

Sustainable Deployment of Information Communication and Technology in Higher Education Learning Environment of Developing Economy

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Abstract.

This paper describes the rationale for sustainable deployment of Information, Communication and Technology (ICT) in learning environment of Higher Education (HE) institutions with a specific focus on the Developing Economy (DE). Effective integration of ICT depends on the way it is deployed, positioned and sustained. ICT would facilitate and improve students' knowledge and promote positive learning attitude. Decision makers need to provide proactive support in the usage of ICT and E-learning in HE settings. If DE students are to compete with their counterparts in the developed world, effort must be made to develop their ICT abilities in a sustainable manner. Sadly, many HE institutions in DE have invested heavily in the use of ICT but its benefits are yet to be manifested. Choosing a sustainable teaching and learning methods is never a passive process; stakeholders are expected to provide additional ICT skills given the complex dynamics of the job market and the increasing needs for multi-tasking workforce. Various methodological approaches, personal development and supportive learning environment are mandatory for sustaining HE development in the DE.

1.0 Introduction

The development, integration and substance of information and communication technologies (ICT) has reshaped the teaching and learning processes in higher education (HE) (Pulkkinen, 2007) despite its low uptake (Olaniyi and Ademola, 2013) in the Developing Economy (DE). Leveraging on global technology improvement, the use of ICT in HE of DE is more critical today than ever before. The HE institutions around the globe have increasingly adopted ICT for teaching, curriculum development, staff development, and as aid to students learning (Kumpulainen, 2007). Although ICT has the potential to improve educational methods and the quality of teaching and learning, the advantages of ICT are often under-realised (Surry and Farquhar, 1997) and more prevalent in the DE (i.e. Nigeria). Taylor categorically stated that ICT adoptions in many institutions are often poorly implemented resulting from unfounded optimism.

Regrettably, significant numbers of academia are still reluctant to adopt technology for teaching and curriculum development. Becta (2004) argued that serious obstacles in integrating ICT in teaching and learning processes of higher education are still prevalent and that there are no holistic solutions to the predicaments. Straub *et al* (1997) stated that the rate of adoption is affected by economic, sociological, organisational, and psychological issues. Pelgrum (2001) later argued an inter-cultural study and noted that there were substantial variations in respect of barriers to ICT deployment in differing economies.

This paper describes the rationale for sustainable deployment of Information, Communication and Technology (ICT) in learning environment of HE institutions with a specific focus on the DE. It narrated the rationale for clear understanding and deployment of sustainable teaching and learning methods that effectively sustain ICT in teaching and learning environment. It synthesises the rationale for appropriate use of ICT in enhancing teaching and learning in higher education and argued for supportive learning environment that proactively engaged teachers and learners in a sustainable manner. It concludes by identifying the crucial ingredients of quality teaching and learning using ICT.

2.0 Literature Review of Sustainable Deployment of ICT in Higher Education

Activity theory was described by Lim and Hang (2003) in studying integration ICT from socio-cultural and pedagogical perspectives. The authors argued that such understanding is critical to education research where the object of its inquiry is not simply knowledge, but useable knowledge. As ICT enters the socio-cultural setting of education environment, learning can be translated into many ways than earlier thought (Papert, 1993, pp. 53) while Salomon (1993, pp. 189) postulated that no tool is good or bad in itself; its effectiveness depends on configuration of the events, activities and contents in addition to the interpersonal processes of the usage context. Sutherland *et al* (2004) argued for both digital (word-processing package, computer simulation etc) and non-digital (hand writing, hands-on laboratory etc) tools in a learning environment and the need to understand the relative merits of different tools in ensuring resourceful learners.

Lim and Chai (2004) examined the integration of ICT and students for enhanced thinking and autonomous learning processes. Using observations, focus group and face-to-face interviews, the authors conceded that time constraints, lack of knowledge and experience of the teachers working environment as limitations of the proposal. The issues described are generically peculiar to those of the DE. Electronic Business Systems (EBS) is playing crucial roles in the global business enterprise and hence the resource re-direction into critical business areas to keep up with economic and market trends (Li *et al*, 2008). EBS framework for seamless integration of internal processes, suppliers and customers includes Supply Chain Management (SCM), Enterprise Resource Planning (ERP), and Enterprise Application Integration (EAI). It is dishearten to note that competent EBS professionals are hard to come by and hence the need for enhanced training in ICT's; e-marketing; e-business programming; and specialist networking to bridge the gap between industry and academia in the DE.

