation of screen and keyboard size (5.3%), no telephone numbers (5.3), lack of face to face contact (5.3%), no need to send SMS cause can easily meet with students (5.3%), never thought of it (5.3%), big number of students (5.3%), among others.

A fifth of the lecturers used content authoring software sometimes while 4.0% always did the same as is seen in Table VII above. A whopping 77.0% had never used content authoring software such as EXE to create interactive study materials. This was because they lacked knowledge about content authoring software (57.9%), lacked access to the software (10.6%), among others.

Regarding students' and lecturers' use of Facebook for interaction, about 3% always interacted while 24.5% of them sometimes used Facebook to interact. A big proportion (72.5%) of respondents never used Facebook. Reasons advanced for not using Facebook include: it was not fun using it for academic purposes (23.5%), 11.8% were not on Facebook, Facebook is for friends and most of the people to interact with in the class were not friends (11.8%), lacked time (11.8%), Facebook was for social reasons not academic (5.9%), fills one's e-mail box (5.9%), not easy with large student numbers (5.9%), among others.

About 26.5% of the respondents reported in Table VII above that they used online assessment tools in assessing their students and only 2.0% always assessed their students using online assessment tools. The majority (71.6%) of respondents had never used online assessment tools. This was because: lack of knowledge for using the tools (50.1%), lack of access to ICTs (14.3%), lack of college support (7.1%), lack of time (7.1%), among others.

None of those surveyed always used video conferencing but 4.3% sometimes use video conferencing as an ICT modification tool in teaching and learning. A whopping 95.7% had never used video conferencing systems. The

major reasons for this state of affairs were: lack of facilities (76.2%), low bandwidth (9.5%), lack of knowledge on how to use them (9.5%), among others.

As can be seen in the foregoing presentation and in Table VII above, the majority of respondents had never used most of the Modification ICTs. Makerere University needs to put in a lot of effort to increase use of ICTs as tools for modifying the way teaching and learning takes place.

M. Redefinition ICTs Used at Makerere University

At the Redefinition stage, technology allows for the creation of new tasks previously inconceivable. Table VIII below shows how respondents were Redefining their teaching and learning tasks using ICTs.

TABLE VIII: REDEFINITION ICTS USED FOR TEACHING AND LEARNING

ICT Tool	Never	Sometimes	Always
I ask students to make their own notes from group discussion threads in MUELE	37.1%	45.4%	17.5%
I use open education resource as my study materials	48.5%	41.2%	10.3%
I use MUELE to assess my students' learning	69.7%	25.3%	5.1%
I use MUELE to encourage group discussions	71.7%	22.2%	6.1%
I use electronic games/simulation/2nd life	83.0%	14.0%	3.0%
I use Massive Open Online Courses (MOOCs)	78.0%	20.0%	2.0%

As can be seen from Table VIII above, there is a trace of student-centered learning at Makerere University because about 63.1% of the respondents agreed that they sometimes (45.4%) or always (17.4%) asked their students to make their own notes from group discussion threads in MUELE. The 37.1% of the respondents who never asked their students to make their own notes advanced reasons such as; lack of knowledge about the existence of such functionality in MUELE (28.6%), high preference for teacher-centered learning (23.9%), low participation levels in online discussions (9.6 %) and students not having enough time (9.5%), among others.

Further, in Table VIII above, the use of open education resources (OER) as Redefinition ICTs also featured since 41.2% of the respondents sometimes and 10.3% of the respondents always used them as their study materials. About half (48.5%) of the respondents had never used OER to Redefine their pedagogical functions. The group which had never used OER indicated, among others that, they did not know how to use OER (35.0%), OER were not available for some disciplines (30.0%), OERs where not necessary (10.0%) and in computer science, OER codes were not clear (10.0%).

In many colleges, student assessment is considered one of the most tedious and time consuming tasks. As to whether the colleges were using MUELE to assess their students, Table VIII above shows that only 25.3% sometimes and 5.1% always used MUELE to assess their students. A whopping 69.7% had never used the online assessment functionality in MUELE. Reasons advanced by the group not using online assessment, among others include: them not knowing how to use the functionality (52.6%), being suitable for objective-type assessments only (15.8%), intermittence of

MUELE (10.5%), resistance from students (5.3%) and there being no time to formulate online questions (5.3%).

Constructivist learning [10] has the potential to redefine the way learning takes place. One way of achieving constructivist learning is through group discussions. In Table VIII above, lecturers sometimes (22.2%) or always (6.1%) used MUELE to encourage group discussions. A whopping 71.7% never used MUELE to encourage group discussions. This is because, not all students were on MUELE (69.3%), high preference for face to face discussions (15.4%) and lecturers lacking time to moderate group discussions (7.7%), among others.

