A Context-Based computer-assisted Teaching and Learning; KNUST Example

Introduction

Globally, there is a growing debate about the relevance of traditional forms of teaching and learning in the 21st century. This is because conventional teaching, typically involving face-to-face teaching and learning, is basically about information delivery with the lecturer as "the sage on the stage." However, modern forms of teaching emphasize collaborative learning (group discussion, demonstrations, practical application of knowledge, peer review, and scaffolding), which has an estimated higher retention rate of 90% (Bjørke, n.d). Currently, there is an increasing demand for relevant higher education programmes given global economic and developmental challenges. This has led to the search for innovative forms of learning that provide individuals with across cultures access to market-driven educational programmes irrespective of geographic location.

That notwithstanding, there exists a fundamental challenge globally to secure adequate resources to expand educational facilities to accommodate the growing number of tertiary students in need of capacity building. UNESCO (2002) reports that "there has been a mad rush for enrolments in institutions of higher learning across the globe. As a result, governments all over the world are making considerable efforts to expand academic facilities to meet the growing numbers of students. Perhaps, the expansion based on traditional models of educational provision has peaked in many countries particularly in the contexts of limited public funding and disconnect between supply and demand are expected to persist. The situation has sparked an interest in finding more versatile and cost effective ways of meeting tertiary education needs. On this basis, modern forms of innovative learning have explored the potential of e-learning technologies to the Open University systems like United Nations University (UNU), the Massive Open Online Courses (MOOC) and HASTAC Future Education Initiative. All these foreshadow the future of higher learning.

The Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana have responded to this growing need to find and develop innovative and cutting edge approaches to educational delivery that defies physical and geographical distances. It is therefore timely that the University through its Institute of Distance Learning (IDL)-KNUST since 2012 has given meaning to the very essence of distance education by the adoption of and integration of e-learning approaches and technologies to revolutionalize the traditional way of teaching and learning while also offering open access education to a wide array of willing and qualified Ghanaian students to pursue higher learning from all corners of the country. Indeed, from 2015, the University through the Institute of Distance Learning started migrating most of its core programme to the e-learning platform, using the Learning Management System (LMS) powered by Moodle after a successful implementation of its E-learning strategy for innovative teaching and learning from 2012. This has thus given the University a competitive advantage over other universities in Ghana in e-learning technologies and pedagogical advances that employs a social constructionist approach for teaching and learning.

This position paper therefore presents a good practice case adopted by the Institute of Distance Learning which has served as a basis for the accelerated and effective implementation of the E-Learning agenda of the institute going into the future of online education delivery in Ghana.

Good Practices In Online Education Delivery: KNUST's Institute of Distance Learning-Msc Development Management Programme's Approach

In the world over, many people view e-learning as a mere channel for information delivery. To them, online learning is a new way to reduce cost of operation by making studying materials readily accessible for download and admit more students for economies of scale. This however is not the case. In this regard, KNUST's Institute of Distance Learning (IDL), has in recent years attempted to change this erroneous perception by employing e-learning technologies to improve its service delivery to the university community especially in its teaching and learning in ways previously unknown within the university community. In spite of such initiatives, some think tanks in the university community still share the general perception that online education is about information delivery as against its real intent of knowledge creation and for the IDL, this constituted a major potential draw back to its attempt at successfully implementing an e-learning pedagogy at the University going into the future.

In this regard, the Institute in 2012 established the Centre for E-learning Technologies (CELT) as the fundamental vehicle for changing and revolutionarizing E-learning and online educational perceptions not only in the Institute but across the University community. Fundamentally, CELT was tasked with pursuing and coordinating the E-learning strategy implementation processes of the Institute towards a full adoption of an integrated E-Learning and online educational pedagogies. Consequently, CELT set out organizing series of training sessions and workshops for *facilitators* and students on the relevance of collaborative learning using the Learning Management System (LMS) known as Moodle also referred locally as the KNUST Virtual Classroom. This KNUST IDL E-Learning infrastructure is an open source platform that has all the features supported by major open universities in the world. Initially, the training

sessions were sporadic and less formal until 2013 when the University through the Institute developed its MSc. Development Management (DM) programme that made exclusive and optimal use of the 'KNUST Virtual Classroom' platform that had already been procured and managed by the institute.