Multimedia techniques are fostering scientific understanding by presenting students with multilevel scientific thoughts. Su (2008) positioned the performance of university students studying sciences using ICT by analysing the students' characteristics and achievements. It was concluded that the ICT applications in multimedia environment facilitate required basic scientific knowledge and improved performance while promoting positive attitude towards learning. Al-Senaidi *et al* (2009) investigated the perceived barriers to adopting ICT in Omani tertiary DE institution and suggested lack of institutional support, disbelief of ICT benefits, lack of confidence, and lack of time as inherent barriers - group differences based on gender, academic rank, and academic field were generally not found to pose a significant barriers. Undoubtedly, academics in DE are expected to perceive at least moderate degrees of barriers in applying ICT to their teaching practices, it is however paramount to provide more institutional support, training, and allowing time for academics to learn and upgrade their ICT knowledge and skills in the sustainable deployment of ICT in the HE of DE.

Vekiri (2010) described an exploratory study of ICT deployment in Greece and argued that teacher expectations were positively associated with students' ability and perceptions to learning. The author found that the study does not support the notion that boys have more positive ICT self-efficacy and value beliefs than girls but boys' and girls' beliefs are differentially affected by parents, teachers, and ICT instructional methodology. Akhshabi *et al* (2011) developed a mobile learning system for students in which they can physically face the target in addition to personal guidance and supplementary materials. The authors argued that the proposed approach helps students improve their learning achievements and showed favourable attitudes toward the usage of mobile learning system. Bidarian *et al* (2011) positioned that ICT entry into educational field as innovative performance modifications that resulted in efficiency. The authors argued for the need for decision makers to improve the 'betterment factor' (*i.e. self regulation, learning, justice, evaluation and innovative thoughts*) for improved teaching and learning.

Muñoz de la Peña *et al* (2012) articulated a web-based educational automated tool and argued that the proposed architectural methodology overcomes the conceptual limits of multiple-choice tests and that students can obtain a continuous measure of their knowledge. Ulmanisa and Denins (2012) described a managerial model (Ordered Logistical Regression Analysis) for ICT adoption based on objective (economic) and managerial (firms level factors) components using a survey of 500 businesses in Latvia in 2008. The authors argued that perceived efficiency gains, technology absorption capacity and cultural factors enhance ICT adoption. Bhuasiri *et al* (2012) deployed Delphi techniques in describing the critical success factors that influence the reception of e-learning systems in the DE. Technology awareness, motivation, and changing learners' behaviour are thought to be the suggested prerequisites for successful e-learning implementations. Important factors influencing e-learning success in the DE includes enhanced basic-technology knowledge and skills, improved learning content, computer training, motivation, institutional support amongst others. The next section describes the rationale and conceptual framework for sustainable deployment of ICT in teaching and learning environment of HE in DE with specific focus on Nigeria.

3.0 Rationales and Conceptual Framework for Sustainable Deployment of ICT in Higher Education Learning Environment of Developing Economy

It is important to adopt a sustainable rationale for deployment of ICT in the HE environment in the DE (Olaniyi and Ademola, 2013). Regrettably, many institutions in the developing Nigerian economy has invested heavily in the use of ICT, sadly, its intended benefits are yet to be realised. Undoubtedly, there is a systemic failing in the project life cycle of ICT deployment in the HE of DE. Such failings are noted in requirements gathering, sourcing, procuring and acquiring the proposed technologies which often results users abandonment. This paper reiterates that sustainable teaching and learning methods that enhance quality of experiential learning should not be passive. A holistic approach is required in acquiring sustainable ICT framework that contributes positively to teaching and learning in a dynamic environment. Stakeholders have a singular responsibility to develop a course that interest learners (students) and keep them engaged as part of students learning and development in an integrative environment.