Researchers such as [11] have advocated for the use of 3-D reality in the classroom because it has the potential to cause authentic learning. In Table VIII above, it is reported that 14.0% of the respondents sometimes and 3.0% always used electronic games/simulations/second life in their pedagogic processes. The majority of respondents (83.0%) had never used these 3-D virtual reality applications in pedagogical processes. Reasons advanced for this include, among others, lack of knowledge on how to use 3D applications (52.0%), lack of appropriate ICT facilities (32.0%) and big student numbers (12.0%).

A new emerging educational technology is the Massive Open Online Courses (MOOCs). A MOOC is "... a gathering of participants, of people willing to jointly exchange information and collaboratively enhance their knowledge" [12]. It is a "... learning and teaching format" [13] that enables a group of people to connect with each other, via the Internet, mobile technologies or social media, to share knowledge and skills about a given learning activity or aspect. Table VIII above indicates that 20.0% and 2.0% of the respondents sometimes and always use MOOCS respectively. A big proportion of respondents (78.0%) had never used a MOOC because, among others, they did not know how to use MOOCs (40.0%), were not aware of MOOCS (15%), MOOCs were not available (10.0%), had no ICT equipment to enable use of MOOCs (5.0%) and MOOCs were a new form of technology (5.0%).

N. Proposed Interventions and Strategies for Adopting the SAMR Model in Institutions of Learning

From the findings, four (4) key areas have emerged that could help institutions be able to integrate the SMAR Model in their pedagogical process. These are: 1) eLearning Unit, 2) Skills and knowledge in educational technologies, 3) infrastructure, and 4) educational technology policy.

O. E-Learning Unit

Institutions' eLearning Units need to be adequately and appropriately resourced in terms of human and infrastructure resources. The staff members need to have the necessary pedagogical skills for transforming the University's pedagogy into a digital pedagogy. As a strategy, the University should establish a center for educational technology and equip it with well qualified personnel who can ably undertake research and roll out the techniques needed for pedagogical integration.

P. Skills and Knowledge in Educational Technologies

As is evident in the findings, the number one reason

advanced for non-use of a number of educational technologies was lack of knowhow on using a particular equipment or application. From the findings, there are pockets of staff at the University who have undertaken ICT pedagogical training programmes. Many of these staff have done the trainings without the help of the University but to just acquire further skills. The University should mobilize these staff into training other staff. Also concerted effort should be made in sending staff for short courses, masters and PhD studies in educational technology related fields. This learned people will comfortably roll out ICTs in the teaching and learning of the institutions.

Q. Infrastructure

Lack of access, low bandwidth and lack of appropriate hardware and software were another major cause for non-use of ICTs. Staff of the institutions should be sensitized about the importance of ICTs in authentic learning. Student and staff ICT infrastructure should be prioritized within the institutions. The budget line for ICT resource mobilizations for the institutions should be increased and made priority if changes are going to be realized. The use of personal computing devices such as laptops, mobile phones, Ipads, Ipods, etc. should be encouraged by the institutions, increasing and strengthening its WiFi hotspots should also be effectively undertaken.

R. Educational Technology Policy

Having an ICT policy in place is not enough but the implementation of this policy in the pedagogical processes is very critical and needs to be done. There should be strict penalties for those that fail to integrate and rewards for those that integrate ICT in pedagogy. Lecturers who attempt to use ICTs in their teaching function should be put to use in training other staff. Staff should be well sensitized so that they do see the push to integrate ICT in pedagogy as a burden but as a way to improve on teaching and learning. The institutions usually have no incentives to encourage innovative integration of educational technologies but should reward staff that has innovatively integrated educational technology in their teaching as role models to others. Non-monetary incentives, e.g. attending conferences, ICT devices, certificates of recognition, employ of year awards, etc should be put in place to recognize staff that are innovatively using educational technologies.

IV. Conclusion

Results have revealed that non-use of a number of ICTs in pedagogical processes in institutions is caused mainly by: 1) lack of a strong and vibrant unit that can push for the implementation of educational technologies 2) lack of knowledge on how to use the ICTs in question, 3) non-availability of relevant ICT infrastructure, and 4) the lackluster implementation of educational technologies policies. It is therefore very pertinent for any institution of learning to excel in pedagogical integration to think about these 4 main issues. This research should be used to trigger a policy change on freedom to use or not to use educational technologies within institutions of learning. It is expected

that when the institutions enforce policies developed, positive change shall be registered in ICT pedagogical integration. ICTs shall come into the lecture room and bring in authentic learning and hence bridge the gap between the digital native and migrants.

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