Curriculum Development and Course Structuring

As a first step, facilitators on the MSc Development Management programme who it must be noted had been trained in E-Learning approaches and pedagogies in Norway began a collaborative working relationship with the Institute through CELT by embarking on a drastic redevelopment and re-design of course curriculum and course outlines to formats that can be fitted to an e-learning environment. Course outlines were developed into study guides that spelt out course overviews, course aims, learning outcomes, Text and Reading materials, grading, assignment schedules that specified the assignment number, assignment description, assignment type (group assignment, group discussion, individual assignment etc), deadlines and value of grade for each assignment. On the basis of this, each chapter or topic to be studied had the contents to be covered, its learning outcomes, Sessions/activities to be carried out by both the facilitator and students which usually involved the reading activities and other practical steps to be undertaken towards the assignment that is given. Assignments followed each session/activity and are carefully timed based on the weight or demands of the assignment. Mostly, the assignment type, i.e. group assignment, individual assignment or group discussion as well as the grade value for the assignment etc is clearly indicated in the study guide so that students are able to adequately estimate the amount of effort required to perform the tasks related to the assignments. Indeed, the study guides are structured that they cover all the teaching period for every semester so that every day and week of the semester, students know and are aware of what is expected of them in the course of life of the semester and hence, prepare adequately towards meeting their obligations as students.

Moreover, the reading materials are also reduced to soft copies and appropriate hyperlinks to those reading materials are created and embedded into the study guides. Initially, study guides were copied on CD-ROMS and distributed to students. However, with time, these study guides were uploaded to all course classrooms or forums for easy downloads by all students in all courses. On the Virtual Classrooms, the course contents are structured according to the respective course study guides so that for each course, the course content in the study guide is exactly the same content placed in the respective course forum in the Virtual Classroom. Indeed, reducing course outlines, curriculum and reading materials to study guides and in soft versions drastically reduced IDL operational costs and expenditure in relation to the printing of handouts and course booklets for students over the years. Currently, the Institute does not print a single course material for students in all programmes run by the Institute since all has been reduced to soft versions for easy download by students. It has also created some permanence in knowledge storage and repositories.

Online Pedagogical Training Sessions for Students

Once the curriculum and course structure are redesigned to fit an E-Learning pedagogical structure, facilitators shift their attention to the students who are perceived as the ultimate drivers of success for any E-Learning approach introduced. On this basis, as students are admitted into the MSc Development Management programme, facilitators through CELT begin 2-3 weeks intensive E-Learning and collaborative learning training sessions for the students before the semester academic work begins. As already stated, the approach used derives from a social constructionist perspective noting that individuals construct their own meanings to social reality based on shared knowledge and assumptions. In this regard, the sessions are designed in such a way that first, previously help perceptions about online teaching and learning are deconstructed and subsequently reconstructed to appreciate the essence of E-Learning and working in a virtual collaborative environment.

During such training sessions, students are first introduced to the technologies used for teaching and learning and the available resources for them in using such technologies for their studies. Emphasis is particularly placed on working together as teams and groups which in many ways run counter to what exist in traditional face to face teaching and learning systems. Students are trained in approaches such as engaging in group discussions and assignments in an online forum, accessing and downloading reading materials on the Virtual Classroom, sharing reading and learning materials with fellow students in the virtual classroom, netiquette in an online teaching and learning environment, submission or hand-In of assignments, Evaluating Courses and facilitators, Messaging, Conferencing, accessing assignment feedback among others. Throughout the training sessions, students and facilitators interact with each other in the Virtual classroom in what is termed as "practice sessions" where students practice all the activities that they are introduced to and taught at the training sessions. Practice tasks are usually given during the training sessions and feedback given. This process, within short period of time builds the confidence of the students in using the technology, debunks their widely held notions and fears about learning in a virtual environment and subsequently generates their interest in using such platforms and technologies for their learning.