Figure 1 describes a rational conception of sustainable teaching and learning methods as originally proposed in Olaniyi and Ademola (2013). It argues that the generic conception teaching and learning focuses on impacting information. It however postulates that sustainable teaching and learning goes beyond '*impacting of information*' to other crucial issues such as '*transmitting of knowledge*', '*transmitting attitude to knowledge*', '*facilitating understand*', '*changing perception*' and '*learning support*'. Synthesising information is paramount for learners during academic development and resumption of their life-long learning. The manner by which information is impacted in academic settings of DE need significant improvement and ICT would enhance the rigour and quality of information that is impacted during lectures, tutorials, seminars, workshops and other learning sessions.

The quality of knowledge transmission is driven by strategic leverage of the information types, teaching methods and the associated learning support available at the concerned institution. It is also important to understand the positive (reinforcing) causal loop diagram between '*impacting information*' and '*transmitting attitude to change*'. It is the position of this paper that if '*attitude to knowledge*' is to be improved in Nigeria HE academic settings, the *methods, tools (ICT) and procedures* for impacting information need to be significantly improved. Educational planners in DE would need to improve the quality of information available to the students, while improving on the teaching methods with the associated student supports.

ICT will play an important role in transmitting learners' attitude to knowledge in the HE settings of DE. Learners need an attitudinal change to their ill-conceived perception of knowledge and the need to challenge the frontiers of knowledge; simulation software and other modelling techniques would aid students learning of complex systems in a dynamic learning environment. *Knowledge transmission, learning support, facilitation of understanding and change perceptions* are other conceptions where ICT are crucial in the learning process. It is however important to argue for feedback mechanism that underpinned efficiency and efficacy of teaching and learning. Adopting a holistic approach to teaching and

learning would enable decision makers to make informed judgement in respect of sustainable policy framework of pedagogic development in HE of DE.

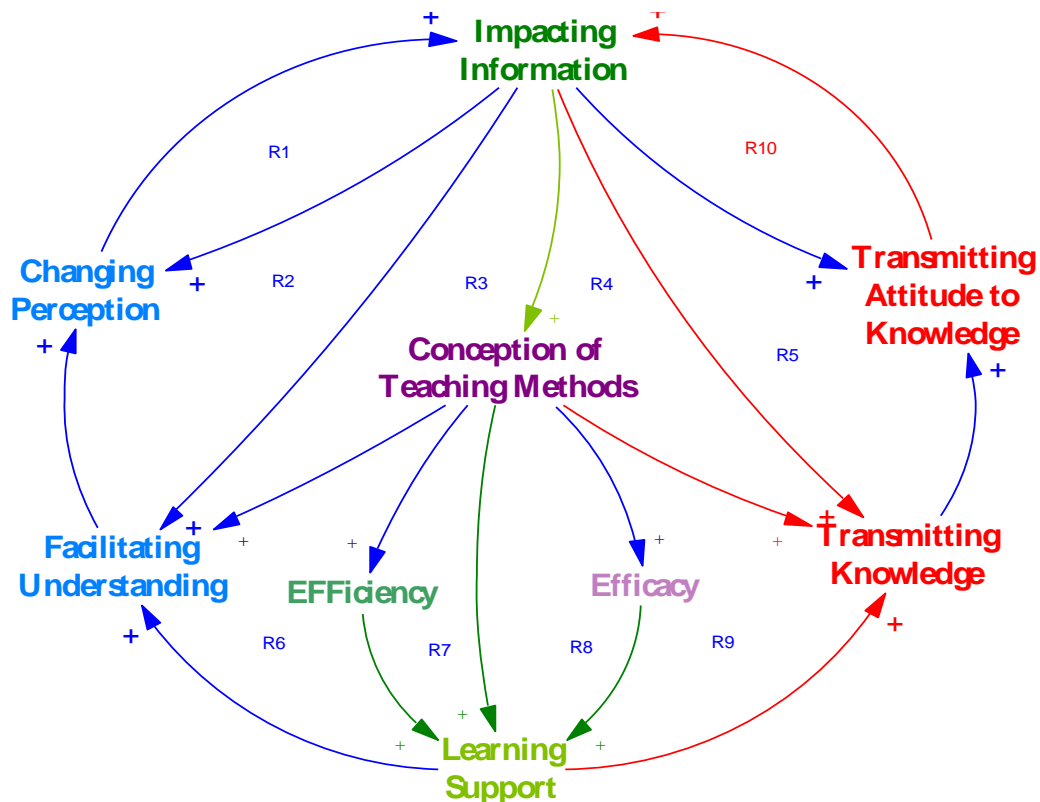


Figure 1 Sustainable Conception of Teaching Methods (Source: Olaniyi and Ademola, 2013)