Learner Support Systems

However, effective teaching and learning requires very effective Learner support systems that are up to speed and sensitive to disruptions in the E-Learning value chain. Due to the entrenched skepticism about online education in the Ghanaian educational space, ineffective technological and pedagogical processes can easily de-motivate students and other users of the system for teaching and learning and eventually sabotage the smooth operation of the system. Aware of such an existential threat, IDL through CELT has set up a Learner Support Unit made up of facilitators and technicians working on shift basis at the CELT office who respond to students queries and challenges and get them rectified within a short of period time. The technicians typically work on the smooth operations and maintenance of the Virtual classroom platform on daily basis to avoid interruptions to the functioning of the platform likely to affect teaching and learning activities on the virtual classroom. The facilitators on the Learner Support Unit also respond to students' enquiries regarding activities on the Virtual Classroom and provide them with answers, advice or suggestions to help them use the platform for their academic activities more smoothly. This has ensured that students using the e-

learning systems do not get frustrated and ultimately abandons their programmes out of frustrations with use of the system implemented.

However, in the interim, video guides and skits of between 10-15 minutes as well as written manuals on how to use the Virtual Classroom has also been developed and uploaded on the virtual classroom for students to watch and read when they are having challenges on using the various functions on the platform. In this regard, only very complex and extremely technical cases get reported to the Learner Support Unit for rectification and solution. In line with the provision of Learner support systems, the Institute has set up a fully furnished recording studio for the production of audio-visual lecture materials and an ICT Lab where students and facilitators can use to for their various online teaching and learning activities.

Online Teaching and Learning in collaborative ways

Our online pedagogical approach to teaching and learning is mostly student centred. While facilitators are generally the originators of content on the virtual classroom, the students are mostly responsible for generating and sharing knowledge in the teaching and learning process. In this approach, facilitators assign students tasks to perform based on the study guides and allocate students to their respective groups and teams to work together in solving the task. Within stated deadlines, student teams and groups work in a collaborative way through group activities and discussions, knowledge and information sharing, active forum engagements as well as peer review and critique to contributions to shape their activities towards producing assignment documents for submission by the group. As already stated, since each chapter in the study guide correspond to a broad topic of study, facilitators guide the thought processes of the students by pre-recording lectures videos on the topic to be studied and uploads on the virtual classroom. Students play and watch the lecture and read around the topic of study and subsequently join their respective groupings in the course forum and engage each other in solving the tasks or assignments at hand.

Usually, facilitators are to observe the students' online activities and contributions when assignments are given and to take notice of each students contributions towards the assignment and award participation grades appropriately based on their individual contributions. This is to make all students active participants and generators of knowledge in the learning process rather than passive receptors of knowledge. Generally, facilitators do not partake in the discussion that results in submission of group work. Students and their groups are in such group assignments required to figure out the task demands and provide appropriate solutions to them on their own. However, when tasks require only discussions by the groups, facilitators engage the students in the discussions by asking questions to shape the discussions on topic while also answering questions from the students on the topic being discussed. Feedbacks on submitted assignment are supposed are sent back to students within three days so that corrections can be made by the students to help them identify their strengths and weaknesses and make improvements in subsequent assignments. This process creates a feedback loop between the students and the facilitators on course activities for the entire semester.

Grading and Assessments

On students' assessments, grading and assessment of our students' online academic activities and works are somewhat different from what pertains in the traditional face to face teaching and learning approaches. Whiles for instance, face to face class contributions and participation may not be necessarily graded, in our E-Learning approach, all students' contributions and participations are graded and eventually constitute an integral part of the students' final grade for the course at the end of the semester. Group discussions as well as group discussions resulting in the submission of group assignments attract what is termed "Participation Grade" [1]which is simply derived from each student's contribution and participation in the group discussions and group assignments. This grade differs from the assignment grade that is earned after the assignment is graded.

In determining participation grade for instance, facilitators work to predefined set criteria for assessing contributions in an online discussion forum. For example, in a discussion rubric, students are measured by posting on 3 different days by making a minimum of 4 postings in total, one new thread and three thoughtful responses to different members. A typical *A-level* contribution or participation involve those that are made in a timely fashion, giving others an opportunity to respond, are thoughtful and analyze the content or question asked, make connections to the course content and/or other experiences, extend discussions already taking place or pose new possibilities or opinions not previously voiced and if students are aware of the needs of the community, motivate group discussion, and present a creative approach to the topic being discussed. On the contrary, typical F-level or bad contributions are not made in timely fashion, if at all, are superficial, lacking in analysis or critique, contribute few novel ideas, connections, or applications, may veer off topic as well as showing little effort to participate in learning community as it develops. These criteria are strictly applied to the grading of each student's participation in group discussions and discussions leading to group assignments. In submitting assignments, assignments folders are created by facilitators for assignment submissions for each assignment or task given. Submitted assignments are downloaded en masse and graded and feedback sent back to students via the same assignment folder created for the assignment. Not only are assignments submitted through submission folders, multiple choice question assignments are also taken using the virtual classroom platform for conducting multiple choice exams where chosen answers and options are immediately graded for each student and generated as a file for the facilitators perusal and feedback to the students.

Technological Integrations and Pedagogical Approach

On media and technology integration, our current approach is an asynchronous one. Asynchronous approach works for developing country contexts such as Ghana where typical lack of ICT4D[2] infrastructure is largely limited in deployment. Indeed, sensitivity to the infrastructural limitations of the university especially on matters such as Internet

bandwidth means that the asynchronous approach works best in such limitations. The asynchronous approach ensures that all students access online teaching and learning resources and activities throughout the day from different part of the country or even across the world without having to congregate at one particular place on campus or logging in at the same time. In such limited infrastructural environment, synchronous approaches have the tendency to crash the system when the capacity is not adequately supported. Therefore, the asynchronous approach works best in our strategy such that all our students are able to actively participate in their respective course activities on the principle of flexibility and easy access throughout the days.

Again, improvements in mobile telephony technologies have been exploited for our purposes and have served to bring online teaching and learning closer to our students. The compatibility of Moodle Learning platform and ultimately the KNUST Virtual Classroom on Android and Iphone Operating Systems (iOS) for mobile phones ensures that our students are able to access the virtual classroom on their mobile handsets anywhere they have mobile internet connectivity. In this regard, the Institute has been spared the very costly internet provision services for our students since most of our students own internet-based mobile phones that can access their virtual classrooms anywhere across the country and the world. In this sense, students follow course activities and undertake their group and individual's tasks even while on the move. It must however be emphasized that our current technological and pedagogical strategy adopted in delivering context-based online education to students across Ghana and the world generally reflects four critical principles of *Scalability* (i.e. the system must be open to upgrades, either with new technology or expansion of users), *Security* (i.e. able to perform as required with a high sense of security by preventing unauthorised access from without including attacks from viruses, *Performance* (able to perform the tasks required with a high number of multiple users without breaking down) and *Availability* (available for use when required, versatile and resilient).

Course Evaluations and Assessments for Quality Assurance

Another good practice area worth sharing is the integration of an evaluation and assessment of facilitators and their performance feature on the Virtual Classroom for quality assurance purposes. Student feedback on facilitators' performance is considered an integral part of the feedback loop between students, facilitators and the university administration in fine tuning our online education processes and integration in the overall university strategy. However, while students initially were sceptical of such evaluation for fear of victimization by facilitators upon linking their respective responses to the student, the evaluation and assessment feature has been designed to be anonymous such that students' evaluation and assessments cannot be linked or connected to any particular student. Such evaluation and assessment have helped improved our teaching approaches, online presence, provision of student feedback as well as overall course structuring over time as the it has enhanced the continuous auditing of our online teaching and learning approaches.