Dissemination of knowledge to students is the major reason for the deployment of ICT in modern learning environment. Hence, students' development that improves their capabilities to use idea and information is critical in the HE settings of DE. Furthermore, students' ability to generate and test ideas as taught and rigorously discussed in the lecture and tutorial environment are needed for their career development. If students in the emerging Nigerian economy are to compete with their global counterparts, effort must be made to help develop their ability to plan and manage their learning using modern ICT in an integrative teaching and learning environment. Aspect of the need for students' personal development cannot be over emphasised in the emerging Nigerian economy. Given the complex dynamics of the job market and increasing demand by employers to recruit and retain multi-tasking candidates, it is imperative for HE settings in the DE to equip their students with additional ICT skills, tools and techniques that would enable them with competitive advantage in the global job market.

4.0 Facilitating Personal Development and Supportive Learning Environment

The primary purpose of a lecture in HE settings is to serve as an avenue for '*subject-matter overview and stimulation of interest*' rather than a platform for '*facts dissemination*'. The time limit for a typical undergraduate course should not exceed fifty-minute followed by in-class exercise. For tutorials, the main objective is to serve as an avenue for clarity of objectives (*learning outcomes*) and reinforcement of the lecture themes in a '*less-structured environment*'. The outcome of tutorials is to acquire some of the '*personal transferable skills*', e.g. in presentation and group work. Hence academia must master the art of 'personal development' that is impacted on the students. This would include the use of action plan, learning log, group projects, self-help groups, time management exercises, exam techniques, constructive feedback, learning contracts, role play, open learning computer packages, peer and self assessment etc.

The ingredients of quality teaching and learning in an ICT enabled environment start by stating the objective(s)/learning outcome of the session in clear and unambiguous terms. Learning objectives are an integral part of the Unit/Module Guide that are given to students at the beginning of the academic sessions and reiterated in all lecture summaries. Notably, Academic Accrediting Bodies in Nigeria do not give provide adequate guidance in the development of learning outcomes, objectives, assessment criteria etc and hence leave the Academic Planning Directorate of various institutions to do the same. The use of clear overhead acetates and lecture slides with the aid of ICT will enabled better experiential learning and development. Academic management ought to provide, support, assess and monitor the appropriate use of ICT for quality teaching and learning. The need for paced delivery to enhance students learning and development should be advocated amongst academic staff – *the standard rule of thumb is that the larger the class and/or the more difficult the material, the slower the pace*. Handouts should be developed with the aid of appropriate ICT for complex diagrams, difficult or critical text. Question and Answer Sessions should be undertaken at agreed times and places after the lectures. Academic staff should be encouraged to engage the students in '*question and answer sessions*' to evaluate their grasps of the subject matter.

Figure 2 below describes the proposed generic framework for a holistic and supportive learning environment in HE of DE. The atmosphere of learning must be stimulating, calm, reassuring and purposeful. The use of ICT in creating a welcome atmosphere of learning is paramount in many Nigerian academic institution of higher learning. Academia must be encouraged of the relevance atmosphere if sustainable learning and development is to be ensured. Students must be taught and motivated to study on how to share their intellectual properties, develop proactively networking abilities using appropriate technologies.

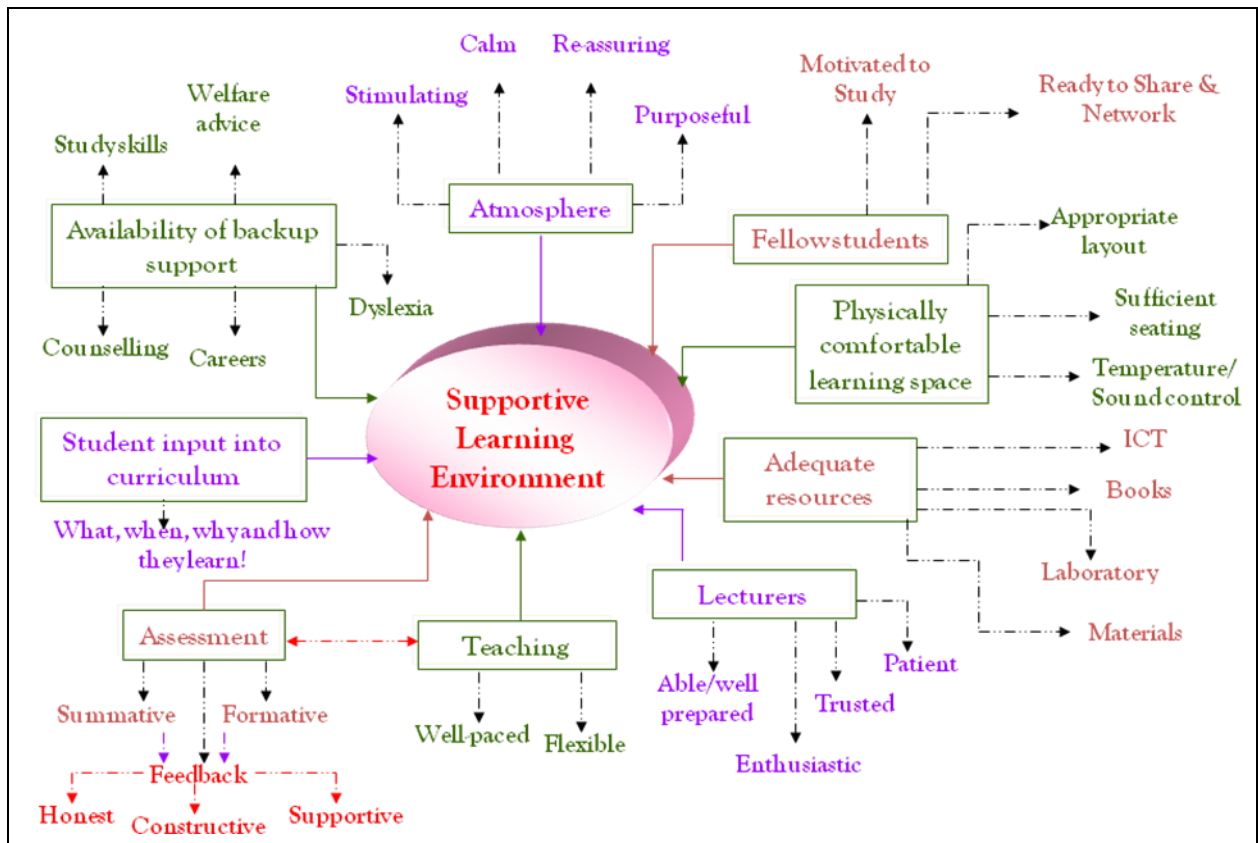


Figure 2 Holistic and Supportive Learning and Teaching Environment (Source: Olaniyi and Ademola 2013)

Resource adequacy is a dilemma that is confronting HE institution in the emerging Nigeria economy. It ranges from adequacy of teaching and learning materials, laboratory equipments, up-to-date text books, appropriate development of ICT etc. It is hope that with the appropriate deployment of ICT many of the resource shortcomings can be minimised. The use of ICT plays significant roles in simulating complex laboratory experiment on personal computers in engineering, science, biological, social and management, medicine and health sciences and legal studies. The use of ICT is not a passive process on the part of academia - lecturers and other instructional staff must be able/well prepared, enthusiastic, trusted and patient. The issue in respect of 'trust and patience' is alarming in the HE sector in Nigeria – there are clear mismatch between attainment of discipline/morality and the need to ensure 'trust' in academic environment. It is imperative to state that '*home discipline*' differs from '*academic discipline*' and that morality in academic settings is a process and various students differs in its uptakes. Proactive academias need to recognise that learners are drawn from various background and exposures. Hence, the needs for patients are crucial in enabling supportive learning environment in all academic institutions of higher learning.