Collaborative Relationships and Partnerships Building

The successful use of our eLearning approach and technology in delivering good quality education through the MSc Development Management Programme to a sizeable number of Ghanaians from all corners of the country has resulted in the building of a number of collaborative working relationships between the Institute of Distance Learning (IDL) and other educational institutions across the country. Currently, the Ghana Health Service as well as the Ghana Midwifery and Nurses Council have tasked the Institute to conduct their pre-admission exams to the nursing and midwifery colleges across Ghana using the Virtual Classroom platform. Based on our usage of the platform to conduct credible and highly impersonal exams and grading, the platform has been found to be a much better tool to use in assessing students in ways that reflect their very performance without much discretion from highly subjective examiners. In this regard, IDL has been running these exams for the past two years and it is hoped that in subsequent years, the capacities and capability of the technology used would be enhanced to provide more advanced and cutting edge educational resources to many students and institutions in Ghana and other countries across the world.

Outcomes/Impact

Since 2013 when the Institute of Distance Learning (IDL) through its MSc Development programme began the full utilization and adoption of the E-Learning pedagogical approach in online education delivery with the Virtual Classroom, a number of outcomes has been realized even in the midst of glaring financial and logistical challenges that every educational institution face in a developing country context. Even in such challenges, the University through the IDL has withered the storm to a larger extent and ensured that its ambition of providing universal and wide access education to many Ghanaian students who hitherto could not have had access to tertiary education due to limited infrastructural space is realized.

Deconstructing Widely Held Perceptions and Attitudes

A major outcome of our online education pedagogy has been a shift in attitudinal and perceptual suspicions of the possibility of using E-learning approaches to deliver quality education to Ghanaian students over the country. The success achieved over the years it has been noted has influenced many lecturers and students alike in the university community on the relevance of using technology to enhance teaching and learning. These days, it is common to see members of the university community asking if their programmes and courses can be enrolled on the Virtual Classroom platform so they could use that to conduct their lectures, organize assignments and exams as well as disseminating academic resources for their students. Subsequently, a new teaching and learning culture different from the traditional modes of teaching (face to face) is beginning to develop and emerge across the university community as colleges, departments and faculties have realized the possibility of using the approach in admitting more students to their departments in cases where their infrastructural capacity cannot support the growing numbers. This signals the gradual behavioral and attitudinal modification needed to open up the educational opportunity space in Ghana for many students who ordinarily would have been left behind in educational access.

Programme Migration and Structuring in ICT-supported Modules

Secondly, the successful use of our current eLearning approach has resulted in a massive paradigm shift in the way IDL programmes are run by the institute since 2015. Flowing from the apparent successes we have chocked since 2013 in providing quality tertiary education to many Ghanaian students, the Institute have subsequently migrated all its Bachelors and Masters programmes on the Learning Management System, the Virtual Classroom Platform. On this basis, all lecturers teaching on programmes run by the IDL are as a matter of requirement trained in the E-Learning pedagogies used for online teaching and learning. Subsequently, series of workshops and training sessions are organized periodically for lecturers and even students to improve their knowledge and skills in using the Virtual Classroom as new features and functions are added on periodically.

Increased Students Enrolment

Furthermore, our online education pedagogy has resulted in increased student numbers pursuing varied programmes at the Institute in a short period of time. As already stated, lack of infrastructure to admit the growing numbers of qualified Ghanaian students have been a major setback to educational delivery and expansion in the country for a number of years. Consequently, many qualified students have been left out in terms of access to tertiary education because the limited available spaces could not guarantee them places of offer in the tertiary institutions. Because our online pedagogical approach latently guarantees flexibility by meeting the educational needs of many students across the country, many of the programmes run by the institute has become the preferred programmes of choice for many students since they are guaranteed the flexibility of studying or pursuing a degree while also focusing on other aspect of their social lives such as family and work. The approach minimizes disruptions to one's career and family life as students are able to follow lessons and academic work from any part of the country without having to travel distances and physical boundaries to campus which in many cases is risky and challenging for the students.