Assessment is an area of concern in many academic institution of higher learning in Nigeria. There is a need of clear guidance in the use of summative and formative assessment. In many sadden instances; assessors are at the liberty of setting assessments at will (including late nights, weekends, religious dates etc) without diligent adherence to the learning contracts. Sadly, many of such assessors have been glorified by management as heroes while committing what is openly described as academic fraud in the developed nations. The issue in respect of students' feedback has become an important element in many academic settings. Students' feedback must be honest, constructive and supportive – instances of lack of feedback have been witnessed in many of the summative assessment across Nigerian higher education institutions. Assessors have equally reported lack of interest by students on the feedback given – *this is evidenced by many of the paperwork that often litters the classrooms after assessment feedback*. Honest, constructive and supportive feedback will be retained by students for their future academic and professional usage.

Students and industry input to curriculum development is gaining ground in the developed nations' HEs. Student and industry involvement in the Nigerian HE sector is negligible. Academic institutions need to recognise the importance of end users (students, and industry) in the development of their products (*academic qualifications*) and services (*supportive learning environment*). The need for backup support is a paramount aspect of learning and development; and the ICT usage play a significant role in ensuring the same. Backup support services would include study-skills centre, welfare advice, counselling, career and dyslexia support. Although many institutions boast of counselling students, however the natures of the counselling are mainly medical while failing on many other aspects of counselling services. Study skills centre should form part of the Learning Resource Centre where students are given an opportunity to develop their skills and knowledge during the course of their experiential learning in the HE academic settings of DE.

Career and dyslexia support lacks backup support in the HE settings of DE with specific focus to the developing Nigerian economy. Many academic institutions do not see it as moral responsibility to make sure that their students compete favourably in the job market and in further education. There is a need to provide adequate career development support for learners. The issue in respect of dyslexia support is alarming in many education institutions in Nigeria. Assessors are didactically encouraged to pass or fail students without taking cognisance of the students learning methods. No considerations are given to dyslexia students and hence majority of the assessments are unfair and profoundly biased. Evidence from the developed nation is that students with learning challenges are inclusive in the assessment protocol; further allowances are given to ensure equity, fairness and transparency in the assessment framework – developing Nigerian economy can equally adopt the same framework in their pursuit for deployment of ICT framework for the development, maintenance and sustenance of academic pedagogy.

5.0 Conclusions of Sustainable Deployment of ICT in HE Environment of DE

Sustainable deployment of ICT in HE academic settings of DE will depend on larger social cultural environment context as no tool is good or bad in itself. Proactive utilisation of ICT will facilitate improved students' knowledge and enhances positive learning attitude. Positively integrated ICT environment would enable prompt gaining of professional knowledge and facilitates opportunity to receive remedial instruction through repeated practice. Provision of proactive institutional support, technical training, and time to faculty members to learn and upgrade their knowledge and skills in ICT usage in modern education settings is urgently needed. E-learning is an effective tool for delivering pedagogic materials; technology awareness, motivation, and changing learners' behaviour are some of the success factors. Identifying the success factors in learning and teaching would enable focusing on pedagogic programmes that promotes self-regulation, self-learning, self-justice, self-evaluation and innovative thoughts. Success factors include enhancing basic ICT skills, improved learning and training, users' motivation to engage in e-learning etc.

If Nigerian students are to compete with their global counterparts, effort must be made to develop their ICT capabilities. Regrettably, many institutions in Nigeria have invested heavily in the use of ICT but its benefits are yet to be manifested. Various methodological approaches are available for knowledge dissemination inclusive of worksheet and self-directed private study, ICT produced handouts, e-books, video and audio tapes, internet and intranet, open learning materials, skill development in library and learning resource centres. Personal development and creation of supportive learning environment with the aid of ICT are urgently needed in the Nigerian education sector. Issue of concern would include the atmosphere, resources adequacy (*ICT, e-books, laboratory etc*), lecturers (able, enthusiastic, trusted and patient), appropriate assessment and feedback, students and industry input into curriculum development, availability of backup support services amongst others. The process of choosing a sustainable teaching and learning methods is not a passive process and hence the need for holistic approach. Academic communities are expected to provide additional ICT skills given the complex dynamics of the global job market and increasing demand by employers to recruit multi-tasking candidates.

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