Breaking Traditional Barriers to Conventional Education Systems

Again, an important outcome has been the breaking of educational barriers for many women across Ghana. Traditionally, several barriers have impeded women's educational attainment as they continue to joggle between the performance of their productive and reproductive roles (Opoku-Ware, 2014). Difficulties in the concurrent performance of these roles limit women's abilities to pursue higher educational opportunities largely due to inherent socio-structural constraints. Subsequently, our online pedagogical approach has ensured that many women can take up educational opportunities while focusing on their reproductive roles more importantly. The flexibility embedded in the system helps women in particular plan their reproductive lives while also paying attention to the demands of academic work. It is therefore not surprising that over the years, the MSc Development Management programme in particular has recorded huge numbers of married women applicants with burning passion to pursue or further their education with the Institute of Distance Learning.

Improved Students Graduation Turnover

Finally, an important outcome has been the rise in the graduate turnover or graduation rates from the Institute of Distance Learning (IDL) when compared with other traditional departments in the University. Indeed, the apparent blurring of distance and boundaries offered by our current online education approach ensures constant interaction between facilitators and students in terms of feedback and assessments of academic and other research activity. The processes involved are such that feedback is timely and flexible without students having to travel miles across distances to meet their facilitators and academic supervisors in the life-cycle of their academic journey. In this regard, academic work and activities required to obtain a degree is facilitated and enhanced in a timely manner as students do not leave behind too many academic deficits resulting in unnecessary delays in their academic fulfillments. This has resulted in greater number of students taking up the MSc Development Management programme for instance, graduating on time compared to other students who take up programmes in the other departments using the traditional face to face mode of teaching and learning. Consequently, the IDL is able to free more academic spaces and admission slots in providing educational access to many Ghanaians desiring to undertake further studies through our E-Learning approach and online pedagogy.

Conclusion

Delivering education through computer-assisted pedagogies has been advocated in recent times. While deep seated skepticism has been identified as a major challenge towards efforts at integrating computer-based approaches to teaching and learning in developing country contexts such as Ghana, the MSc Development Management (DM) Programme at KNUST's Institute of Distance Learning (IDL) has proven a major breakthrough in educational access and delivery in Ghana's educational system at the tertiary level in the last five years. The computer-based pedagogy employed to teaching and learning has demonstrated the significance of ICT blended educational pedagogies that are sensitive to socio-cultural milieu while breaking the digital divide created by entrenched pessimism and skepticism. Through the approach adopted by the MSc DM programme at IDL, individuals with minimal computer literacy skills eventually get equipped with ICT skills through the hands-on experience they get while pursuing their degrees using the online learning mode. This has contributed immensely towards providing educational access and opportunities to many Ghanaians who hitherto may not have obtained such educational opportunity or access in spite of the numerous infrastructural and technological constraints such as bandwidth capacities which in some ways limit our ability to integrate other functions into our current online pedagogy deployed.

On this basis, it is not surprising that the IDL and its MSc DM programme continues to enjoy many positive reviews from within and outside the university community, attracting many applicants year on year even without any massive advertisement. Indeed, our students have over the years advertised the programme to others by themselves due to

their experiences on the programme and has encouraged other prospective students especially those with very tight work and family schedules to pursue their degrees through the online learning modes employed by IDL's MSc Development Management (DM) programme.

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[1] *Participation Grade* is the grade students earn by virtue of their contribution to group activities in an online virtual task or assignment. It is awarded according to predefined assessment criteria in an eLearning environment.

[2] **ICT4D** stands for Information Communication Technology for Development

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